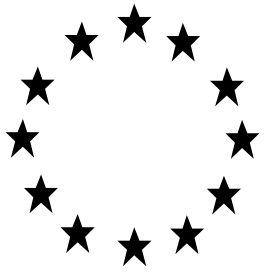
Regulation (EU) n°528/2012 concerning the making available on the market and use of biocidal products

Evaluation of active substances

Assessment Report



Zineb

Product-Type 21

(Anti-fouling products)

December 2013

RMS: IRELAND

Zineb PT21

Assessment report

Finalised in the Standing Committee on Biocidal Products at its meeting on 13 December 2013

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1. STATEMENT OF SUBJECT MATTER AND PURPOSE

1.1. PRINCIPLE OF EVALUATION

This assessment report has been established as a result of the evaluation of Zineb as product-type 21 (Antifouling products), carried out in the context of the work programme for the review of existing active substances provided for in Article 16(2) of Directive 98/8/EC concerning the placing of biocidal products on the market[1], with a view to the possible inclusion of this substance into Annex I or IA to the Directive.

The evaluation has therefore been conducted in the view to determine whether it may be expected, in light of the common principles laid down in Annex VI to Directive 98/8/EC, that there are products in product-type 21 containing Zineb that will fulfil the requirements laid down in Article 5(1) b), c) and d) of that Directive.

1.2. PURPOSE OF THE ASSESSMENT

The aim of the assessment report is to support a decision on the approval of Zineb for product-type 21, and should it be approved, to facilitate the authorisation of individual biocidal products in product-type 21 that contain Zineb. In the evaluation of applications for product-authorisation, the provisions of Regulation (EU) No 528/2012 shall be applied, in particular the provisions of Chapter IV, as well as the common principles laid down in Annex VI.

The conclusions of this report were reached within the framework of the uses that were proposed and supported by the applicant (see Appendix II). Extension of the use pattern beyond those described will require an evaluation at product authorisation level in order to establish whether the proposed extensions of use will satisfy the requirements of Regulation (EU) No 528/2012.

For the implementation of the common principles of Annex VI, the content and conclusions of this assessment report shall be taken into account.

However, where conclusions of this assessment report are based on data protected under the provisions of Regulation (EU) No 528/2012, such conclusions may not be used to the benefit of another applicant, unless access to these data has been granted.

1.3. PROCEDURE FOLLOWED

This assessment report has been established as a result of the evaluation of Zineb as product-type 21 (Antifouling products), carried out in the context of the work programme for the review of existing active substances provided for in Article 16(2) of Directive 98/8/EC concerning the placing of biocidal products on the market.

1 Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market. OJ L 123, 24.4.98, p.1.

Zineb (CAS no. 12122-67-7) was notified as an existing active substance by two companies, Cerexagri S.A.S. and Agria S.A., in product-type 21.

Commission Regulation (EC) No. 1451/2007 of 4 December 2007[2] lays down the detailed rules for the evaluation of dossiers and for the decision-making process in order to include or not an existing active substance into Annex I to the Directive.

In accordance with the provisions of Article 7(1) of that Regulation, Ireland was designated as Rapporteur Member State to carry out the assessment on the basis of the dossier submitted by the applicant. The deadline for submission of a complete dossier for Zineb as an active substance in product-type 21 was 30 April 2006, in accordance with Annex V of Regulation (EC) No. 1451/2007.

On 28 April 2006, the Irish competent authorities received a dossier from the applicants Cerexagri S.A.S. and Agria S.A. in support of Zineb as a product-type 21. The Rapporteur Member State concluded that the dossier supplied by Agria S.A. was incomplete for the purpose of the evaluation on 5 December 2006. The Rapporteur Member State accepted the dossier supplied by Cerexagri S.A.S. as complete for the purpose of the evaluation on 5 December 2006. It was also adjudged by the Rapporteur Member State that efforts were made by both applicants to avoid duplicate animal testing in preparation of their respective dossiers. Hereafter, Cerexagri S.A.S. is referred to as the applicant.

On 29th March 2011, the Rapporteur Member State submitted, in accordance with the provisions of Article 14(4) and (6) of Regulation (EC) No. 1451/2007, to the Commission and the applicant a copy of the evaluation report, hereafter referred to as the competent authority report. The Commission made the report available to all Member States by electronic means on 12th April 2011. The competent authority report included a recommendation for the inclusion of Zineb in Annex I to the Directive for PT 21.

In accordance with Article 16 of Regulation (EC) No 1451/2007, the Commission made the competent authority report publicly available by electronic means on 20 April 2011. This report did not include such information that was to be treated as confidential in accordance with Article 19 of Directive 98/8/EC.

In order to review the competent authority report and the comments received on it, consultations of technical experts from all Member States (peer review) were organised by the Commission. Revisions agreed upon were presented at technical and competent authority meetings and the competent authority report was amended accordingly.

In accordance with Article 15(4) of Regulation (EC) No 1451/2007, the present assessment report contains the conclusions of the Standing Committee on Biocidal Products, as finalised during its meeting held on 13 December 2013.

[2] Commission Regulation (EC) No 1451/2007 of 4 December 2007 on the second phase of the 10-year work programme referred to in Article 16(2) of Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market. OJ L 325, 11.12.2007, p. 3

2. OVERALL SUMMARY AND CONCLUSIONS

2.1. PRESENTATION OF THE ACTIVE SUBSTANCE

2.1.1. Identity, Physico-Chemical Properties and Methods of Analysis

CAS Number: 12122-67-7

EINECS Number: 235-180-1

CA Name: [[2-[(dithiocarboxy)amino]ethyl]carbamodithioato(2−)-κS,κS′]zinc

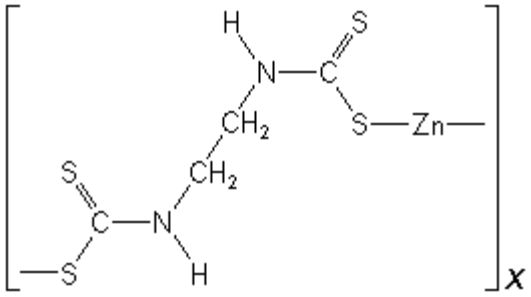
IUPAC Name: Zinc ethylenebis(dithiocarbamate)(polymeric)

Common Name: Zineb

Molecular formula: $(C_4H_6N_2S_4Zn)x$

Purity: Minimum 94% w/w.

Structural Formula:



Molecular weight (g/mol): (275.7)x g/mol

Zineb is a solid, yellowish-white powder with non-characteristic odour (range of comments: woody, sawdust, faint rotten eggs). The melting point could not be determined, however there was no phase transition up to 360°C with a large endothermal peak at 165°C assumed to be decomposition. The vapour pressure and Henry's law constant values calculated at 20°C were <3.6 x 10^{-5} Pa and <0.046 Pa.m3.mol^{-1} respectively. Therefore, Zineb is not considered to be volatile. The compound has very low solubility in water (0.22 mg/l at pH 7) and organic solvents (< 10 mg/l in xylene, solvent naphtha, methyl isobutyl ketone, methyl isoamyl ketone and 1-methoxy-3-propanol). It has a log Kow value of 0.32 at pH 7 (20°C), indicating that the molecule will not be fat soluble. . No reactivity towards container material is known. Zineb is not oxidising or explosive. Zineb will classify as being highly flammable from a phys.chem. point of view.

2.1.1.1. Analysis of the active substance as manufactured

CIPAC Method 25/TC/M/3 is available to analyse the Zineb content in the TGAI.

Methods are available for all of the impurities contained in the technical specification (see Section Doc.III A4 and the Confidential Section of the CAR for specific details).

2.1.1.2. Formulation analysis

Suitable methods of analysis are available for the determination of Zineb in the biocidal product Interspeed 340 (see Section Doc.III B4 of the CAR for specific details).

2.1.1.3. Residue analysis

The residue definition for monitoring in soil, air, drinking and surface water, body fluids and tissue, fish and shell-fish is ETU only. Suitable methods of analysis are available for the relevant matrices (see Section Doc.III A4 of the CAR for specific details).

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2.1.2. Intended Uses and Efficacy

The assessment of the biocidal activity of the active substance demonstrates that it has a sufficient level of efficacy against the target organism(s) and the evaluation of the summary data provided in support of the efficacy of the accompanying product, establishes that the product may be expected to be efficacious.

In addition, in order to facilitate the work of granting or reviewing authorisations, the intended uses of the substance, as identified during the evaluation process, are listed in Appendix II.

2.1.2.1. Field of use envisaged / Function and organism(s) to be controlled

Main group 4 (MG04) – Other biocidal products
Product-type 21 (PT21) – Antifouling products

Anti-fouling products containing zineb are to be used on parts of ferries, fishing vessels, tankers, cruise liners, liners, super-yachts, container ships, pleasure craft and can also be used on immersed objects/structures to protect submerged surfaces from attack, by animal fouling, but also from fouling due to weed and algal based slimes. All surfaces are treated while they are in dry-dock (i.e. out of the water).

Treated vessels will be exposed to a variety of fouling species. As the trading pattern of a commercial vessel (or potential destination of a pleasure craft) can cross multiple marine biotopes, the number of organisms to which it will be exposed is vast.

Zineb is proposed for use against a range of fouling organisms including algae, diatoms (slimes) and invertebrate fouling organisms:

Red and green algae (e.g. *Chorda filum; Fucus vesiculosus; Furcellaria lumbricalis; Polysiphonia; Enteromorpha intestinalis; Cladophora rupestris; Hildenbrandia rubra: Monostroma grevillei*),diatoms (slimes) (e.g. *Acanthes* and *Amphora* species) and Mollusca (e.g. *Mytilus edulis*; Crustacea; *Balanus improvisus*; *Eliminus modestus* and *Semibalanus balanoides*).

2.1.2.2. Effects on target organism(s)

Zineb acts as a general inhibitor of metabolic pathways within fouling organisms. This is achieved through interaction with thiol groups (-SH) within metabolically active proteins. It is considered that this will manifest itself in a reduction in growth rate that will be most profound on young (pre-settlement stage, e.g. cyprid larvae of barnacles) individuals of common fouling species.
There will be no time delay in effect. Once a vessel is launched the paint will work immediately, as the biocide is held at the outermost surface.

On the basis of the evaluationin this CAR the efficacy of Zineb and its role in the representative product(s) is considered as a “booster biocide” or “co-biocide”. Such active substances termed as “booster biocides” or “co-biocides” are utilised to enhance/improve the biocidal performance of antifouling paints, such as copper-based paints, by having for example a broader-spectrum mode of action or impact against target organisms in comparison to other antifouling agents with a more specific-spectrum impact.

2.1.2.3. Humaneness

Not applicable.

2.1.2.4. Resistance

The applicant has stated that there are no reported incidences of resistance developing in fouling organisms to zineb. This is considered to be due to the general mode of action of the biocide.

EBDC molecules have been used successfully for decades as plant protection products, where crops are repeatedly treated at high application rates in relatively static terrestrial environments. Despite this, no resistance of fungi to EBDC molecules has ever been observed, due to their multisite mode of action. It is therefore highly unlikely that development of resistance will be observed in the highly dynamic aquatic environment, where for colonisation purposes, larval stages predominantly develop in non-impacted (open ocean) areas where generational traits such as resistance will not be developed as a consequence of there being no repeated exposure to zineb.

Please note, resistance is not the same as tolerance whereby some species have evolved mechanisms to cope with a range of environmental stressors, both physical and chemical in nature, or have a higher capacity to up- and down-regulate essential nutrients as required for improved development and growth. These species may be considered more physiologically robust than other, less well adapted species, but this is not an indicator of "development of resistance" to a particular substance.
A more comprehensive data package relating to resistance will be required at the product authorisation stage.

2.1.3. Classification and Labelling

The current classification and labelling of the active substance zineb according to Annex I of Council Directive 67/548/EEC is shown below.

Table 2.1.3-1 Current classification / labelling of zineb

Hazard symbol:	Xi, 
Indication of danger:	Irritant
R-phrases:	R37: Irritating to the respiratory system R43: May cause sensitisation by skin contact
S-phrases:	S2: Keep out of reach of children S8: Keep container dry S24/25: Avoid contact with skin S46: If swallowed, seek medical advice immediately and show this container or label.

2.1.3.1. Proposal for the classification and labelling of the active substance

Proposed classification based on Directive 67/548/EEC:

Hazard symbol:	F, Xn, N	
Indication of danger:	Highly Flammable Harmful Dangerous for the Environment	
R-phrases:	R11 Highly flammable R63 Possible risk of harm to unborn child R43 May cause sensitisation by skin contact R50 Very toxic to aquatic organisms R53 May cause long-term adverse effects in the aquatic environment	
S-phrases:	S2 Keep out of reach of children S36/37 Wear suitable protective clothing and gloves S46 If swallowed, seek medical advice immediately and show this container or label. S60 This material and its container must be disposed of as hazardous waste S61 Avoid release to the environment. Refer to special instructions/Safety data sheet	

Proposed classification based on CLP Regulation:

Pictogram	GHS02, GHS07, GHS08, GHS09	
Signal word	WARNING	
H-Statements	H361d (Repr. 2): H317 (Skin sens. 1): H228 (Category 1): Flammable solid H410 (Acute Cat 1, Chronic Cat 1): Very toxic to aquatic life with long lasting effects.	
M-Factor	1 Acute =10 (based on 0.01< L(E)C_{50} ≤ 0.1 mg/l) Chronic=10 (based on 0.001< NOEC ≤ 0.01 mg/l)	

2.1.3.2. Proposal for the classification and labelling of the product(s)

Proposed classification for the biocidal product, Interspeed 340 (containing 4.53% w/w), according to Directive 99/45/EC

Hazard symbol: (for labelling)	N, F	
Indication of danger:		Flammable Dangerous for the Environment
Risk Phrases: (for labelling)	R10 R50 R53	Flammable Very toxic to aquatic organisms May cause long-term adverse effects in the aquatic environment
Safety Phrases: (for labelling)	S2 S3 S15/16/33 S35 S36/37 S40 S43 S46 S60 S61	Keep out of reach of children Keep in a cool place Keep away from heat, Keep away from sources of ignition, Take precautionary measures against static charge This material and its container must be disposed of in a safe way Wear suitable protective clothing and gloves To clean the floor and all objects contaminated by this material use . (to be specified by the manufacturer) In case of fire use . (indicate in the space the precise type of fire-fighting equipment. If water increases the risk add: Never use water) If swallowed, seek medical advice immediately and show this container or label This material and its container must be disposed of as hazardous waste Avoid release to the environment. Refer to special instructions/Safety data sheet

Proposed classification for the biocidal product, Interspeed 340 (containing 4.53% w/w), according to CLP Regulation (EC) No 1272/2008

Pictogram: (for labelling)	GHS02, GHS07, GHS08, GHS09	
Signal word:		DANGER WARNING
Hazard Statement: (for labelling)	H226 (Flam.Liq. 3) H361d (Repr. 2) H410 (Acute Cat 1, Chronic Cat 1)	Flammable liquid and vapour Suspected of damaging the unborn child Very toxic to aquatic life with long lasting effects.
Precautionary Statement: (for labelling)	P102 P370 + P378 P403 + P235 P280 P210 P501 P303 + P361 + P353 P308 + P313 P273 + P391	Keep out of reach of children In case of fire: Use … for extinction. Store in a well-ventilated place. Keep cool. Wear protective gloves/protective clothing/eye protection/face protection. Keep away from heat/sparks/open flames/hot surfaces. No smoking. Dispose of contents/container to … IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. If exposed or concerned: Get medical advice/attention Avoid release to the environment. Collect spillage.

Proposed Classification and labelling of the 10% Product

Proposed classification for the biocidal product, Zineb 10% product (containing 10% w/w), according to Directive 99/45/EC

Hazard symbol: (for labelling)	N, Xn, F	
Indication of danger:		Flammable Harmful Dangerous for the Environment
Risk Phrases: (for labelling)	R10 R50 R53 R63	Flammable Very toxic to aquatic organisms May cause long-term adverse effects in the aquatic environment Possible risk of harm to unborn child

Safety Phrases: (for labelling)	S2	Keep out of reach of children
	S3	Keep in a cool place
	S15/16/33	Keep away from heat, Keep away from sources of ignition, Take precautionary measures against static charge
	S35	This material and its container must be disposed of in a safe way
	S36/37	Wear suitable protective clothing and gloves
	S40	To clean the floor and all objects contaminated by this material use . (to be specified by the manufacturer)
	S43	In case of fire use . (indicate in the space the precise type of fire-fighting equipment. If water increases the risk add: Never use water)
	S46	If swallowed, seek medical advice immediately and show this container or label
	S60	This material and its container must be disposed of as hazardous waste
	S61	Avoid release to the environment. Refer to special instructions/Safety data sheet

Justification for the proposal:

Physical-Chemical Properties:
The molecule when formulated into the representative product Interspeed 340 will classify as 'Flammable' (Directive 99/45/EC).

Human Health:
R63 is transposed from the active substance because it is at a concentration greater or equal to 5% in the product.

Environment:
Based on the $EC_{50}$of 0.036 mg/L (measured) in the algal toxicity test, (*Skeletonema costatum)* and the NOEC of 0.00219 mg mancozeb/L (measured) in the fish toxicity test (*P.Promelas*), and the fact that , Zineb is not rapidly degradable. Zineb classifies as R50/53. This is based on the M-factors of 10 applied to both the acute and chronic endpoints.

Additional labelling:
Not applicable

Proposed classification for the biocidal product, Zineb 10% product (containing 10% w/w), according to CLP Regulation (EC) No 1272/2008

Pictogram: (for labelling)	GHS02, GHS07, GHS08, GHS09	
Signal word:		DANGER

		WARNING
Hazard Statement: (for labelling)	H226 (Flam.Liq. 3) H361d (Repr. 2) H410 (Acute Cat 1, Chronic Cat 1) H317	Flammable liquid and vapour Suspected of damaging the unborn child Very toxic to aquatic life with long lasting effects. May cause an allergic skin reaction.
Precautionary Statement: (for labelling)	P102 P261 P272 P370 + P378 P403 + P235 P280 P210 P501 P303 + P361 + P353 P333+P313 P321 P363 P308 + P313 P273 + P391	Keep out of reach of children Avoid breathing dust/fume/gas/mist/vapours/spray. Contaminated work clothing should not be allowed out of the workplace. In case of fire: Use … for extinction. Store in a well-ventilated place. Keep cool. Wear protective gloves/protective clothing/eye protection/face protection. Keep away from heat/sparks/open flames/hot surfaces. No smoking. Dispose of contents/container to … IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation or rash occurs: Get medical advice/attention. Specific treatment (see … on this label). Wash contaminated clothing before reuse. If exposed or concerned: Get medical advice/attention Avoid release to the environment. Collect spillage.

Justification for the proposal:

Physical-Chemical Properties:
The molecule when formulated into the representative product Interspeed 340 will classify as 'Flammable liquid and vapour' (CLP Regulation (EC) No 1272/2008).

Human Health:
The category 2 reproductive toxicant classification H361d should be applied to the product as the concentration of zineb is greater than 3% w/w. This classification requires the signal word WARNING and the pictogram GHS08. The classification H317 is applied because the active substance is a senstizer and the product contains the substance at >1%.

Environment:
Based on the $EC_{50}$of 0.036 mg/L (measured) in the algal toxicity test, (*Skeletonema costatum)* and the NOEC of 0.00219 mg mancozeb/L (measured) in the fish toxicity test (*P.Promelas*), and the fact that , Zineb is not rapidly degradable. Both products containing 4.53 and 10 % w/w Zineb classify as H410 (Acute Cat 1, Chronic Cat. 1) when the M-factors of 10 for both the acute and chronic toxicity endpoints are applied.

Additional labelling:
Not applicable

2.2. SUMMARY OF THE RISK ASSESSMENT

2.2.1. Human Health Risk Assessment

2.2.1.1. Hazard Identification

Zineb is intended for us by both professional and non-professional users. Typical products are expected to contain 4.53% w/w Zineb and 10% w/w Zineb. The products as expected to be applied by professionals in dockyards and slipways. Professional application is expected to be by high pressure airless spraying. Non-professionals and chandlers are expected to apply the products by brush and roller. Paint removal is expected by be carried out by either high pressure hydroblasting or mechanical abrasion.

2.2.1.2. Effects Assessment

Read-across from Mancozeb to Zineb

Zineb is a zinc ethylenebisdithiocarbamate (EBDC) polymer. The toxicological data base for Zineb refers principally to studies with Mancozeb, a zinc/manganese EBDC polymer.

Justification for the use of Mancozeb toxicology data to support Zineb can be summarised as follows:

I. Comparability of the molecular structures of Zineb and Mancozeb.
II. Only the EBDC anion is considered to be of toxicological relevance.
III. Absorption, distribution and excretion of Zineb and Mancozeb have been shown to be comparable. The degradation products of both members of the EBDC group are the same: the principal metabolite in mammalian metabolism studies is ethylene thiourea (ETU).
IV. A review of available data shows that Zineb and Mancozeb have similar toxicological properties. The toxicological properties of EBDC compounds are entirely attributed to the presence (as impurity) or the formation via transformation processes, of ethylene thiourea (ETU).
V. Several reports on the mammalian toxicology of Zineb, or EBDC compounds have concluded that Mancozeb data may be used for the derivation of safety standards for Zineb.

Therefore, results obtained with Mancozeb are considered to be equally relevant to Zineb.

Toxicokinetics

Metabolism and toxicokinetics studies have been performed with Mancozeb. Absorption of Mancozeb from gastrointestinal tract has been estimated by combining urinary and biliary excretion data, and approximately half of the dose is absorbed in rats and one third in mice after oral dosing. For the both rats and mice, the elimination occurred mainly via urine and faeces and only a small fraction was detected in the bile. For both species, the majority of the dose was excreted within 24 hours. The plasma peak concentration was detected after 1-2 hours after dosing in mice and 3-6 hours in rats. Highest levels of radioactivity both in mice and rats were detected in the thyroid. Metabolism of Mancozeb is complex and extensive. The major metabolite of Mancozeb is ethylene thiourea (ETU) both in rats and mice. The estimated bioavailability of ETU in rats was about 6.8 % on a weight/weight basis, and 20 % on a mole/mole basis. Other metabolites include ethylenebis-(isothyocyanate)sulphide (EBIS), ethyleneurea (EU), N-acetylethylenediamine (N-AcEDA) and ethylenediamine (EDA). Metabolites other than ETU were generally present in low amounts and were of a highly polar nature.

Oral absorption is expected to be rapid and has been established at 50% based on urinary and biliary excretion. Absorption via the inhalation route is assumed to 100%.

Dermal penetration

Following a single dermal application of [14C]-Mancozeb in a high level dose formulation (nominally 12 mg Mancozeb/cm2) to male rats, 0.11% of the dose had been absorbed by 8 hours (analogous to the length of a normal working day). A higher proportion (0.24%) of the low level dose (nominally 0.014 mg Mancozeb/cm2) was absorbed over the same period.

Acute toxicity

Zineb showed low acute oral, dermal and inhalation toxicity in the rat. Zineb showed no potential to cause skin irritation and only a slight potential to induce eye irritation in the rabbit. Under the conditions of the maximization method of Magnusson and Kligman, Zineb showed no potential to induce skin sensitisation in the Guinea-Pig. However, Mancozeb is classified as sensitising (R43) and therefore as this is a read across evaluation Zineb will also classify as Sensitising, assigned the symbol "Xi" and the indication of danger "irritant" and the risk phrase R43: May cause sensitisation by skin contact. The single negative zineb study does not offer sufficient evidence that the almost chemically identical mancozeb acts as a sensitiser and zineb does not.

Repeat dose toxicity

Repeat oral administration of Mancozeb results mainly in thyroid toxicity. It is established and agreed that the thyroid effects are due to the metabolic conversion of Mancozeb into ethylene thiourea (ETU). This compound interferes with the production of thyroid hormones thus leading to hypertrophy and hyperplasia of the follicular cells of the thyroid. However, the impact of hormone disruption during critical periods of exposure is potentially of concern.

A very large database of repeat dose toxicity studies is available for Mancozeb and a single study is available for zineb. In a 13-week study in the rat administered Mancozeb (Dean et al, 1989), the NOAEL and LOAEL were 1.7 and 7.0-mg/kg bw/day, respectively. However, the endpoints on which the LOAEL was based were an equivocal, reduction of neutrophils and T4 in females only. Following evaluation of the equivocal effects in females it was decided to set the NOAEL at 7.0-mg/kg bw/day based on statistically significant reductions in neutrophils and T4 hormone. The effects noted, however, were not deemed sufficiently adverse to form the basis of the calculation of the AOEL for risk assessment.

There seems to be huge variation in determining the LOAEL and this appears to be related to setting of doses in different studies. The NOAEL reported by Cox et al, 1986 following a 13-week exposure was 3.0-mg/kg bw/day in dogs. A second study by Broadmeadow et al, 1991, following a 52-week exposure period, reported a lower NOAEL of 2.3-mg/kg bw/day. However, the LOAELs from the two studies ranged from ca. 22.6 to 28.6 mg/kg bw/day based on reduced body weight gain and changes in haematological parameters or a reduction of T4. In a third study (Shaw, 1990, IUCLID 5.4/2052), during a 52-week exposure period, dogs were exposed to three doses of Mancozeb 1.8, 7.6, and 28.4-mg/kg bw/day. The NOAEL reported from this study was the intermediate dose of 7.6-mg/kg bw/day. In the three aforementioned studies, the effects seen at doses ranging from 23-29 mg/kg bw/day were similar, including decreased body weight and T4 hormone and changes in haematology parameters.

However, the 13-week subchronic repeat dose administration study (Goldman et al., 1986) was chosen as the most suitable short-term or sub-chronic study to provide an NOAEL that can be used to establish a systemic AEL medium-term reference value.

Sub-acute repeat dose dermal toxicity studies are available for Mancozeb in both the rat and the rabbit. In the rat, repeat dermal exposure to Mancozeb over 4 weeks at dose levels of up to 1000 mg/kg bw/day produced no systemic or local adverse effects (Trutter, 1988). In the rabbit, repeat dermal exposure over 3 weeks at dose levels of up to 1000 mg/kg bw/day produced some dermal irritation but no systemic adverse effects (Smith et al., 1988). However, the rabbit study is only of sufficient quality to be regarded as supporting data.

Mancozeb had been tested in a sub-acute and sub-chronic repeat dose inhalation toxicity study in the rat (Hagan et al., 1986). Thyroid follicular hyperplasia and a reduction in the level of T4 were seen at the highest dose level of 144 mg/m^3. The NOAEL in this study was 36 mg/m^3. Taking into consideration a breathing capacity of 45 l/kg bw/h and duration of exposure of 6 hours the equivalent systemic NOAEL is 9.7-mg/kg bw/day.

A dietary mixture of Zineb in rats was administered at concentrations up to 3200 ppm in a 4-week sub-acute study (28-days). The low dose was 50 ppm, which is equivalent to 4.7 mg/kg bw/day, was established as the NOAEL for males and females in this study based on effects on the thymus.

Taking in to consideration the range of no-effect levels in the sub-chronic studies an overarching level of 7 mg/kg bw/d was established. This value is in agreement with the value derived in the PPP process for zineb.

Genotoxicity

No studies are available for Zineb

Mancozeb showed no genotoxicity potential in in vitro or in vivo test systems.
In a reverse mutation test with Salmonella typhimurium with and without metabolizing enzyme system Mancozeb was not mutagenic. Mancozeb did not induce mutations at the HGPRT locus in Chinese hamster ovary cells in culture when tested in the absence and presence of metabolic activation.

In an in vivo cytogenicity test performed with Fischer-344 rats no significant increases in chromosomal aberrations were observed in bone barrow cells following acute or subacute administration of Mancozeb at 4.4 g /kg bw. Mancozeb did not induce micronuclei in bone marrow cells when tested at 2000 mg/kg bw in CD-I mice using a 0 h + 24 h oral dosing and 48 h sampling regimen. In a host mediation mutation assay Mancozeb did not demonstrate a mutagenic response using Salmonella typhimurium strain TA1530 as the indicator strain and male B6C3F1 mice as the host.

Carcinogenicity

The carcinogenic potential of Mancozeb has been investigated in life time feeding studies in rodents. Thyroid carcinomas and adenomas were seen at high doses after long term feeding in rats. There was no evidence of an oncogenic response in the lifetime feeding studies in mice. Thyroid follicular cell adenomas were also seen at the highest dose level in the two generation reproduction study in the rat.
The effects of Mancozeb after long-term dietary exposure are consistent with those caused by its metabolite ethylene thiourea (ETU). ETU produces thyroid tumours in mice and rats by a non-genotoxic mechanism, which involves interference with the functioning of thyroid peroxidase.

Mancozeb does not meet the criteria for classification for carcinogenicity.

Reproductive toxicity

Developmental toxicity studies are available for Mancozeb both in the rat and the rabbit. Mancozeb does not induce developmental toxicity in the absence of marked maternal toxicity. The overall, maternal and embryo/foetal NOAEL in the rat is 60 mg/kg bw/day.

In a two generation study in rats no reproduction toxicity was seen at dose levels up to 1100 ppm (lowest equivalent intake of ca. 75 mg/kg bw/day). In addition to general parental toxicity (reduced body weight gain and food consumption) thyroid follicular hyperplasia and hypertrophy, and follicular cell adenomas were seen at the high dose level. Offspring toxicity (slight delay in the opening of the eye, reduced body weight) was seen at this maternally toxic dose level. The NOAEL for parental toxicity was 25 ppm (ca. 1.7 mg/kg bw/day) and for offspring toxicity was 150 ppm (ca. 10.3 mg/kg bw/day).

ETU is classified in Annex 1 of 67/548 as a Cat 2 R61, developmental toxicant. It does not cause maternal toxicity at developmentally toxic doses and it is concluded that the malformations caused by ETU exposure are not secondary non-specific consequences of maternal toxicity and are actually caused directly by the metabolite itself.

Mancozeb has been discussed by specialised experts as part of the pesticides 91/414 EC peer review process. A specific pattern of malformations in the rats were observed at maternally toxic doses with Mancozeb as with ETU and it was the consensus of the experts that these effects were on the same spectrum of malformations seen with ETU. Therefore, Mancozeb has been classified a developmental toxicant Cat 3 R63 in the ECB 31st ATP

Developmental Neurotoxicity

Dietary exposure to Mancozeb from gestation day 6 through weaning produced no test substance-related effects on clinical findings, functional observational battery (FOB) parameters, food consumption at any stage of gestation or lactation, gestation length, parturition or macroscopic findings at scheduled necropsy in dams.

At 30 mg/Kg bw, maternal body weight gain was reduced from the onset of treatment: the effect was significant ($p<0.05$ or $p<0.01$) from gestation days 6–9 and 6-12. Over the entire gestation treatment period (gestation days 6-20), body weight gain decreased by 4.6% (not statistically significant). However, when litter size was used as a covariate in the statistical analysis of body weight gain, the reduction during gestation days 6-20 at 30 mg/kg/day was significant ($p=0.001$) (14.7 vs 16.0 pups/litter in control and 30 mg/Kg bw, respectively). In addition, when the body weight gain data were normalized for litter size and historical gestation day 20 conceptus weights, the decrease in gain during gestation days 6-20 was 9.4% At 30 mg/kg/day, absolute and relative mean thyroid weights in F0 females were increased by 7.5% and 9.1% (both not statistically significant.) respectively In addition, not significant increased incidence of thyroid follicular cell hypertrophy was observed

There were no test substance-related effects on any of the F1 litter parameters investigated in this study.
Therefore, developmental neurotoxicity NOAEL was 30 mg/kg/day, the highest dose tested.
Based on these findings and on the presence of ETU in pup plasma and in milk (investigated in the preliminary study), it can be concluded that Mancozeb has been tested for DNT and the results show that Mancozeb showed no developmental neurotoxicity under the conditions of the study.

Neurotoxicity

In a 13 week feeding study in rats, males and females in the high dose group showed clinical functional signs of neurotoxicity (impaired hind limb and motor activity) and microscopic damage on nerve and muscle tissues, in the presence of severe general toxicity (mortality and reduced body weight gain). Damage on nerve tissues was also seen in males and females at 750 ppm. Systemic toxicity (reduced body weight gain) was seen in females at this dose level. The NOAEL was 125 ppm (equivalent to 8.2 and 10.5 mg/kg bw/day for males and females, respectively).

Human data

No biologically significant differences were observed for the concentrations of T3, T4 and TSH in the blood samples collected before and after each shift from 12 workers exposed to Mancozeb.

Toxicity of relevant impurities:The effects of EBDC compounds (Zineb and Mancozeb) are entirely due to the presence (as an impurity) or the formation via transformation processes of ETU (Marinovich et al; 1997).

Thus, ETU is an impurity and also a metabolite of Zineb.

- The toxicity of ETU as a metabolite is covered by the toxicological tests on the parent.

Data on ethylene thiourea (ETU):
The carcinogenic potential of Mancozeb has been investigated in life time feeding studies in rodents. Thyroid carcinomas and adenomas were seen at high doses after long term feeding in rats. There was no evidence of an oncogenic response in the lifetime feeding studies in mice. Thyroid follicular cell adenomas were also seen at the highest dose level in the two generation reproduction study in the rat.

The effects of Mancozeb after long-term dietary exposure are consistent with those caused by its metabolite ethylene thiourea (ETU). It is established and agreed that the thyroid effects are due to the metabolic conversion of Mancozeb into ETU. ETU produces thyroid tumours in mice and rats by a non-genotoxic mechanism, which involves interference with the functioning of thyroid peroxidase.
Mancozeb (and thus Zineb) does not meet the criteria for classification for carcinogenicity.

ETU is classified in Annex 1 of 67/548 as a Cat 2 R61, developmental toxicant. It does not cause maternal toxicity at developmentally toxic doses and it is concluded that the malformations caused by ETU exposure are not secondary non-specific consequences of maternal toxicity and are actually caused directly by the metabolite itself.

Mancozeb has been discussed by specialised experts as part of the pesticides 91/414 EC peer review process. A specific pattern of malformations in the rats were observed at maternally toxic doses with Mancozeb as with ETU and it was the consensus of the experts that these effects were on the same spectrum of malformations seen with ETU. Therefore, Mancozeb (and thus Zineb) has been classified a developmental toxicant Cat 3 R63 in the ECB 31st ATP

- The toxicity of ETU as an impurity is the point of concern. Indeed, the level of ETU in the substance could impact the toxicity of Zineb (and Mancozeb), because if the impurity is at a higher level, its toxicity would be higher.
  The potential medium-term AEL of ETU could be based on the NOAEL issued from an oral 1 year study on dogs of 0.18 mg/kg/d (based on thyroid and liver effects), divided by a safety factor of 100. An absorption of 100% is applied by default because unknown.
  An AEL of 0.0018 mg/kg/d could be proposed.

  The medium-term AEL of Mancozeb extrapolated to Zineb is 0.035 mg/kg bw/day.

If ETU is at a max concentration of 0.1% in the substance, the max exposure to ETU corresponds to 0.1% x 0.035 = $3.5.10^{-5}$

This exposure compared to the potential medium-term AEL of ETU, is lower. Consequently, we can conclude that 0.1% of ETU as an impurity would not have an impact on Zineb toxicity.

In terms of classification, no impact is expected based on the max level mentioned below.

	CAS	Mean	Mean +/- 3S.D.(% w/w)	Specification	Classification	Consequences
Zineb	112122-67-7	95.92	95.67	94.0 min	Harmonized classification: *Directive 1999/45/EC : R37, R43 Proposed classification: *Directive 1999/45/EC : R43 Repro cat 3 ; R63 *Regulation 1272/2008: Skin sens. 1; H317 Repr. Cat 2; H361d	Harmonized classification: R37, R43 Proposed classification: Repro cat 3 ; R63 R43
ETU	96-45-7	0.0486	0.08	0.1 max.	Harmonized classification: *Directive 1999/45/EC : Xn; R22 Repr. Cat 2 ; R61 *Regulation 1272/2008: Acute Tox 4, H302 Repr. 1B, H360D	No consequence on Zineb classification according to Directive 1999/45/EC and Regulation 1272/2008 for a concentration of 0.1%
DIDT	33813-20-6	0.001	0.001	0.06 max.	Harmonized classification: *Directive 1999/45/EC : R22 * Regulation 1272/2008: Acute Tox 4, H302	No consequence on Zineb classification according to Directive 1999/45/EC and Regulation 1272/2008 for a concentration of 0.06%

Toxicological profile of metabolite

Toxicological Profile of Ethylenethiourea (ETU)

Ethylenethiourea (ETU) is: metabolite in mammals, environmental degradation product, impurity of Mancozeb and other EBDCs.

Unlike Mancozeb, after oral administration ETU is rapidly absorbed and rapidly excreted, mainly via urine.
Unchanged ETU is a major metabolite in rat and guinea pigs, together with small amounts of Ethyleneurea (EU). In mice the principal identified metabolites are ETU and imidazolinyl sulfenate.
ETU has a low acute toxicity profile.

The primary toxicological target in laboratory animals is the inhibition of the synthesis of thyroid hormones T_4 and T_3, leading to elevated serum levels of TSH. Prolonged and continuous elevation of TSH results in hypertrophy and hyperplasia of the thyroid follicular cells in rats, mice, monkeys and dogs, and development of nodular hyperplasia, adenoma and/or carcinoma in rats and mice (not in hamster).

There is evidence for reversibility. Direct evidence for inhibition of thyroid hormone synthesis by ETU has been obtained in rats in vivo. In vitro ETU has also reversibly inhibited thyroid peroxidase-catalysed iodination reactions (TPO).

Rat is the most sensitive species, followed by dog and monkey. It is known that rats are more sensitive to ETU induced thyroid changes than humans. This must be taken into consideration where evaluating the risk asssessment for humans.

Long-term toxicity and carcinogenicity
The relevant NOEL determined for ETU after long-term exposure are as follows:
Rat, 2 year administration:
NOEL = 5 ppm - 0.37 mg/kg bw
Mouse – 2 year administration
No NOEL
Dog, 1 year
NOEL: 5 ppm – 0.18 mg/kg bw

Mutagenicity
The mutagenic potential of ETU has been extensively examinated, through a great number of qualified studies. In summary it can be concluded that ETU is not mutagenic in mammalian systems.
Teratogenicity and Embryotoxicity
Two-generation, rat
NOEL: 2.5 ppm – 0.11-0.43 mg/kg bw
Teratology, rat
NOEL: 5 mg/kg bw
Teratology, rabbit
NOEL: > 80 mg/kg bw
There are clear evidence that ETU is teratogenic. When administered to pregnant rats produced brain, face, limbs and skeleton malformations at dose levels maternally not toxic.

ADI: 0.002 mg/kg bw/day (based on a NOAEL of 0.18 mg/kg bw/day in a chronic feeding study in dog, applying a SF = 100)

AOEL: 0.002 mg/kg bw/day (based on a NOAEL of 0.18 mg/kg bw/day in a chronic feeding study in dog, applying a SF = 100)

Critical End Points

$AEL_{LONG-TERM}$, AEL_{ACUTE}, AND AEL_{MEDIUM}

The lowest NOAEL in the key long-term carcinogenicity study was 125 ppm corresponding to 4.8 mg/kg bw/day for males and 6.7 mg/kg bw/day for females based on increased incidence of thyroid adenomas and carcinomas at the highest dose level (Stadler, 1990). Including an assessment factor of 100 and factoring in oral absorption of 50% the $AEL_{LONG-TERM}$ is 0.024-mg/kg bw/day.

$AEL_{LONG-TERM}$ is 0.024-mg/kg bw/day

The developmental neurotoxicity NOAEL was set at 30 mg/kg bw the highest dose tested (Beck 2008). The maternal NOAEL in the study was set at 15 mg/kg bw/day based on findings of thyroid follicular cell hypertrophy and decreased body weight gain during gestation at 30mg/kg bw/day the LOAEL. Including an assessment factor of 100 and factoring in oral absorption of 50% the AEL_{ACUTE} (ARfD) is 0.075-mg/kg bw/day.

AEL_{ACUTE} (ARfD) is 0.075-mg/kg bw/day

The overall NOAEL after subchronic repeat dose oral administration is considered to be 7-mg/kg bw/day. Including an assessment factor of 100 and factoring in oral absorption of 50% the AEL_{MEDIUM} (AOEL) is 0.035-mg/kg bw/day.

AEL_{MEDIUM} (AOEL) is 0.035-mg/kg bw/day

2.2.1.3. Exposure Assessment

Industrial/Professional Users

The potential routes of exposure for the professional operator are via the dermal and the inhalation routes. Professionals are likely to be exposed while working in dockyards and slipways applying Zineb products using high pressure airless spraying, brush and roller, mixing/loading and removing old paint from the surface of vessels. Exposure via the oral route is unlikely for professional operators.

Professional operators are expected to be intermittently exposed. Hence, it is suggested that the most appropriate NOAEL/Acceptable Exposure Limit (AEL) for use in the risk characterisation is that for exposures of medium-term duration.

The potential exposure of operators (body weight 60 kg) was determined using the calculation models and assumptions given in the TNsG - Human Exposure to Biocidal Products, as revised by User Guidance version 1 (EC, 2002), which represent a reasonable scenario for risk assessment purposes.

Professional Users – Primary Exposure to Zineb 4.53% and 10%
Summary of professional exposure levels to antifouling application.

Intended use (MG-04/PT 21)	Exposure scenario	PPE	Inhalation uptake (mg/day)	Dermal uptake (mg/day)	Systemic Dose (mg/kg bw/day)	Medium term AEL 7mg/kg bw day at 50% absorption = (3.5 mg/kg bw/day)	AF MOE_{ref}	MOE	Exposure /AEL
PT21 4.53% Zineb	Airless spraying viscous solvent-based liquids at >100bar pressure, overhead and forwards.	Yes	0.07	0.09	0.003	3.5	100	1167	0.085714
	Loading liquid antifoulant into reservoir for airless spray application.	Yes	0.008	0.18	0.003	3.5	100	1167	0.085714
	Brush and roller application of antifoulant	Yes	0.004	0.2	0.004	3.5	100	875	0.114286
	Professional removal using hydro-blasting or grit blasting	Yes	0.01	0.01	0.0003	3.5	100	11666	0.008571
	Keeping lines clear	Yes	1.89	0.12	0.034	3.5	100	103	0.971429
PT21 10% Zineb	Airless spraying viscous solvent-based liquids at >100bar pressure, overhead and forwards.	Yes	0.162	0.2	0.006	3.5	100	583	0.171429
	Loading liquid antifoulant into reservoir for airless spray application.	Yes	0.017	0.4	0.007	3.5	100	500	0.2
	Brush and roller application of antifoulant	Yes	0.009	0.45	0.008	3.5	100	438	0.228571
	Professional removal using hyrdoblasting or grit blasting	Yes	0.02	0.027	0.001	3.5	100	3500	0.028571
	Keeping lines clear	Yes	0.417	0.27	0.012	3.5	100	291	0.342857

Non-Professional Users – Primary Exposure

The potential routes of exposure for the non-professional operator are via the dermal and the inhalation routes. Non-professionals are expected to apply antifouling paint by brush and roller and remove it by abrasive brushing or hydro blasting. Exposure is expected to intermittent so the medium term AEL has been chosen for comparison.

Tier 1 assessment

A dermal absorption value of 0.24% has been applied and Zineb is expected to be absorbed by inhalation at a rate of 100%. The non-professionals clothing is expected provide 50% protection. Gloves or RPE are not expected to be worn by non-professionals and only tier 1 assessments are presented for non-professional exposure.

Non-Professional Users – Primary Exposure

Tier 1 Exposure Scenario (Indicate time frame: acute, medium or long term)	Estimated Internal Exposure				Relevant NOAEL/ LOAEL [mg/kg bw day] Reference Value e.g.: AEL (acute or medium or chronic)	AF MOE ref	MOE	Exposure /AEL
	Estimated oral uptake [mg/kg bw day]	Estimated inhalation uptake [mg/kg bw day]	Estimated dermal uptake [mg/kg bw]	Estimated total uptake [mg/kg bw day]				
- **PT-21** - **4.53% Zineb** - **Medium term exposure**					Medium term AEL 7mg/kg bw day at 50% absorption (3.5 mg/kg bw/day)			
Consumer Product Painting: brush and roller painting of antifoulant on the underside of small boats (leisure craft) without gloves Coverall 50% penetration.	NA	$7.08x10^{-5}$	0.017	0.017	3.5	100	206	0.49
Removal using hydroblasting or grit blasting	NA	0.0002	0.0065	0.007	3.5	100	524	0.19
Non professional washing out paint brushes	NA	NA	With gloves; 0.0002 Without gloves; 0.002	With gloves; 0.0002 Without gloves; 0.002	3.5	100	PPE 17500 No PPE 1750	0.0057 0.057
Non professional washing of work wear	NA	NA	0.0002	0.0002	3.5	100	17500	0.0057

Secondary Exposure

Indirect exposures to zineb from professional use of the substance are unlikely. There is, however, potential for humans to be exposed to zineb by the dermal route through contact with the product's residues after application by non-professionals in addition, infants could be exposed to zineb by touching the surface of boats painted by amateurs.

Indirect Exposure As A Result Of Use Of The Active Substance In Biocidal Products

Intended use (MG/PT)	Exposure scenario	Dermal uptake	Systemic Dose
PT21 4.53% Zineb	**Adult** exposures from washing work wear used in the amateur or small chandler application of Zineb products.		Tier 1; 0.0003 mg a.s./kg bw/event Tier 2; 0.0002 mg a.s./kg bw/event
	Exposure to a child (hands on wet paint)	0.65 mg/event	0.043 mg/kg bw/event
PT21 10% Zineb	**Adult** exposures from washing work wear used in the amateur or small chandler application of Zineb products.		Tier 1; 0.0006mg/kg bw/event Tier 2; 0.0004mg/kg bw/event

Risk characterisation for indirect exposure to the product.

Tier 2 Exposure Scenario	Estimated oral uptake [mg/kg bw day]	Estimated inhalation uptake [mg/kg bw day]	Estimated dermal uptake [mg/kg bw]	Estimated total uptake [mg/kg bw day]	Relevant NOAEL/ LOAEL [mg/kg bw day] Reference Value e.g.: AEL (acute or medium or chronic)	AF MOE_{ref}	MOE	Exposure /AEL
Exposure to a child (hands on wet paint) PT21 4.53% Zineb	NA	NA	0.65 mg/event	0.043 mg/kg bw event	7.5 (AEL acute)	100	174	0.57
Non professional washing of work wear PT21 4.53% Zineb	NA	NA	0.0002	0.0002	7.5	100	375000	0.0003
Non professional washing of work wear PT21 10% Zineb	NA	NA	0.0006	0.0006	7.5	100	12500	0.008

Combined exposure

Combined exposure or exposure that could arise from a number of tasks being done in the same day is not expected to be of concern for Zineb use. The following scenarios describe worst case examples of combined exposure.

Professional

A professional worker wearing appropriate personal protective equipment (PPE) & RPE and working with a 10% product is estimated to maintain a MOE of more than 100 after performing all the professional tasks modelled. A professional worker spraying, acting as potman, removing paint and applying paint by brush and roller in the same day is estimated to be systemically exposed to 0.022 mg/kg bw/day. This equates to a MOE of 160.

Non-professional

A non-professional worker wearing no personal protective equipment could perform the tasks of painting a boat, paint removal, washing of brushes and washing of work wear and maintain a safe margin of exposure. The total exposure of a non-professional is estimated be 0.0262 mg/kg bw/day after completing all of the aforementioned tasks. This equates to a MOE of 134 when compared to the AEL medium-term or AOEL.

2.2.1.4. Risk Characterisation

Primary Exposure

Risks were characterised for two products; a 4.53% Zineb product and a 10% Zineb product.

Risks of toxicity associated with dermal and inhalation exposures (oral exposure was deemed not relevant) were characterised for medium term exposure scenarios. Exposures were compared to the AEL_{MEDIUM} 0.035 mg/kg bw/day. Risks are considered acceptable if the MOE >100 of id the systemic exposure/AEL ratio is <1.

Professional Users

Potman and Ancillary Workers

Loading of antifouling paint into reservoirs for spraying yielded acceptable exposure risk for both paint types at tier 2. Professionals at work loading liquid antifouling paints into a reservoir for airless spray application wearing full PPE (1% penetration) and RPE with a reduction factor of 40 are expected to receive a systemic exposure of 0.003 mg/kg bw/day when using the 4.53% paint and 0.007 mg/kg bw/day when using the 10 % paint. These exposures represent MOEs of 1167 and 500 respectively.

Antifouling Paint Spraying

Spraying of both paint types yielded acceptable exposure levels at tier 2. Professionals at work spraying antifouling paints wearing full PPE (1% penetration) and RPE with a reduction factor of 40 are expected to receive a systemic exposure of 0.0027 mg/kg bw/day when using the 4.53% paint and 0.006 mg/kg bw/day when using the 10 % paint. These exposures represent MOEs of 1296 and 583 respectively.

Brush and Roller Application

Professionals applying paint by brush and roller wearing a single coverall allowing 5% penetration and no RPE are expected to receive a systemic exposure of 0.0035 mg/kg bw/day when using the 4.53% paint and 0.008 mg/kg bw/day when using the 10 % paint. These exposures represent MOEs of 1000 and 438 respectively.

Abrasive blasting (Paint Removal)

Paint removal operators wearing full PPE (1% penetration) and RPE with a reduction factor of 40 are expected to receive a systemic exposure of 0.00026 mg/kg bw/day when using the 4.53% paint and 0.0008 mg/kg bw/day when using the 10 % paint. These exposures represent MOEs of 8750 and 4375 respectively.

Overall the RMS proposes the following risk mitigation measures for professional spraying of Zineb products or acting as ancillary workers in such operations.

Professional operators (sprayers) exposed to antifouling products containing Zineb should wear RPE. Appropriate RPE includes air-fed respiratory equipment with combined protective helmet and visor to protect the skin of the head and neck. Impairment of vision should be avoided. For non-sprayers, the need for RPE should be informed by a suitable risk assessment.

All professional operators exposed to antifouling products containing Zineb should wear a disposable coverall with hood (providing head protection) and a second overall beneath this coverall of a contrasting colour to the antifouling product being applied. All bare skin should be covered. The disposable coverall should normally be used for no more than one spraying session. The second overall should be changed regularly and whenever product break-through has been detected.

Professional operators working with antifouling products containing Zineb should wear impermeable gloves of a type recommended by the antifouling manufacturer as suitable for use with the formulation. These gloves should be changed regularly, e.g. after one or two days use. Operators should wear impermeable (and non-slip) footwear that protects the lower leg.

For professional operators applying Zineb products by brush or roller a suitable coverall offering 95% reduction in penetration should be worn. No RPE is expected to be required.

Non-professional Workers

Non-professional workers are expected to wear no protective clothing and exposure has been evaluated using a clothing penetration factor of 50%. Insult is expected to be light and no RPE is expected to be worn. Brush and roller application yields systemic exposure of 0.017 mg/kg bw/day (MOE 206) and paint removal via abrasive blasting yields exposure of 0.007 mg/kg bw/day (MOE 524). Washing of brushes without gloves yields systemic exposure of 0.002 mg/kg bw/day (MOE 1750).

The RMS concludes the use of the 4.53% product is safe for non-professional workers. However, the 10% Zineb product should be for professional use only.

Secondary Exposure

Indirect exposures to zineb from professional use of the substance are unlikely. There is, however, potential for humans to be exposed to zineb by the dermal route through contact with the product's residues after application by non-professionals. In addition, the washing of workwear could also lead to exposure.

Exposure through washing of work wear is expected in a scenario were work wear exposure to the 10% product is washed exposure is expected to be in the order of 0.0003 mg/kg bw/event. This is a MOE of 17500.

A child exposed to wet paint is regarded as the worst case for secondary exposure. Exposure is expected to be acute and is compared to the acute AEL of 7.5 mg/kg bw/day. Exposure to both hands to he 4.53% product is expected to lead to a total systemic exposure of 0.043 mg/kg bw/day a MOE of 174. This MOE is acceptable as it is above the cut off of 100.

2.2.2. Environmental Risk Assessment

2.2.2.1. Fate and Distribution in the Environment

Fate in the aquatic compartment (including sediment)

Zineb was shown to be hydrolytically unstable at pH 4, 7 and 9 at 20 and 40°C. The amount of zineb at time 0 ranged from 4.2 % to 24.8 %, with most of the values < 10 %. Similar rates of degradation were observed at pH 4, 7 and 9 (DT_{50} << 1 d). The major products of Zineb hydrolysis were identified as DIDT (max 36 % (0 d) pH 9, 20°C), ETU (15.6 %(7 d) pH 9, 20°C), and EU (max 52.3 %(30 d), pH 7 marine). Additional analysis revealed three distinct radioactive compounds. These were identified as the inner salt (max 54.1 %(14 d) pH 7, 20°C), EDA (max 55.4 %(14 d), pH 4, 20°C) and the parent material. These were not observed at >10 %AR in water-sediment systems.
The DT_{50}s for the metbolites are considered unreliable[3]. However, the data[4] clearly indicate that the hydrolytic DT_{50} of DIDT is less than one day. All the other metabolites degrade slower. EU was the most persistent with over 50 % remaining in the water (pH 7 and pH 9) after 30 d incubation at 20°C. The available aqueous photolysis study suggests this process is unimportant as Mancozeb, which is structurally similar to zineb, was rapidly and completely decomposed within 3 hours in the presence or absence of irradiation.

According to the results from a modified Sturm test, Zineb does not meet the stringent criteria for readily biodegradability. Biodegradability was also investigated in a seawater system containing no sediment using the Closed Bottle Test. This test assessed ultimate biodegradation or mineralisation. Zineb was not rapidly mineralised. However, zineb entering marine environments will be rapidly broken down by hydrolytic processes.

The rapid removal of Zineb from aqueous systems was confirmed by the results of a water/sediment study carried out in river (20°C), brackish (20°C), marine (10°C), and marine and copper[5] (20°C), water-sediment systems. 6 hr after the initial application between 3.9% and 10.5 %AR could be attributed to zineb. The whole system DT_{50} values obtained for zineb were similar in all systems and ranged from 0.271 to 0.68 hr at 9°C (normalised data). The results of both marine and freshwater studies suggest that it would be unlikely that zineb would accumulate in the aquatic environment, as losses would occur via degradation. A slightly longer DT_{50} was observed in the marine system that contained copper (II) ions (DT_{50} 0.39 hr Vs 0.25 hr at 10°C). In addition lower amounts of radioactivity were observed in the water phase until day 63. There was a corresponding higher amount of radioactivity found in the sediment, which was due to an increase in non-extractable radioactivity. This might be due to the formation of copper complexes with zineb metabolites.

Degradation of zineb was accompanied by metabolite formation DIDT (max 35.8 %, 0.25 d), ETU (41.3 %, 2 d) and EU (65.2 %, 29 d) in brackish/marine water sediment systems, **Table 2.2.2.1-1a**. The three degradates detected in the water/ sediment test systems >10% AR all had longer DT_{50}s relative to zineb (DT_{50} << 1 d), **Table 2.2.2.1-1a.** Separate reliable DT_{50}s for the water and sediment compartments could not be obtained for DIDT, ETU and EU. **Table 2.2.2.1-1a**. summarises the $DegT_{50}$ observed in the whole system. EU was observed to be stable in marine environments and may be regarded as persistent. ETU is potentially persistent in a freshwater environment ($DT_{50\ river\ system}$ 63 d at 12°C), **Table 2.2.2.1-1a**. DIDT is not expected to be persistent in water/sediment systems (DT_{50} << 40 d). Dissipation times from the water phase are presented in **Table 2.2.2.1-1b**.

Bound residues reached 43.5 %AR in the brackish test system at the end of the incubation. Apart from the marine and copper systems (10°C, 48.2 %AR 7 d), lower levels of bound residues were

[3] Please refer to IIA for further details
[4] Percentage of metabolite in water/sediment
[5] Copper as Cu^{2+}

observed in the other systems (river system, 20°C, 24.5 %AR 103 d, marine system, 10°C, 30.6 %AR 103 d). Bound residues steadily increased during the study and did not reach a plateau. The highest level of mineralisation occurred in the river system (61.7%AR $^{14}CO_2$ at the end of the incubation (103 d)). Lower amounts of mineralisation were observed in the brackish (33.7 %AR), marine (5.6%) and marine and copper systems (2.1 %) respectively. DIDT was observed in significantly lower amounts in the marine and copper system.

Table 2.2.2.1-1a. DT_{50}s and maximum observed levels of zineb metabolites in water-sediment systems

System	%AR			$DegT_{50\ System}$ (d)	r^2	Normalised $DT_{50\ System}$ (d)			
	Water	Sediment	System			9°C#	12°C#	15°C	20°C
DIDT									
Brackish (20°C)	25.8 (0.04d)	3.4(0.04 d)	29.2 (0.04d)	1.1	0.99	2.7	2.1	1.6	1.1
River (20°C)	27.6 (0.25 d)	14.6 (0.04 d)	34.4(0.04 d)	1.0	0.98	2.41	1.9	1.5	1.0
Marine (10°C)	**33(0.25 d)**	**2.8(0.04 d)**	**35.8(0.25 d)**	**3.2**	0.99	3.47	2.73	2.15	1.44
Marine & copper (10°C)	1.9(0.04 d)	4.4(1d)	5.7(1 d)	NC	NC	---	---	---	---
ETU									
Brackish (20°C)	**38.3 (2 d)**	**6.5 (7 d)**	**41.3 (2 d)**	8.0	0.99	19	15	12	8.0
River (20°C)	36.9(1 d)	4.8(7 d)	39.4 (1 d)	**33.4**	0.71	80.5	63	50	33.4
Marine (10°C)	19.2(1 d)	3.0(14 d)	21.4(1 d)	12.0	0.97	13.0	10.2	8.04	5.4
Marine & copper (10°C)	16.5 (0.04 d)	8.2 (14 d)	17.3 (0.04 d)	22.4	0.94	24.3	19.1	15	10
EU									
Brackish (20°C)	**52.9 (29 d)**	**12.4 (14 d)**	**65.2 (29 d)**	**28.6**	0.91	68.9	54.2	42.7	28.6
River (20°C)	26.8 (14 d)	4.8 (7 d)	31 (14 d)	15.2	0098	36.6	28.8	22.7	15.2
Marine (10°C)	38.2(103 d)	11.1(14 d)	46.2(63 d)	*	*	---	---	---	---
Marine & copper (10°C)	40.2 (103 d)	10.7 (63 d)	50 (103 d)	*	*	---	---	---	---

$DT_{50}(X\ \ C) = DT_{50}(t)\ e^{(0.08(T-X))}$ where X = reference temperature

Temperature specified in the TGD

NA Not Applicable NC = Not calculated due to low values * No degradation was observed during the incubation period

Marine & copper = system was treated with copper (II) sulfate at a target concentration of 100 mg/L.

pH of the water phase ranged from 7.94 to 8.27 pH of the sediment phase ranged from 7.4 to 8.3.

Kinetic analysis was performed for the metabolites using the decline curve starting at the time point where the maximum amount of metabolite was seen.

Observed levels of DIDT

In this study one-dimensional thin-layer chromatography (TLC) was used to characterise and/or quantify Zineb and its main metabolite fractions. Caution should be exercised when interpreting these results, as the observed amount of DIDT found on the TLC plate does not reflect the composition in the conical flask as a result of air oxidation.

Separate reliable $DegT_{50}$s for the water and sediment compartments could not be obtained

Table 2.2.2.1-1b. $DissipT_{50}$ from water as a function of system type

Substance	$DissipT_{50}$ from water (hr)	r^2	Normalised $DissipT_{50}$ (hr) as a function of temperature (°C)			
			9	12	15	20
Brackish (20 °C)						
Zineb	0.22	0.9866	0.53	0.42	0.33	0.22
DIDT	1.0	0.9991	2	1.90	1.49	1
ETU	6.3	0.9995	15.2	11.9	9.4	6.3
EU	30.3	0.8706	73.1	57.5	45.2	30.3
River (20 °C)						
Zineb	0.25	0.9478	0.60	0.47	0.372	0.25
DIDT	1.2	0.9763	2.9	2.3	1.8	1.2
ETU	25.6	0.8874	61.71	48.5	38.2	25.6
EU	15.6	0.9730	37.6	29.6	23.3	15.6
Marine (10 °C)						
Zineb	0.24	0.9831	0.26	0.20	0.16	0.11
DIDT	2.9	0.9972	3.1	2.5	1.9	1.3
ETU	9.0	0.9717	9.8	7.7	6.0	4.0
EU	---	---	---	---	---	---
Marine + copper (10 °C)						
Zineb	0.35	0.9853	0.38	0.29	0.23	0.16
DIDT	---	---				
ETU	6.1	0.9853	6.6	5.2	4.1	2.74
EU	---	---	---	---	---	---

Monitoring data

NIVA was commissioned by the Norwegian Climate and Pollution Agency (Klif) to establish the occurrence of nonylphenol, octylphenol and bisphenol A in the marine and freshwater aquatic environments, the antifouling biocide zineb and its transformation product ethylenethiourea (ETU) in harbours.[6] Samples that were screened for zineb/ETU were collected from two small craft harbours: Oslo motorbåtforening (Bestumkilen, Oslo) and Bergens seilforening (Kviturspollen, Bergen). Skånevikfjorden was used as the reference location. Neither zineb nor ETU were detected in the dissolved aqueous phase of the water samples collected. In the particulate phase ETU was detected at concentrations of between 1.3 and 2.2 ng/L in the samples collected from Bestumkilen, Oslo and between 3.3 and 15.5 ng/L in the samples collected at Kviturspollen, Bergen. The concentrations in the particulate samples collected from Skånevikfjorden were below the limit of detection (< 1 ng/L) as were the levels of zineb in all particulate samples. The concentrations of zineb and ETU were also below the limit of detection in the sediment samples collected. The PEC of zineb and ETU in marine surface water are substantially higher. This may be due to a variety of reasons:

1. Relevant removal processes may not have been taken into account in the calculated PEC
2. The used model is not suitable for simulation of the actual situation
3. Measured values, may only be representative of background values of the PEC
4. Degradation of the substances may also be underestimated

[6] Screening of selected alkylphenolic compounds, biocides, rodenticides and current use pesticides TA2899 2012, NIVA, Oslo, April 2012

http://www.klif.no/no/Tema/Miljoovervakning/Statlig-miljoovervakning/Endringer-i-menneskeskapte-utslipp-av-naringssalter-TEOTIL/Rapporter/Screening-of-selected-alkylphenolic-compounds-biocides-rodenticides-and-current-use-pesticides/
(Web link was valid on the 28/09/12)

The most likely cause of the observed deviation between the measured environmental concentration (EC) and the PEC in the current exposure assessment is underestimation of degradation. Reliable $DegT_{50}$s could not be determined for the water and sediment compartments. Instead a work around procedure was agreed upon at TM I (2012). This resulted in conservative $DegT_{50}$s been selected for modelling.

At product authorisation Member States may wish to consider any relevant monitoring data to refine the exposure assessment (where necessary) for small crafts in marine harbours e.g. pleasure craft. However, if the measured environmental concentration (EC) is to replace the PEC, Member States should consider if the EC has been derived from a sufficient number of representative samples. If the measured values meet the procedure of critical statistical and geographical evaluation, these data can be considered to be reliable and may replace the calculated PEC for small crafts in harbours. In the current risk assessment it was not necessary to refine the PECs arising from pleasure craft in marine surface water when the *wider environment* is considered. To summarise, if a measured EC is to replace a PEC, Member States should consider if the EC has been derived from a sufficient number of representative samples and meets the relevant statistical and geographical criteria.

Fate in the terrestrial compartment

Mancozeb which is structurally similar to zineb degraded rapidly in soil under aerobic conditions, with half-lives of < 1 to 3 hours (max DT_{50} at 12°C is 0.2568 d). As in aquatic studies, the significant degradation products were DIDT (14.8 %, day 0), ETU (9.1 %, day 0) and EU (19 % day 0), all of which subsequently degraded further. Soil DT_{50}s normalised to 12 °C are less than < 6 months for DIDT (max DT_{50} at 12°C is 14.67 d), ETU (max DT_{50} at 12°C is 9.05 d) and EU (max DT_{50} at 12°C is 59.58 d). Consequently, these metabolites do not fulfil the persistence criteria in soil.

The use of zineb in product type 21 (antifouling) is not expected to result in widespread exposure of the soil environment. Whilst it is possible that small scale exposure soil may occur during application the area of contamination is considered limited in comparison to STP sludge applications to agricultural soil.

Soil mobility

The potential for mobility in soil was investigated with Mancozeb using the batch equilibrium method. At the end of the experimental period nearly complete degradation of mancozeb was observed. Consequently, the adsorption/desorption behaviour described by radioanalysis is actually for mancozeb and its degradates, taken together. Mancozeb and its degradates bind strongly to soil. Adsorption Koc values ranged from 363 (silt loam) to 2,334 (sand) L/kg. The mean Kaoc (Freundlich adsorption isotherm) for all four soils tested was 997.5 L/kg. ETU is not strongly adsorbed by soil. An average adsorption coefficient of 70 L/kg (high mobility) was obtained. The mean Kaoc for all four soils tested was 9.75 L/kg for EU. No experimentally derived data are available on the adsorption/desorption properties of the soil metabolite DIDT. This is presumably due to its fast degradation in soil. The notifier calculated a Koc for DIDT (40.02 L/kg) using the US EPA EPIWIN v 3.12-computer program.

Degradation in the atmospheric compartment

Zineb is unlikely to enter the air compartment to any significant level based on its vapour pressure ($V_P < 3.6 \times 10^{-5}$ Pa at 25°C) and intended use pattern. The half-live for reaction of zineb ($EDBC^{2-}$) with hydroxyl radicals in air is estimated to be 0.109 days (24 hour day; 0.5×10^5 $OH^{\bullet}/cm^3$, AOPWIN, USEPA EPIWIN v. 3.12).

2.2.2.2. Effects Assessment

Substances relevant to the environmental risk assessment

Zineb degrades rapidly in both the aqueous and terrestrial environments. In both compartments, the metabolites of significance have been shown to be DIDT, ETU and EU. In view of the pattern of exposure resulting from the proposed use of Zineb as a biocide in antifouling applications, with potential for continuous low-level emissions to the marine environment and intermittent release to the freshwater and terrestrial environments, it is considered appropriate to base the risk assessment on the potential for exposure of organisms to bothe the parent ant each of its significant metabolites.

Effects on aquatic organisms

Water Compartment

Zineb
The following endpoints have been used to determine the Predicted No Effect Concentration for Zineb in the freshwater and marine aqueous environments ($PNEC_{freshwater}$ and $PNEC_{marine}$):

Fish early life stage (Mancozeb) 34 d NOEC in *Pimephales promelas* = 0.00219 mg/l (measured).
Chronic toxicity to Daphnids (Mancozeb) 21d NOEC in *Daphnia magna* = 0.0073 mg/l (measured).
Chronic toxicity to algae: 72h $NOEC_r$ in *Skeletonema costatum* = 0.022 mg/l, measured; 0.04 mg/l (nominal).

The current strategy for deriving a protective $PNEC_{freshwater}$, outlined in the Technical Guidance Document for Risk Assessment of New and Existing Substances (TGD), indicates that the appropriate assessment factor should be applied to the lowest acute $L(E)C_{50}$ or chronic NOEC value obtained from toxicity testing in fish, aquatic invertebrate and algal species. Here, the lowest endpoint is that for chronic toxicity to fish (0.00219 mg/l). In the case that chronic toxicity data are available from three separate trophic levels the assessment factor used is 10. On this basis, the **$PNEC_{freshwater}$ = 0.000219 mg/l**, based on the application of an assessment factor of 10 to the measured NOEC value obtained for chronic toxicity to *Pimephales promelas.*

With regard to the $PNEC_{marine}$, in the case that chronic toxicity data are available from three separate trophic levels the assessment factor established in the TGD is 100. On this basis, the **$PNEC_{marine}$ = 0.0000219 mg/l** based on the application of an assessment factor of 100 to the measured NOEC value obtained for chronic toxicity to *Pimephales promelas.*

DIDT
The following endpoints have been used to determine the $PNEC_{freshwater}$ and $PNEC_{marine}$:

Acute fish toxicity: 96 h LC_{50} in *Poecilia reticulata* = 0.49 mg/l (nominal).
Acute invertebrate toxicity: 48 h EC_{50} in *Daphnia magna* = 0.21 mg/l (nominal).
Acute algal toxicity: 72 hour E_bC_{50} in *Chlorella pyrenoidosa* = 0.18 mg/l (nominal).

According to the current strategy for deriving a protective PNECfreshwater outlined in the TGD, in the event that acute toxicity data are only available from three trophic levels, the assessment factor used is 1000. On this basis, the **$PNEC_{freshwater}$ for DIDT = 0.00018 mg/l**, based on the application of an assessment factor of 1000 to the E_bC_{50} value obtained in the algal toxicity test.
According to the current strategy for deriving a protective PNECmarine outlined in the TGD, in the event that acute toxicity data are only available from three trophic levels, the assessment factor used is

10,000. On this basis, the **$PNEC_{marine}$ for DIDT is 0.000018 mg/l**, based on the application of an assessment factor of 10,000 to the E_bC_{50}value obtained in the algal toxicity test.

ETU
The following endpoints have been used to determine the $PNEC_{freshwater}$ and $PNEC_{marine}$:

Acute fish toxicity: 96 h LC_{50} in *Onchorynchus mykiss* > 500 mg/l (nominal).
Acute invertebrate toxicity: 48 h EC_{50} in *Daphnia magna* = 21.6 mg/l (nominal).
Acute algal toxicity: 72 hour E_bC_{50} in *Chlorella pyrenoidosa* = 23.7 mg/l (nominal).

Applying an assessment factor of 1000 (see discussion for DIDT), the **$PNEC_{freshwater}$ for ETU = 0.0216 mg/l**, based on the EC_{50} value obtained in the invertebrate toxicity test.
Applying an assessment of 10,000 (see discussion for DIDT), the **$PNEC_{marine}$ for ETU = 0.00216 mg/l**, based on the EC_{50} value obtained in the inverebrate toxicity test.

EU
The following endpoints have been used to determine the $PNEC_{freshwater}$ and $PNEC_{marine}$:

Acute fish toxicity: 96 h LC_{50} in *Onchorynchus mykiss* > 122 mg/l (nominal).
Acute invertebrate toxicity: 48 h EC_{50} in *Daphnia magna* > 985 mg/l (nominal).
Acute algal toxicity: 72 hour E_bC_{50} in *Chlorella pyrenoidosa* > 119 mg/l (measured).

Applying an assessment of 1000 (see discussion for DIDT), the **$PNEC_{freshwater}$ for EU = 0.119 mg/l** based on the E_bC_{50} value obtained in the algal toxicity test.
Applying an assessment factor of 10,000 (see discussion for DIDT), the **$PNEC_{marine}$ for EU = 0.0119mg/l**, based on the E_bC_{50}value obtained in the algal toxicity test.

Sediment compartment

PNECs for the sediment compartment were calculated using the surface water concentration and the equilibrium partitioning method. Mancozeb adsorption data was used as a surrogate for zineb in these calculations. It should be noted that it was assumed that the adsorption constant obtained represented only Mancozeb. However, in reality it represented the overall behaviour of the applied substance and its degradates due to rapid degradation of the test substance during the adsorption test. A similar statement can be made in relation to the adsorption behaviour of ETU and EU.

On this basis, **PNEC values of 9.88×10^{-3}** and **9.88×10^{-4} mg/kg wwt (4.55×10^{-2}** and **4.55×10^{-3} mg/kg dwt)** has been derived for freshwater and marine sediment organisms, respectively.

With regard to the significant metabolites of Zineb in sediment, the following PNEC values have been determined for organisms in the sediment compartment:

Compound	PNEC for freshwater sediment organisms	PNEC for marine sediment organisms
DIDT	2.97×10^{-4} mg/kg wwt 1.37×10^{-3} mg/kg dwt	2.97×10^{-5} mg/kg dwt 1.37×10^{-4} mg/kg dwt
ETU	4.98×10^{-2} mg/kg wwt 0.229 mg/kg dwt	4.98×10^{-3} mg/kg wwt 0.0229 mg/kg dwt
EU	0.118 mg/kg wwt 0.544 mg/kg dwt	1.18×10^{-2} mg/kg wwt 0.0544 mg/kg dwt

Biological methods of sewage treatment

A study to investigate the effects of Zineb on the respiration of activated sludge micro-organisms following a contact time of 30 minutes resulted in an EC_{50} of > 1000 mg/l. In accordance with the strategy set out in the TGD, the value $PNEC_{micro\text{-}organisms}$ is derived by applying an assessment factor of 100 to the EC_{50} derived from laboratory testing, in this case resulting in a **$PNEC_{micro\text{-}organisms}$ of 10 mg Zineb/litre** within a sewage treatment plant.

In view of the rapid hydrolysis of Zineb in aqueous solution, it is considered that the micro-organisms in this test will have been exposed to a mixture of the parent and its degradation products. It is therefore considered appropriate to extend the **$PNEC_{micro\text{-}organisms}$ of 10 mg/litre** within a sewage treatment plant to each of Zineb's significant organic degradates. In the case of ETU and EU in particular, this is considered to represent an absolute worst-case interpretation.

Effects on terrestrial organisms

Zineb
In the absence of data on the toxicity of Zineb to soil-dwelling organisms, EUSES 2.0.3 has been used to derive a PNEC on the basis of equilibrium partitioning. A PNEC of **7.79×10^{-3} mg/kg wwt (8.83×10^{-3} mg/kg dwt)** was derived in this way for soil-dwelling organisms.
The toxicity of the significant metabolites of Zineb to soil-dwelling organisms has also been considered.

DIDT
The equilibrium partitioning method has also been applied to DIDT, resulting in a PNEC for soil-dwelling organisms of **1.48×10^{-4} mg/kg wwt (1.68×10^{-4} mg/kg dwt) in soil**.

ETU
The LC_{50} of ETU in earthworms is >1000 mg/kg soil dwt. The test substance had no effect on either nitrogen transformation or carbon transformation at the maximum concentration tested (5.6 mg/kg soil dry weight). The NOEC is therefore considered to be > 5.6 mg/kg soil dwt. Applying the procedure set out in the TNG, the PNEC for soil-dwelling organisms is determined by applying an assessment factor of 100 to the lowest LC_{50} or NOEC, having first normalised the data to take account of variability in organic carbon content of soil. This results in a PNEC for soil-dwelling organisms of **0.119 mg/kg soil dwt (0.11 mg/kg wwt)**.

EU
The LC_{50} of EU in earthworms is >886 mg/kg soil dwt. The test substance had no effect on either nitrogen transformation or carbon transformation at the maximum concentration tested (5.6 mg/kg soil dry weight). The NOEC is therefore considered to be > 5.6 mg/kg soil dry weight. Applying the procedure described above for ETU, results in a PNEC for soil-dwelling organisms of **0.119 mg/kg soil dwt (0.11 mg/kg wwt)**.

Atmosphere

Methods for the determination of effects of chemicals on species arising from atmospheric contamination have not yet been fully developed, except for inhalation studies with mammals. For volatile compounds, acute or short-term LC_{50} data may give indications of adverse effects, and may therefore be used for a coarse estimation of the risk a chemical poses for animals. In the case of Zineb, an acute inhalation limit test in the rat resulted in a 4-hour LC_{50} value of > 5 mg/l.

2.2.2.3. PBT Assessment

PBT Assessment:

Persistence

A substance is considered to fulfil the persistence criteria when a DT_{50} value is > 60 days in marine water (or > 40 days in freshwater) or > 180 days in marine sediment (or > 120 days in freshwater sediment). The criteria for a substance to be considered as very persistent are when a DT_{50} value is > 60 days in marine waters or freshwater or > 180 days in marine or freshwater sediment.

Zineb is rapidly removed from aqueous systems. 6 hr after the initial application between 3.9% and 10.5 %AR could be attributed to zineb. Zineb cannot be regarded as readily biodegradable. The results of a biodegradation test in sea water suggest that Zineb entering the marine environment will not be rapidly mineralised. However, zineb entering marine environments will be rapidly broken down by hydrolytic processes. The normalised DT_{50}s obtained for zineb in the different water/sediment systems (brackish, river, marine, marine system containing copper) were similar ranging from 0.271 hr at 9°C (marine system) to 0.68 hr at 9°C (river system). The corresponding values at 12°C were 0.21 hr and 0.46 hr respectively. The results of both marine and freshwater studies suggest that, it would be unlikely that zineb would accumulate in the aquatic environment, as losses would occur via degradation.

DIDT, ETU and EU were observed at greater than 10 %AR in the water compartment. DIDT was detected at >10%AR in sediment in one out of four water/sediment systems. ETU was not observed in the sediment compartment of four water/sediment systems at >10%AR. However, EU was observed in three out of four water/sediment systems at > 10%AR.

Separate reliable DT_{50}s for the water and sediment compartments could not be obtained for DIDT, ETU and EU. DIDT is not expected to be persistent in water/sediment systems (DT_{50} << 40 d). EU was observed to be stable in marine water/sediment systems. ETU was observed to be potentially persistent in a freshwater environment (DT_{50} river system 63 d at 12°C), **Table 2.2.2.3-1**. In monitoring studies carried out in two Norwegian small craft harbours (Oslo motorbåtforening (Bestumkilen, Oslo) and Bergens seilforening (Kviturspollen, Bergen). Skånevikfjorden was used as the reference location.) neither zineb nor ETU were detected in the dissolved aqueous phase of the water samples collected. In the particulate phase ETU was detected at concentrations of between 1.3 and 2.2 ng/L in the samples collected from Bestumkilen, Oslo and between 3.3 and 15.5 ng/L in the samples collected at Kviturspollen, Bergen. The concentrations in the particulate samples collected from Skånevikfjorden were below the limit of detection (< 1 ng/L) as were the levels of zineb in all particulate samples. The concentrations of zineb and ETU were also below the limit of detection in the sediment samples collected.

Table 2.2.2.3-1. Metabolite degradation rate in water/sediment systems

System	$DegT_{50\ System}$ (d)	r^2	Normalised $DT_{50\ System}$ (d)			
			9°C	12°C	15°C	20°C
DIDT						
Brackish (20°C)	1.1	0.99	2.7	2.1	1.6	1.1
River (20°C)	1.0	0.98	2.41	1.9	1.5	1.0
Marine (10°C)	**3.2**	0.99	3.47	2.73	2.15	1.44
Marine & copper (10°C)	NC	NC	---	---	---	---
ETU						
Brackish (20°C)	8.0	0.99	19	15	12	8.0
River (20°C)	**33.4**	0.71	80.5	63	50	33.4
Marine (10°C)	12.0	0.97	13.0	10.2	8.04	5.4
Marine & copper (10°C)	22.4	0.94	24.3	19.1	15	10
EU						
Brackish (20°C)	**28.6**	0.91	68.9	54.2	42.7	28.6
River (20°C)	15.2	0098	36.6	28.8	22.7	15.2
Marine (10°C)	*	*	---	---	---	---
Marine & copper (10°C)	*	*	---	---	---	---

* Substance was observed to be stable

Conclusion:

Zineb does not meet the P or vP screening criteria based on the aquatic studies submitted ETU is potentially persistent in a freshwater environment. EU was observed to be stable in marine environments and may be regarded as persistent.

Bioconcentration and bioaccumulation

A substance is considered to fulfil the B (bioaccumulative) criterion when the bioconcentration factor (BCF) exceeds a value of 2,000 or when the log K_{ow} exceeds 4.5. The following relevant information is available for Zineb:

Parameter	Value	Type of study (measured/estimated value)
BCF_{fish}	34 l/kg	Measured value (Non-GLP test in juvenile rainbow trout)
	1.41 l/kg	Estimated value (calculated using USES 2.0.3*)
$BCF_{soil\ dweller}$	0.865	Estimated value (calculated using USES 2.0.3*)
Log K_{ow}	0.32	Measured value

* biomagnification factor applied by EUSES 2.0.3 was 1

Based on the above information, it is clear that there is no concern of bioaccumulation and biomagnification of zineb and it does not meet the B or vB screening criteria. The measured BCF_{fish} value of 34 is well below the trigger of 2000. Log K_{ow} values of 1.5, -0.66 and -0.74 for DIDT, ETU and EU respectively similarly suggest that the significant metabolites of Zineb are unlikely to bioaccumulate.

Toxicity

A substance is considered to fulfil the toxicity criterion (T) when:

- the long-term no-observed effect concentration (NOEC) for marine or freshwater organisms is less than 0.01 mg/L, or
- the substance is classified as carcinogenic (category 1 or 2), mutagenic (category 1 or 2), or toxic for reproduction (category 1, 2, or 3), or
- there is other evidence of chronic toxicity, as identified by the classifications: T, R48, or Xn, R48 according to Directive 67/548/EEC

The following relevant ecotoxicological information is available for Zineb:

Species	Time-scale	Endpoint	Toxicity
Fish (*Pimephales promelas)*	34 days	NOEC (effects on mean length & weight)	≤0.00219 mg a.s./L
Invertebrates	21 d	Reproduction, NOEC	0.032 mg a.s./L
Algae	72 h	Growth rate NOEC Biomass, NOEC	0.022 mg a.s./L 0.011 mg a.s./L
Microorganisms	30 min contact	NOEC	320 mg/l
Aquatic Plants	7 days	NOEC	0.098 mg/kg

The following classification on the basis of toxicological properties have been proposed (see Doc I Section 2.1.3):

Proposed classification based on Directive 67/548/EEC:

Hazard symbol:	Xn,
Indication of danger:	Harmful
R-phrases:	*R63 Possible risk of harm to unborn child*
S-phrases:	S36/37 Wear suitable protective clothing and gloves

The measured NOEC value for fish (is <0.01 mg/L, therefore Zineb is considered to fulfil the T criterion.

Conclusion

As zineb has only fulfilled 1 criterion (T) out of the 3 considered, it can be accepted that it is not a PBT substance.

The metabolites of zineb:

ETU potentially fulfils 1 criterion (P) out of the 3 considered, it can be accepted that this metabolite is not PBT.
EU fulfils 1 criterion (P) out of the 3 considered, it can be accepted that this metabolite is not PBT.

ETU is potentially persistent in a freshwater environment. EU was observed to be stable in marine environments and may be regarded as persistent. From an ecotoxicological viewpoint, neither of these metabolites meet the T criteria as defined by Regulation (EC) No. 1907/2006, REACH Annex XIII, (*the long-term no-observed effect concentration (NOEC) for marine and freshwater organisms is less*

than 0.01 mg/L'). ETU has a log Kow of -0.85[7] (estimated -0.49; experimental -0.66[8]) and EU has a log Kow of -1.24[9] (estimated -0.74[10]) indicating that neither of these metabolites meet the B or T criteria in PBT assessment.

POP Assessment:

Persistence

According to the Stockholm Convention a substance is defined as persistent when the half-life of the chemical in water is greater than two months, or when its half-life in soil is greater than six months, or when its half-life in sediment is greater than six months; or if the chemical is otherwise sufficiently persistent to justify its consideration within the scope of the Convention. Zineb (DT_{50soil} < <1 d, $DT_{50water\text{-}sediment}$ < < 1 d) does not fulfil the screening criteria for persistence as laid out in the Stockholm Convention

Separate reliable DT_{50}s for the water and sediment compartments could not be obtained for DIDT, ETU and EU. ETU and EU could potentially fulfil the POP persistence criteria in some water bodies as the system DT_{50}s were greater than 2 months (**Table 2.2.2.3-1)**. DIDT is not expected to be persistent in water/sediment systems (DT_{50} << 2 months).

Zineb (DT_{50} 0.2568 d at 12°C), DIDT (DT_{50} 14.67 d at 12°C), ETU (DT_{50} 9.05 d at 12°C), and EU (DT_{50} 59.58 d at 12°C), all exhibited DT_{50}s < than 6 months in soil and consequently are not regarded as persistent in soil. DIDT and EU exceeded 10 %AR in soil

Bioaccumulation

Based on measured BCF_{fish} value of 34 L/kg, Zineb does not fulfil the screening criteria for bioaccumulation as laid out in Annex D of the Stockholm Convention (evidence that the bioconcentration factor in aquatic species for the chemical is greater than 5,000 or, in the absence of such data, that the log Kow is greater than 5).

Long-range environmental transport

Biocides used in antifouling paints are not very volatile (Vp zineb < 3.6×10^{-5} Pa at 20°C). In case of the emission of paint particles due to overspray deposition of the particles will occur. Consequently, long-range environmental transport should not occur.

Adverse effects (includes ED Assessment)

Based on its ecotoxicological hazards, zineb is classified as N, R50/53 (very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment).

Based on its toxicological hazards, zineb is classified as Xn R63 (Possible risk of harm to unborn child). On this basis, zineb meets the criteria for adverse effects under the Stockholm convention.

Additionally, Zineb is is suspected for endocrine disruption. Zineb is listed in the EU Prioritisation list of possible endocrine disruption chemicals in category I. Zineb was selected for the list being a high production volume chemical (HPV) and a potential endocrine disrupter (EDS). Overall, Zineb is identified as Category I for possible endocrine disruptor substances (Cat. I for human health and Cat.

[7] Review report for the active substance mancozeb. Commission Working Doucment, FINAL, July 2009

[8] EPISUITE, SMILECAS Database

[9] CSID:8142, http://www.chemspider.com/Chemical-Structure.8142 html (accessed 17:10, Jan 24, 2013)

[10] EPISUITE, SMILECAS Database

III for wildlife). On the basis of the evaluation by the Irish CA for Biocides of toxicology/eco-toxicology studies using Zineb, no determination of endocrine disruption effects could be ascertained in the test organisms dosed with Zineb.

However, it should be noted that information on the potential and relevance of Zineb to thyroid toxicity has been discussed further by the International Agency for Research on Cancer (IARC) and the EU Classification and Labelling group based on the activity of the class of chemicals known as alkylenebis(dithiocarbamate), i.e. Mancozeb, Zineb, Maneb. The Working Group of the IARC concluded that whilst ethylenethiourea (ETU), a metabolite of Zineb, produced thyroid tumours that were observed in mice and rats it was by a non-genotoxic mechanism. Consequently, ETU would not be expected to produce thyroid cancer in humans exposed to concentrations that do not alter thyroid hormone homeostasis. Additionally, the IARC Working Group further concluded that evidence from epidemiological studies and from toxicological studies in experimental animals provide compelling evidence that rodents are substantially more sensitive than humans to the development of thyroid tumours in response to thyroid hormone imbalance.

As such, it has been agreed that zineb should be further assessed with regards to its potential endocrine disruptor properties once further guidance is available and preferably before the product authorisation stage. The conclusion of that assessment might lead to review the active substance approval.

Conclusion:
Although it meets the criteria for "adverse effects", overall based on the information presented, it is considered that zineb does not fulfil the screening criteria for a POP substance.

2.2.2.4. Exposure Assessment

Zineb is intended for use on commercial ships and pleasure craft. The environmental risk assessment was carried out for products containing 4.53 %w/w and 10% w/w zineb. In the case of the 10% w/w formulation only professional use was assessed as this formulation poses a toxicological risk to amateurs users that cannot be mitigated against. The Interspeed 340 product contains two active substances: zineb and copper (I) oxide. For Annex I inclusion the environmental risk assessment focuses on the zineb active. At product authorisation a combined risk assessment for both active substances will be necessary.

The leaching rates of zineb from surfaces treated with Interspeed 340 was determined using the CEPE mass-balance method. Predicted environmental concentrations (PEC) of zineb and its major degradation products (≥ 10%AR) in and around the OECD-EU marina and commercial harbour as well as in an OECD-EU shipping lane have been calculated for the in-service life stage with MAMPEC 2.5.

Emissions during application, maintenance and repair of commercial ships and pleasure crafts have been calculated according to the OECD ESD for PT 21 (2004). The following scenarios have been considered:

<u>New building</u>

Professional application of paint during the new building of commercial ships
Professional application of paint during the new building of pleasure craft

<u>Maintenance and repair-application</u>

Commercial ships application by professional
Pleasure craft application by professionals
Pleasure craft application by non-professionals

Maintenance and repair-removal

Commercial ships removal of paint by professional
Pleasure craft removal of paint by professionals
Pleasure craft removal of paint by non-professionals

Apart from the new building of pleasure craft all scenarios make direct emissions to surface water depending on the control measures in operation. The initial PEC was calculated by dividing the daily load (Elocalwater) emitted during paint application or removal with the water volume of the water body in the harbour or marina. Where necessary, the PECs were refined using MAMPEC 2.5. To do this the emission rate calculated in Tier 1 in accordance with the ESD for PT 21 was input directly into MAMPEC 2.5. This allows for the simulation of dissipation processes in aquatic environments which can be a significant refinement over simple first tier approaches based on entry to essentially static environments. PECs were calculated for both within (Tier 2a) the harbour/marina and for the surroundings environment (Tier 2b).

Simultaneous exposure from periodic application/removal activities and in-service losses could occur to several environmental compartments. To address this, a cumulative exposure assessment was performed for the following categories:

- Cumulative scenario for commercial shipping -OECD harbour
- Professional pleasure crafts activities- OECD marina
- Amateur pleasure craft activities- OECD marina

using the procedure outlined in the UK CA document on '*Cumulative Exposure Assessments'*. In accordance with TM IV (2011) two scenarios were assessed for commercial ships: i) emissions from application and in-service, and ii) emissions from removal and in-service. This was not applicable to pleasure craft as only removal activities result in direct input to surface water.

According to the OECD ESD for PT 21 emissions to soil are only considered for pleasure craft construction and maintenance and repair including removal of the paint. PECs arising in soil from direct emissions have been calculated on the basis of a single maintenance cycle. The treatment periods are the same for both application and removal activities. The concentration arising from a single maintenance period was multiplied by a multiple application factor (MAF) to account for accumulation of residues throughout the entire treatment period. To calculate the concentration arising from a single maintenance event, the information from the ESD was combined to derive an amended Elocalsoil value (essentially the Nboat and Tpaint or Tremoval parameters are removed). The Elocalsoil value was then used to calculate an initial PECsoil following a single maintenance cycle assuming even mixing in the standard soil volume associated with the scenario described in the ESD. PECs were also generated for the soil compartment associated with the new building of pleasure craft by taking the painting frequency into account.

New building and activities associated with the M&R of pleasure craft can make emissions to the STP. Indirect exposure to the soil compartment can occur through the application of sewage sludge. Concentrations arising in soil after 10 successive years of application were calculated in accordance with the TGD. PECs for three different soils were generated:

- a PEC in local soil for comparison against terrestrial ecosystem endpoints,

- a PEC in agricultural soil for comparison against crop endpoints for human consumption
- and a PEC in grassland soil for comparison against endpoints in grass for cattle.

Different values for mixing depth of soil and dry sludge application rate were selected, depending upon the endpoint being considered.

2.2.2.5 Risk Characterisation

4.53% w/w formulation
Risk for emissions to the STP

Losses of zineb to the STP as a result of professional and non-professional new building or M&R of pleasure craft do not pose an unacceptable risk to STP microorganisms.

Risk due to direct and indirect emissions to the environment

Commercial ships

Commercial ships pass the risk assessment for in-service, new building, and M&R stages when the wider environment is considered. No risk has been identified for the cumulative exposure to the marine harbour in any of the scenarios examined in the wider environment. Consequently, a safe use exists for commercial ships. However, at product authorisation, MS's may need to consider the water body within the harbour/marina depending on their protection goals.

Pleasure craft

Direct emissions to surface water and sediment (wider environment)
Direct emissions to (marine) surface water and sediment from the treatment of pleasure craft (professional & non professional use) do not pose a risk to aquatic organisms in areas surrounding marinas (the wider environment). At product authorisation MS will have to assess the relevance of the assessment in relation to their own national conditions and protection goals and perform additional assessment where necessary (Doc 6.3c from CA September 2011).

Indirect emissions to surface water and sediment (marina)
From indirect emissions, zineb when applied by non-professionals (4.53% w/w product) does not cause a risk to freshwater and sediment. However, there is an *apparent* unacceptable risk to freshwater organisms via STP emissions during professional activities associated with pleasure craft. Where possible, attempts should be made to minimise indirect exposure to these water bodies from the STP via drains. Where this is not possible, other Risk Mitigation Measures (RMM) or local adaptations will need to be considered in order that exposure from STP via drains to water bodies is minimised from professional use of products on pleasure craft. Further refinement of the risk could be considered with additional data on the product or active substance. Where no further RMM or refinement can be identified other restrictions will need to be considered.

Direct and indirect emissions to soil (includes emissions to groundwater)
Corresponding emissions (direct and indirect (sludge application)) to the soil compartment pose a risk to terrestrial organisms. These direct and indirect emissions to soil may also contribute to groundwater exposure. Direct exposure to soil from professional activities (and also for non-professionals) is

expected to occur on an area of compacted earth (industrial soil, drive-ways, slip-ways etc), and from an environmental point of view this area may be considered less important relative to agricultural soil. For the assessment of (direct) terrestrial exposure, the determination of the surface of the receiving soil compartment is based on a *"walking path"* around the boat, with an estimated width of 1 metre. Consequently, exposure is limited. Where possible, attempts should be made to minimise direct exposure to the soil compartment via suitable covers/sealants or concrete surfaces. These measures will also mitigate against groundwater pollution from direct soil emissions. Where possible, attempts should also be made to minimise indirect exposure to soil via STP sludge application by prevention of the emissions to the STP via drains. Minimisation of exposure from this route could be achieved by the collection and re-use of waste product or through suitable covers/sealants or bunded concrete surfaces. These measures will also mitigate against groundwater pollution from indirect soil emissions. For both direct and indirect exposure to soil, where such technical mitigation measures are not possible, other RMM or local adaptations will need to be considered in order to mitigate direct and indirect exposure. Further refinement of the risk could also be considered with additional data on the product or active substance. Where no further RMM or refinement can be identified other restrictions will need to be considered.

Risks to the Atmosphere

Antifouling paint particulates from airless spraying and droplets from brushing and rollering are heavier than air and will not, therefore carry Zineb into the atmosphere. Furthermore, the physico-chemical properties of Zineb (vapour pressure, < $3.6x\ 10^{-5}$ Pa at 20°C; Henry's Law Constant, 0.046 Pa m^3mole^{-1}) indicate that it will not be subject to evaporation. The half-live for reaction of zineb ($EDBC^{2-}$) with hydroxyl radicals in air is estimated to be 0.109 days (24 hour day; $0.5\ x\ 10^5$ OH●/cm^3, AOPWIN, USEPA EPIWIN v. 3.12). Consequently, atmospheric concentrations resulting from the proposed use will be negligible, aswill the residence time of any minute amounts that do enter the air compartment. It is therefore considered that the resulting level of risk to biota is insignificant and does not give cause for concern.

10 % w/w formulation

Only commercial shipping scenarios were examined in this case, as pleasure craft activities pose toxicological risks with the 4.53 %. No risk was identified for any of the scenarios examined in the wider environment. However, at product authorisation, MS's may need to consider the water body within the harbour/marina depending on their protection goals.

Non-compartment specific effects relevant to the food chain (secondary poisoning)

Available data on the bioaccumulation and biomagnification potential of Zineb and its significant metabolites indicates that there is no potential for secondary poisoning to occur.

Environmental Risk mitigation methods

Cumulative exposure of zineb and its metabolites arising from activities (application/removal phase losses + in-service losses) associated with commercial ships do not pose a threat to the surrounding (marine) environment. Thus, a safe use exists for the purpose of recommending Annex I listing. Depending on MS protection goals risk mitigation measures such as dock floor discipline, use of containment nets and good spraying practices may be needed for the environment within the harbour at product authorisation. These measures were presented and quantified for tralopyril.

Cumulative exposure of zineb and its metabolites arising from activities (removal phase losses + in-service losses) associated with pleasure craft (professional/non professional use, 4.53 % w/w formulation) do not pose a threat to the surrounding marine environment. Risk mitigation methods are needed for the environment within the marina at product authorization depending on the protection goals of Member States. General risk mitigation methods for pleasure craft are still under preparation. At TM II 2012 the antifouling industry gave an undertaking to provide more information to member states on IPPC rules as well as practical examples. According to the antifouling industry a lot of activities are carried out in boatyards and marinas, which are regulated by the IPPC rules. The code of practices and best practice are incorporated within BREFs (the Best Available Techniques (BAT) reference documents) which are related to the IPPC directive.

Zineb causes an *apparent* unacceptable risk to freshwater organisms via STP emissions during professional activities associated with pleasure craft. Where possible, attempts should be made to minimise indirect exposure to these water bodies from the STP via drains. Where this is not possible, other RMM or local adaptations will need to be considered in order that exposure from STP via drains to water bodies is minimised from professional use of products on pleasure craft. Where no RMM can be identified and where there are no further alternatives available professional use should be prohibited on pleasure craft.

According to the applicant, in practice dock yard and boatyard abatement systems (e.g. removing waste paint and flakes from beneath the vessel, filtering waste washing water etc) will minimise the emission of antifouling paint to the environment. Therefore, the worst case scenarios are unlikely to be realized at facilities in the Europe. However, some MS are of the opinion there are facilities in existence which do not have sufficient risk mitigation measures in use.

Corresponding emissions (direct and indirect (sludge application)) to the soil compartment from the treatment of pleasure craft pose a risk to terrestrial organisms. Exposure from professional activities is expected to occur on an area of compacted earth (industrial soil), and from an environmental point of view this area may be considered less important relative to agricultural soil. For the assessment of (direct) terrestrial exposure, the determination of the surface of the receiving soil compartment is based on a *"walking path"* around the boat, with an estimated width of 1 metre. Consequently, exposure is limited. Where possible, attempts should be made to minimise direct exposure to the soil compartment via suitable covers/sealants, concrete or bunded surfaces, or on soil covered with an impermeable tarpaulin. These measures will also mitigate against groundwater pollution. Where possible, attempts should also be made to minimise indirect exposure to soil via STP sludge application by preventing emissions to the STP via drains. In both cases, where this is not possible, other RMM or local adaptations will need to be considered in order to mitigate direct and indirect exposure. Further refinement of the risk could also be considered with additional data on the product or active substance. Where no further RMM or refinement can be identified other restrictions will need to be considered.

2.2.3. List of Endpoints

In order to facilitate the work of Member States in granting or reviewing authorisations, the most important endpoints, as identified during the evaluation process, are listed in Appendix I.

3. PROPOSED DECISION

3.1. BACKGROUND TO THE PROPOSED DECISION

Zineb has been evaluated as an antifoulant (PT21) for the control of the growth and settlement of fouling organisms on boats.

Zineb is intended for us by both professional and non-professional users. Typical products are expected to contain 4.53% w/w Zineb (non-professionals and professionals) and 10% w/w Zineb (professionals). The products as expected to be applied by professionals in dockyards and slipways. Application is expected to be by high pressure airless spraying. Non-professionals and chandlers are expected to apply the products by brush and roller. Paint removal is expected by be carried out by either high pressure hydroblasting or mechanical abrasion.

Risks of toxicity associated with dermal and inhalation exposures (oral exposure was deemed not relevant) were characterised for medium term exposure scenarios. Exposures were compared to the AEL_{MEDIUM} 0.035 mg/kg bw/day. Risks are considered acceptable if the MOE >100 of id the systemic exposure/AEL ratio is <1.

For professional users, loading of antifoulant paint and paint spraying yielded acceptable exposure risk for both paint types at tier 2. Professionals at work loading liquid antifouling paints into a reservoir for airless spray application wearing full PPE (1% penetration) and RPE with a reduction factor of 40 are expected to receive a systemic exposure of 0.003 mg/kg bw/day when using the 4.53% paint and 0.007 mg/kg bw/day when using the 10 % paint. These exposures represent MOEs of 1167 and 500 respectively. Professionals at work spraying antifouling paints are expected to receive a systemic exposure of 0.0027 mg/kg bw/day when using the 4.53% paint and 0.006 mg/kg bw/day when using the 10 % paint. These exposures represent MOEs of 1296 and 583 respectively.

Professionals applying paint by brush and roller wearing a single coverall allowing 5% penetration and no RPE are expected to receive a systemic exposure of 0.0035 mg/kg bw/day when using the 4.53% paint and 0.008 mg/kg bw/day when using the 10 % paint. These exposures represent MOEs of 1000 and 438 respectively.

Paint removal operators wearing full PPE (1% penetration) and RPE with a reduction factor of 40 are expected to receive a systemic exposure of 0.00026 mg/kg bw/day when using the 4.53% paint and 0.0008 mg/kg bw/day when using the 10 % paint. These exposures represent MOEs of 8750 and 4375 respectively.

Non-professional workers are expected to wear no protective clothing and exposure has been evaluated using a clothing penetration factor of 50%. Insult is expected to be light and no RPE is expected to be worn. Brush and roller application yields systemic exposure of 0.017 mg/kg bw/day (MOE 206) and paint removal via abrasive blasting yields exposure of 0.007 mg/kg bw/day (MOE 524). Washing of brushes without gloves yields systemic exposure of 0.002 mg/kg bw/day (MOE 1750). The RMS concludes the use of the 4.53% product is safe for non-professional workers. However, the 10% Zineb product should be for professional use only.

In order to minimise the exposure of non-professional users, and without prejudice to the possibility of imposing more restrictive measures based on the product assessment, products supplied to those users should always be supplied with appropriate gloves.
Indirect exposures to zineb from professional use of the substance are unlikely. There is, however, potential for humans to be exposed to zineb by the dermal route through contact with the product's residues after application by non-professionals. In addition, the washing of work-wear could also lead to exposure.

Cumulative exposure of zineb and its metabolites arising from activities (application/removal phase losses + in-service losses) associated with commercial ships do not pose a threat to the surrounding environment. Thus, a safe use exists for the purpose of recommending Annex I listing. Depending on MS protection goals risk mitigation measures may be needed for the environment within the harbour. In monitoring studies, neither zineb nor ETU were detected in the dissolved aqueous phase of the water samples collected from two small craft marine harbours (Oslo motorbåtforening (Bestumkilen, Oslo) and Bergens seilforening (Kviturspollen, Bergen). Skånevikfjorden was used as the reference location). In the particulate phase ETU was detected at concentrations of between 1.3 and 2.2 ng/L in the samples collected from Bestumkilen, Oslo and between 3.3 and 15.5 ng/L in the samples collected at Kviturspollen, Bergen. The concentrations in the particulate samples collected from Skånevikfjorden were below the limit of detection (< 1 ng/L) as were the levels of zineb in all particulate samples. The concentrations of zineb and ETU were also below the limit of detection in the sediment samples collected. Where appropriate at product authorisation Member States may wish to consider the use of monitoring data as a higher tier refinement.

Cumulative exposure of zineb and its metabolites arising from activities (removal phase losses + in-service losses) associated with pleasure craft (professional/non professional use, 4.53 % w/w formulation) do not pose a threat to the surrounding marine environment. Risk mitigation methods may be needed for the environment within the marina at product authorization depending on the protection goals of Member States. General risk mitigation methods for pleasure craft are still under preparation. At TM II 2012 the antifouling industry gave an undertaking to provide more information to member states on IPPC rules as well as practical examples. According to the antifouling industry a lot of activities are carried out in boatyards and marinas, which are regulated by the IPPC rules. The code of practices and best practice are incorporated within BREFs (the Best Available Techniques (BAT) reference documents) which are related to the IPPC directive.

Zineb causes an *apparent* unacceptable risk to freshwater organisms via STP emissions during professional activities associated with pleasure craft. Where possible, attempts should be made to minimise indirect exposure to these water bodies from the STP via drains. Where this is not possible, other Risk Mitigation Measures (RMM) or local adaptations will need to be considered in order that exposure from STP via drains to water bodies is minimised from professional use of products on pleasure craft. Further refinement of the risk could also be considered with additional data on the product or active substance. Where no further RMM or refinement can be identified other restrictions will need to be considered.

Corresponding emissions (direct and indirect (sludge application)) to the soil compartment pose a risk to terrestrial organisms. Exposure from professional activities is expected to occur on an area of compacted earth (industrial soil), and from an environmental point of view this area may be considered less important relative to agricultural soil. For the assessment of (direct) terrestrial exposure, the determination of the surface of the receiving soil compartment is based on a *"walking path"* around the boat, with an estimated width of 1 metre. Consequently, exposure is limited. Where possible, attempts should be made to minimise direct exposure to the soil compartment via suitable covers/sealants, concrete or bunded surfaces or on soil covered with an impermeable tarpaulin. These measures will also mitigate against groundwater pollution. Where possible, attempts should also be made to minimise indirect exposure to soil via STP sludge application by preventing emissions to the STP via drains. In both cases, where this is not possible, other RMM or local adaptations will need to be considered in order to mitigate direct and indirect exposure. Further refinement of the risk could also be considered with additional data on the product or active substance. Where no further RMM or refinement can be identified other restrictions will need to be considered.

Zineb does not meet the P or vP screening criteria based on aquatic studies submitted. Based on the measured BCF_{fish} it is concluded that zineb does not meet the B or vB screening criteria.
As zineb has only fulfilled 1 criterion (T) out of the 3 considered, it can be accepted that it is not a PBT substance. Although it meets the criteria for "adverse effects", overall based on the information presented, it is considered that zineb does not fulfil the screening criteria for a POP substance.

Metabolites
ETU is potentially persistent in a freshwater environment. EU was observed to be stable in marine environments and may be regarded as persistent. From an ecotoxicological viewpoint, neither of these metabolites meet the T criteria as defined by Regulation (EC) No. 1907/2006, REACH Annex XIII, (*the long-term no-observed effect concentration (NOEC) for marine and freshwater organisms is less than 0.01 mg/L*'). ETU has a log Kow of -0.85[11] (estimated -0.49; experimental -0.66[12]) and EU has a log Kow of -1.24[13] (estimated -0.74[14]) indicating that neither of these metabolites meet the B or T criteria in PBT assessment.

No significant risk of secondary poisoning has been identified as a result of the proposed uses of Zineb.

The overall conclusion from the evaluation of zineb for use in product type 21 (Antifouling products) is, that it may be possible for Member States to issue authorisations of products containing zineb for professional use on ships in accordance with the conditions laid down in Directive 98/8/EC. However, it should be noted that assessments carried out for human health and the environment for the limited number of substances under PT21 (antifouling products) indicate unacceptable risks to certain end users and/or environmental compartments exposed to these substances.

Specifically for zineb, unacceptable risks for the human health assessment were identified for the potman scenario(s) and for the environmental assessment for the marina scenario(s). These assessments also indicate the need for risk mitigation measures for other use scenarios, such as technical controls and/or personal protective equipment, in order to protect end-users using these substances and minimise exposure of the relevant environmental compartments. It was agreed to utilise generic conditions in the approval Regulation (as outlined in Section 3.2) for all PT21 substances evaluated as part of the EU review programme for existing active substances so to reduce the risks for human health as well as the risks to the environment from use of these substances.

Additional provisions were also agreed on a case-by-case basis for substances where a specified risk to human health was identified. These additional provisions are outlined in Section 3.2. For the PT21 active substance, zineb, a specific risk of skin sensitisation was identified.

3.2. PROPOSED DECISION

The overall conclusion from the evaluation of Zineb for use in Product Type 21 (Anti-fouling products), is that it may be possible to issue authorisations of products containing Zineb in accordance with the conditions laid down in Article 5(1) b), c) and d) of Dir. 98/8/EC.

[11] Review report for the active substance mancozeb. Commission Working Doucment, FINAL, July 2009
[12] EPISUITE, SMILECAS Database
[13] CSID:8142, http://www.chemspider.com/Chemical-Structure.8142 html (accessed 17:10, Jan 24, 2013)
[14] EPISUITE, SMILECAS Database

It is therefore proposed to approve Zineb as an active substance for use in product-type 21 (Antifouling products), subject to the following specific conditions:

The product assessment shall pay particular attention to the exposures, the risks and the efficacy linked to any uses covered by an application for authorisation, but not addressed in the Union level risk assessment of the active substance.

Persons making products containing zineb available on the market for non-professional users shall make sure that the products are supplied with appropriate gloves.

Authorisations are subject to the following conditions :

- For industrial or professional users, safe operational procedures and appropriate organizational measures shall be established. Where exposure cannot be reduced to an acceptable level by other means, products shall be used with appropriate personal protective equipment.
- Labels and, where provided, instructions for use shall indicate that children shall be kept away until treated surfaces are dry.
- Labels and, where provided, safety data sheets of products authorised shall indicate that application, maintenance and repair activities shall be conducted within a contained area, on impermeable hard standing with bunding or on soil covered with an impermeable material to prevent losses and minimize emissions to the environment, and that any losses or waste containing zineb shall be collected for reuse or disposal.
- For products that may lead to residues in food or feed, the need to set new or to amend existing maximum residue levels (MRLs) in accordance with Regulation (EC) No 470/2009 or Regulation (EC) No 396/2005 shall be verified, and any appropriate risk mitigation measures shall be taken to ensure that the applicable MRLs are not exceeded.

Where a treated article has been treated with or intentionally incorporates zineb, and where necessary due to the possibility of skin contact as well as the release of zineb under normal conditions of use, the person responsible for placing the treated article on the market shall ensure that the label provides information on the risk of skin sensitisation, as well as the information referred to in the second subparagraph of Article 58(3) of Regulation (EU) No 528/2012.

3.3. ELEMENTS TO BE TAKEN INTO ACCOUNT WHEN AUTHORISING PRODUCTS

1. Products must be labelled appropriately to ensure safe storage, handling, use and disposal in accordance with national arrangements. In particular, the professional product should carry the statement “Unprotected persons should be kept out of treatment areas”.

2. In particular, the use instructions carried on product labels when authorised must indicate that the risk of local effects on skin, eyes and respiratory tract must be controlled, especially for paint spraying and paint removal. As well, any potential systemic effects from zineb must also be controlled. Use of suitable risk management measures, including process optimisation, engineering control and appropriate and suitable PPE/RPE (chemically resistant gloves and

boots, goggles/face shield, protective clothing, suitable respiratory equipment etc) has to be established.

3. Professional operators involved in the application of antifoulants containing Zineb by sprayers or the removal of antifoulant products by pressure blasting containing Zineb should wear RPE. Appropriate RPE includes air-fed respiratory equipment with combined protective helmet and visor to protect the skin of the head and neck. Impairment of vision should be avoided. For non-sprayers, the need for RPE should be informed by a suitable risk assessment. All professional operators exposed to antifouling products containing Zineb should wear a disposable coverall with hood (providing head protection) and a second overall beneath this coverall of a contrasting colour to the antifouling product being applied. All bare skin should be covered. The disposable coverall should normally be used for no more than one spraying session. The second overall should be changed regularly and whenever product break-through has been detected. Professional operators working with antifouling products containing Zineb should wear impermeable gloves of a type recommended by the antifouling manufacturer as suitable for use with the formulation. These gloves should be changed regularly, e.g. after one or two days use. Operators should wear impermeable (and non-slip) footwear that protects the lower leg.

4. For professional operators applying Zineb products by brush or roller a suitable coverall offering 95% reduction in penetration should be worn. No RPE is expected to be required, but an assessment should be provided at product authorisation.

5. In order to minimise the exposure of non-professional users, products supplied to those users should always be supplied with appropriate gloves. More restrictive measures can in addition be imposed based on the assessment of the product (ex: that the packaging of the products contains the protective gloves).

6. The size of the package placed on the market should be proportionate to the duration of the treatment and appropriate to the pattern of use of particular user groups.

7. When authorising products, the product formulation in relation to the active and non-active components within the product should be carefully considered, since these factors could affect the potential for local human health effects and the dermal penetration of the substance, i.e. through the leaching rate of the substances from the antifouling product.

8. All necessary measures must be taken to reduce the risk of fire and explosion when handling the product.

9. Valid information on local human health effects and dermal penetration of the product should be provided

10. The efficacy of individual products must be quantitatively demonstrated prior to product authorisation at Member State level.

11. Efficacy studies should be provided from trials conducted in freshwater conditions at the product authorisation stage

12. A more comprehensive data package relating to resistance will be required at the product authorisation stage.

13. Robust leaching data must be provided at the product authorisation stage in order to demonstrate safe use of antifouling products.

14. The current environmental exposure assessment does not consider direct emissions to freshwater during the service life of the product. At TM III (2012), the Netherlands presented a discussion paper on this topic. The main objective was to develop a scenario for fresh water marinas which is intended for product authorisation. The Netherlands proposed the development of a fresh water marina based on the OECD marina, adjusting the harbour and boat settings. The salt water marina has a tidal influence that affects the refreshment rates, which is one of the main inputs that influences the PEC. As a result some MS do not consider the salt water marina protective enough for the fresh water marina. At product authorisation stage this issue should be considered, where relevant.

15. Antifouling biocidal products are often used in fishnet impregnation in order to prevent fouling. In April 2012 the Swedish CA instigated an E-consultation on the development of a harmonised scenario for the use of fishnet impregnation biocides. According to the Minutes of TM II(2012) Sweden suggested that the e-consultation is to be followed by a workshop at the November TM. At product authorisation stage this issue should be considered.

16. PECs for the wider environment (MAMPEC calculations) were considered in the risk assessment for Annex I inclusion. Depending on the protection goals of each Member State, it may be necessary to carry out a risk assessment for the environment within the harbour and/or marina at product authorisation and implement risk mitigation measures as appropriate

17. The ESD recognises that specific local or seasonal influences could have a very significant effect on exposure levels. Member States may need to take these influences into account during product authorisation stage. For example *"tidal height is a sensitive parameter in the MAMPEC model that influences water exchange volumes along with other hydrological settings. Although the default value of 1.5 m was selected as being typical, across the EU tidal height can range from effectively zero in the eastern Baltic to greater than 15 m in some UK waters."*[15]

18. The Interspeed 340 product contains two active substances: zineb and copper (I) oxide. The exposure and subsequent risk assessment, has concentrated on zineb. At product authorisation a combined risk assessment for both active substances will be necessary. A risk assessment may also need to be performed for zinc. Zinc has been evaluated under the previous Existing Chemicals Program where PNEC values were derived (please refer to the minutes of TM I(2012) for further details).

19. Unacceptable risks to the soil compartement were shown at the approval stage of the active substance for the use on pleasure crafts. This should be carefully considered at the product authorisation stage of biocidal products.

20. Specific uses not described within the assessment presented and applied for at product authorisation stage, will require further assessment in relation to the human health and environmental risk characterisation. In particular, changes to the active substance content of a product and areas of environmental release should be carefully evaluated to ensure that safe uses can be demonstrated.

21. The potential for residues of zineb in food and feed of marine origin was not assessed as part of this Competent Authority Report. Member States should be aware to fully evaluate, as part of a dietary risk assessment, the potential for food/feed residues of zineb if application at product authorisation is being sought where there is a risk of food/feed contamination, such as its potential use on aquaculture structures.

[15] 38th meeting of representatives of Members States Competent Authorities for the implementation of Directive 98/8/EC concerning the placing of biocidal products on the market Discussion paper on PT21 environmental risk assessment issues.

22. When Member States are authorising products containing zineb the potential of zineb to cause endocrine disruption will need to be further analysed and considered once guidance is available. This is because zineb may have the potential to cause endocrine disruption based on suspected properties. However, in the submitted studies there were no effects in the test animals which could be related to possible endocrine disruption. Therefore, it has been agreed that zineb should be further assessed with regards to its potential endocrine disruptor properties once further guidance is available and preferably before the product authorisation stage. The conclusion of that assessment might lead to review the active substance approval.

3.4. REQUIREMENT FOR FURTHER INFORMATION

It is considered that the evaluation has shown that sufficient data have been provided to verify the outcome and conclusions, and permit the proposal for the approval of Zineb in accordance with Article 9 of Regulation (EU) No 528/2012.
The following data requirements have been identified:

Identity of the active substance

Not applicable.

Physical and chemical properties of the active substance

Not applicable.

Physical and chemical properties of the biocidal product

The applicant used an 'Interspeed 340' product containing 3.57% w/w Zineb for their IIIB phys/chem studies. According to the Technical Specification for the product, the Zineb content should be present at *ca.* 4.53% w. The applicant will have to provide a complete phys/chem. data package for the 4.53% w/w product at the product authorisation stage in order to support a 4.53% w/w product.

Methods of analysis

Methods of analysis for the relevant impurities (ETU and DIDT) in the formulated product (4.53% w/w product). The methods of analysis can be provided at the product authorisation stage.

Human health

Not applicable.

Environment
In order to address a potentially severe underestimation of the risk to sediment dwelling organisms from exposure via suspended matter, caused by the fact that sorption data (Koc) has only been studied at concentrations which are not fully relevant in the marine environment, a new study on sorption at environmentally relevant conditions (concentrations µg/L to ng/L, pH ~8, DOC not too high, etc.) is to be performed before the antifouling active substances are evaluated for a potential renewal of the approval.

This new sorption study should ideally be carried out in the same laboratory for all antifouling substances which are on the market at the time. By using the same seawater and sediment, the study

will provide harmonized sorption data of relevance to marine environmental conditions. The study should as a minimum follow the OECD guidelines, unless by then, established scientific progress in the field of sediment risk assessment indicates other directions (SETAC books, OECD guidelines). Since low concentrations are to be studied, technical problems with limits of quantification may need to be addressed as stated in OECD 106 §34 by selecting appropriate amounts of sample matrix (water and sediment), possibly this will mean up-scaling of the traditionally small amounts used, or new test methods. An outline test protocol will by then have to be developed and agreed by the e-consultation group (of TM 2012) in dialogue with sorption researchers.

For product authorisation depending on MS protection goals the significance of effects occurring in the immediate vicinity of the STP outflow may need to be considered where indirect exposure to surface water is apparently higher than direct emission due to the nature of the exposure models (MAMPEC Vs. EUSES). To refine the exposure assessment in the immediate vicinity of the STP, a STP simulation test maybe required at product authorisation stage for zineb to provide more reliable information on fate and behaviour in a STP. If a confirmatory data requirement is set for zineb a confirmatory data requirement should be set for other PT21 substances in a similar situation.

3.5. UPDATING THIS ASSESSMENT REPORT

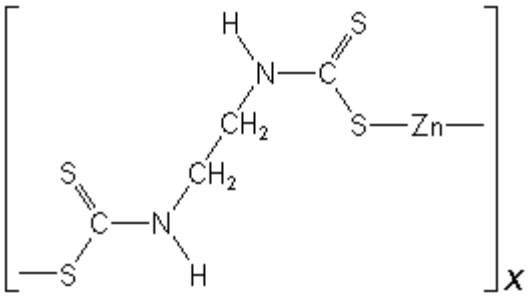
This assessment report may need to be updated periodically in order to take account of scientific developments and results from the examination of any of the information submitted in relation with Regulation (EU) No 528/2012. Such adaptations will be examined and finalised in connection with any amendment of the conditions for the approval of zineb.

APPENDIX I: LIST OF ENDPOINTS

CHAPTER 1: IDENTITY, PHYSICAL AND CHEMICAL PROPERTIES, CLASSIFICATION AND LABELLING

Active substance (ISO Common Name)	Zineb
Product-type	PT 21

Identity

Chemical name (IUPAC)	Zinc ethylenebis(dithiocarbamate) (polymeric)
Chemical name (CA)	[[2-[(dithiocarboxy)amino]ethyl]carbamodithioato(2−)-κ*S*,κ*S*′]zinc
CAS No.	12122-67-7
EC No.	235-180-1
Other substance No.	None
Minimum purity of the active substance as manufactured (g/kg or g/l)	940 g/kg
Identity of relevant impurities and additives (substances of concern) in the active substance as manufactured (g/kg)	ETU (maximum 1 g/kg) DIDT (maximum 0.6 g/kg)
Molecular formula	$(C_4H_6N_2S_4Zn)x$
Molecular mass	$(275.7)_x$ g/mol
Structural formula	

Physical and Chemical Properties

Melting point (state purity)	It was not possible to record a melting point value. Zineb decomposes before melting. Decomposition observed at *ca.* 165°C.(Purity: 96.8%)
Boiling point (state purity)	It was not possible to record a boiling point value. Zineb decomposes before boiling. Decomposition observed at *ca.* 165°C.(Purity: 96.8%)
Temperature of decomposition	165 C decomposition (Purity: 96.8%)
Appearance (state purity)	Yellowish-white powder (Purity 97.54%)
Relative density (state purity)	0.44 (Purity 96%).
Surface tension	72.1 mN/m (20ºC, 1 g/l solution) (Purity: 94%)
Vapour pressure (in Pa, state temperature)	$<3.6 \times 10^{-5}$ Pa at 20°C (Purity: 96.8%)
Henry's law constant (Pa m^3 mol^{-1})	<0.046 Pa m3 mol^{-1} at 20°C
Solubility in water (g/l or mg/l, state temperature)	pH 5: <0.1 mg/l at 20°C (Purity: 97.6%) pH 7: ___ 0.22 mg/l at 20°C (Purity: 97.6%) pH 9: ____ 5.0 mg/l at 20°C (Purity: 97.6%)
Solubility in organic solvents (in g/l or mg/l, state temperature)	< 10 mg/L in Xylene , Solvent naphtha, Methyl isobutyl ketone, Methyl isoamyl ketone and 1-methoxy-3-propanol at 20°C (Purity: 96.4%)
Stability in organic solvents used in biocidal products including relevant breakdown products	Stable in Xylene; Solvent naphtha; Methyl isobutyl ketone; Methyl isoamyl ketone and 1-methoxy-3-propanol. (Purity: 96.4%)
Partition coefficient (log P_{OW}) (state temperature)	pH 5: 0.32 at 20°C (calculated) pH 7: 0.32 at 20°C (calculated) pH 9: 0.32 at 20°C (calculated)
Hydrolytic stability (DT_{50}) (state pH and temperature)	See the fate and behaviour in the environment section
Dissociation constant	The dissociation constant K for zineb = 6.08×10^{-13} 20°C and the resulting pK_a at 20°C is 12.2 (Purity: 97.6%)
UV/VIS absorption (max.) (if absorption > 290 nm state ε at wavelength)	No data generated - It is not possible to produce a representative UV/Vis. Spectra for zineb. Zineb breaksdown in water and is virtually insoluble in organic solvents. No further data required.
IR Spectral data	Wavelengths of peaks in cm^{-1} are typical of compound of the structure of dithiocarbamates. 3228 – NH stretch

	3027 – CH stretch 1536 – CN stretch with NH bend 1446 - CH_2 in plane deformation 1378 – C=S stretch 1292 – C=S stretch 1048 – C=S stretch 977 – C=S stretch 945 – C=S stretch Unknown peaks at 1318, 1245, 875, 777, 717, 656, 614, 564, 540 and 477 cm^{-1}. (Purity 97.6%)
NMR Spectral data	No data generated - The active substance is not stable in solvents and is irreversibly decomposed, therefore no data can be obtained.
MS Spectral data	No data generated - The active substance is not stable in solvents and is irreversibly decomposed, therefore no data can be obtained.
Photostability (DT_{50}) (aqueous, sunlight, state pH)	See the fate and behaviour in the environment section
Quantum yield of direct phototransformation in water at $\Sigma > 290$ nm	See the fate and behaviour in the environment section
Flammability	Highly flammable
Explosive properties	Not explosive.
Oxidising properties	Not oxidising.

Classification and Proposed Labelling

With regard to physical/chemical data	Directive 67/548/EEC - R11, Highly flammable. CLP Regulation - Category 1; H228
With regard to toxicological data	Directive 67/548/EEC – R63, R43 CLP Regulation – Repr. 2 H361d, Skin Sens. 1 H317
With regard to fate and behaviour data	Not applicable.
With regard to ecotoxicological data	Directive 67/548/EEC - R50, R53 CLP Regulation – H400, H413

CHAPTER 2: METHODS OF ANALYSIS

Analytical Methods for the Active Substance

Technical active substance (principle of method)	CIPAC Method 25/TC/M/3 - The sample is dispersed in sodium EDTA and then decomposed in a boiling dilute sulphuric acid solution. The liberated CS_2 is entrained in an air stream and passed through lead acetate scrubbers to remove hydrogen sulphide. The CS_2 is trapped in methanolic KOH solution forming potassium methylxanthate. The solution is carefully washed into a beaker to a total volume of 400 ml. Phenolphthalein indicator is added and the solution neutralized with dilute acetic acid adding three drops excess. Starch indicator is added and the resulting solution titrated to a blue endpoint with the colour remaining for at least one minute.
Impurities in technical active substance (principle of method)	See confidential section.

Analytical Methods for Residues

Soil (principle of method and LOQ)	ETU: Extraction from Soil followed by LC-MS/MS. LOQ = 5 ppb The residue definition for monitoring in soil is ETU only.
Air (principle of method and LOQ)	ETU: ETU was extracted from tubes and residues of ETU were analysed directly using *UPLC-MS/MS.* (103.1 – 44.0 m/z).. LOQ = 0.1 µg/m^3 The residue definition for monitoring in air is ETU only.
Water (principle of method and LOQ)	ETU in drinking and surface water: The sample is concentrated and ETU is extracted and then analysed by LC-MS/MS (103.1 – 44.0 m/z). The LOQ = 0.1 µg/L in drinking and surface water. The residue definition for monitoring in drinking and surface water is ETU only.
Body fluids and tissues (principle of method and LOQ)	ETU in urine - Sample concentration followed by clean-up, then analysis by HPLC with UV detection. LOQ = 1.02 µg/L. ETU in blood – Extraction of ETU from blood followed by clean-up, then analysis by LC-MS/MS (103.1 – 44.0 m/z). LOQ = 1 ng ETU/ml. ETU in meat – Extraction of ETU from meat followed by clean-up, then analysis by HPLC-ECD using two different columns for confirmatory purposes.

	LOQ = 0.001 mg/kg. The residue definition for monitoring in body fluids and tissues is ETU only.
Food/feed of plant origin (principle of method and LOQ for methods for monitoring purposes)	Not relevant
Food/feed of animal origin (principle of method and LOQ for methods for monitoring purposes)	Not relevant
Food/Fish and Shellfish/feed of animal origin (principle of method and LOQ for methods for monitoring purposes)	ETU – Extraction of ETU from fish and shellfish followed by clean-up, then analysis by LC-MS/MS. LOQ = 0.01μg ETU/g wet fish and shellfish tissue. The residue definition for monitoring in fish and shellfish is ETU only.

CHAPTER 3: IMPACT ON HUMAN HEALTH

Absorption, Distribution, Metabolism and Excretion in Mammals

Rate and extent of oral absorption:	Rapid, 50% based on urinary and biliary excretion
Rate and extent of dermal absorption:	0.11% by 8 hrs (high level dose formulation) 0.24% by 8 hours (low level dose formulation) Based on results of the in vivo rat dermal absorption study.
Distribution:	Widely distributed, the highest residues in thyroid
Potential for accumulation:	No potential for accumulation
Rate and extent of excretion:	Rapid, > 95% within 4 days
Toxicologically significant metabolite	Ethylene thiourea (ETU)

Acute Toxicity

Rat LD_{50} oral	> 2000 mg/kg bw
Rat LD_{50} dermal	> 2000 mg/kg bw
Rat LC_{50} inhalation	> 5 mg/l (nose only)
Skin irritation	Non irritant
Eye irritation	Non irritant
Skin sensitization (test method used and result)	Sensitizing (M&K)

Repeated Dose Toxicity

Species/ target / critical effect	Thyroid (inhibition of thyroid peroxidase, hyperplasia/hypertrophy)
Lowest relevant oral NOAEL	7 mg/kg bw/day (overall NOAEL, 90-day rat, 90-day & 1-yr dog)
Lowest relevant dermal NOAEL	>1000 mg/kg bw/day (28-day, rat)
Lowest relevant inhalation NOAEL	36 mg/m^3 (respirable concentration) (90-day, rat)

Genotoxicity (Annex IIA, point 6.6)	The overall body of toxicological data coming from a number of in vitro and in vivo assays indicates that there is no concern.

Carcinogenicity

Species/type of tumour	Rat/ thyroid adenomas and carcinomas
lowest dose with tumours	30.9 mg/kg bw (rat, 750 ppm)

Reproductive Toxicity

Species/ Reproduction target / critical effect	Rat, decreased pup weight at parentally toxic level

Lowest relevant reproductive NOAEL	150 ppm (about 7 mg/kg bw/day) (two-generation study in rat)
Species/Developmental target / critical effect	Malformations at high doses in rats; embryo-/fetotoxicity (delayed ossification, abortions) at lower maternally toxic doses in rats and rabbits
Lowest relevant developmental NOAEL	Rat: 60 mg/kg bw/day

Neurotoxicity/Delayed Neurotoxicity

Species/ target/critical effect	There is evidence from the 13-week neurotoxicity study for delayed neurotoxicity. Clinical signs (impaired hind limb and motor activity) and histopathology (myelin damage and Schwann cell proliferationin sections of nerve tissue and myelin damage in tested nerve fibres).
Lowest relevant NOAEL	Rat: 125 ppm (8.2 mg/kg bw/day)
Developmental neurotoxicity: Species/ target/critical effect	Thyroid follicular cell hypertrophy and decreased body weight gain during gestation at 30 mg/kg bw/day. No test substance-related effects on any of the F1 litter parameters investigated in this study. Lowest relevant developmental NOAEL: 30 mg/kg bw/d Lowest relevant maternal NOAEL: 15 mg/kg bw/d

Other Toxicological Studies

.....	None

Medical Data

.....	Human studies of manufacturing workers exposed to mancozeb have detected the presence of mancozeb in urine but, with the exception of sporadic reports of sensitisation by skin contact; no evidence of thyroid effects; evidence of increased chromosomal aberrations in manufacturing workers in one report.

Summary

	Value	Study	Safety factor
$AEL_{MEDIUMTERM}$	0.035 mg/kg bw/day	overall sub chronic NOAEL in rats and dogs; correction for 50 % oral absorption	100
$AEL_{LONGTERM}$	0.024 mg/kg bw/d	2 year rat; correction for 50 % oral absorption	100
AEL_{ACUTE} (and ARfD)	0.075 mg/kg bw/day	NOAEL from rat developmental neurotox study	100

	correction for 50 % oral absorption	
(ETU) 0.05 mg/kg bw/day		

Acceptable Exposure Scenarios (including method of calculation)

Professional users	<u>Spray application</u> Method of calculation as specified in – Spraying: Model 3, Professionals at work, airless spraying viscous solvent-based liquids at > 100bar pressure, overhead and forwards. TNsG, Human Exposure to Biocidal products, Part 2, p150. <u>Mixing and loading</u> Method of calculation as specified in – Model 6, Professionals at work, loading liquid antifoulant into reservoir for airless spray application. TNsG, Human Exposure to Biocidal products, Part 2, p139. With modifications stated in: User Guidance for Human Exposure to Biocidal products, p25. <u>Brush and roller application</u> Method of calculation as specified in – Consumer Product Painting: Model 4, brush and roller painting of antifoulant on the underside of small boats (leisure craft) using household gloves. TNsG, Human Exposure to Biocidal products, Part 2, p204. With modifications stated in: User Guidance for Human Exposure to Biocidal products, p29. <u>Paint Removal</u> Method of calculation as specified in – Spraying: Model 3; Professionals at work, airless spraying viscous solvent-based liquids at > 100bar pressure, overhead and forwards. TNsG, Human Exposure to Biocidal products, Part 2, p150.
Non-professional users	<u>Brush and roller application</u> Method of calculation as specified in – Consumer Product Painting: Model 4, brush and roller painting of antifoulant on the underside of small boats (leisure craft) using household gloves. TNsG, Human Exposure to Biocidal products, Part 2, p204. With modifications stated in: User Guidance for Human Exposure to Biocidal products, p29. <u>Paint Removal</u> Method of calculation as specified in – Spraying: Model 3; Professionals at work, airless spraying viscous solvent-based liquids at > 100bar pressure, overhead and forwards. TNsG, Human Exposure to Biocidal products, Part 2, p150.
Indirect exposure as a result of use	Possible exposure of a child by touching wet paint was found to yield a safe MOE of 174.

CHAPTER 4: FATE AND BEHAVIOUR IN THE ENVIRONMENT

Route and Rate of Degradation in Water

Hydrolysis of active substance and relevant metabolites (DT_{50}) (state pH and temperature)

Max values

At 20°C, Zineb hydrolysed rapidly under all conditions tested, with DT_{50}s ranging from 0.029 days in freshwater at all pHs to 0.048 days in marine water at pH 7. The study author fitted the zineb data to single first order kinetics. According to the study report the amount of zineb at time 0 ranged from 4.2 % to 24.8 %, with most of the values < 10 %. Consequently, it is inappropriate to use first order kinetics as the hydrolysis of zineb is characterised by a rapid degradation phase followed by a slower degradation phase. Consequently, the DT_{50}s calculated are not considered reliable. However, the DT_{50} is expected to be < 1 d

Maximum levels of transformation products observed at pH 4, pH 7 and pH 9 at <u>20°C</u>

Substance	pH 4	pH 4 (Test 2)	pH 7	pH 7 (Marine)	pH 9
DIDT	5.8% (0 d)#	6.7% (0 d)#	31.5% (0 d)#	30.1 % (1 d)#	**36.1 % (0 days)#**
ETU	0.9 % (0.25 d)	0.8% (30 d)	5.5 %(3 d)	11.7 %(3 d)	**15.6 % (7 d)**
EU	28.4 % (0.25)	25.4 (0.25 d) 24.5 % (30 d)	35.4 %(30d)	**52.3 % (30 d)**	50 % (30 d)
B-1(Inner salt)	33.0 (0 d)	36.1% (0 d)	**54.1 % (14 d)**	29.4 % (30 d)	4.6 % (30 d)
EDA	**55.4 % (14 d)**	47 % (3 d)	14.6 % (21d)	4.7 % (0 d)	29.4 % (21 d)

The DT_{50}s presented for the metabolite in the study report were not considered reliable

Photolytic / photo-oxidative degradation of active substance and resulting relevant metabolites

Mancozeb (zineb surrogate) was rapidly degraded in both the irradiated samples and the dark control samples. Based on the results of this study, photolysis was not considered to be a major route of elimination of mancozeb from the environment.

Readily biodegradable (yes/no)

No.

Biodegradation in seawater

Not readily biodegradable in seawater (Closed Bottle

Test, < 10 % degradation).

Note

This test assessed ultimate biodegradation or mineralisation. Zineb was not rapidly mineralised However, zineb entering marine environments will be rapidly broken down by hydrolytic processes.

Non-extractable residues

Bound residues in water/sediment systems (% of initial applied radioactivity)
River sediment: max. 24.5% after 103 days.
Marine sediment: max. 30.6% after 103 days.
Marine + copper sediment: max. 48.2% after 7 days.
Brackish water sediment: max. 43.5% after 103 days.

Mineralisation in water/sediment systems

River system: 61.7%AR $^{14}CO_2$ 103 d.
Brackish system 33.7 %AR $^{14}CO_2$ 103 d.
Marine 5.6%AR $^{14}CO_2$ 103 d.
marine and copper systems 2.1 %AR 103 d.

Distribution in water / sediment systems (Zineb)

Distribution in *river* water/sediment systems at 20°C (% of applied radioactivity)
Water: max 10.5% at day 0.25; DissipT_{50} 0.24 hr, r^2 0.9478
Sediment: max 1.7% at day 0.25
Total system: max 12.2% at day 0.25; DT_{50} 0.288 hr, r^2 0.93

Distribution in *marine* water/sediment systems at *10*°C (% of applied radioactivity)
Water: max 6.2% at day 0.25; DT_{50} 0.24 hr,
Sediment: max 2.2% at day 14
Total system: max 6.5% at day 0.25; DT_{50} 0.25hr r^2 0.9745

Distribution in marine water+copper/sediment systems at 10°C (% of applied radioactivity)
Water: max 14.6% at day 0.04; DT_{50} 0.35 h
Sediment: max 2.8% at day 0.04
Total system: max 17.4% at day 0.04; DT_{50} 0.39 hr, r^2 0.9788

Distribution in brackish water/sediment systems at 20°C (% of applied radioactivity)
Water: max 5.8% at day 103; DT_{50} 0.22 h
Sediment: max 0.9% at day 14
Total system: max 6.1% at day 103; DT_{50} 0.24 hr r^2 0.9836

Distribution in water / sediment systems (metabolites)

System	Maximum observed level (%)			DT_{50} System (d)	r^2
	Water	Sediment	System		
DIDT					
Brackish (20 C)	25.8 (0.04d)	3.4(0.04 d)	29.2 (0.04d)	1.1	0.99

River (20 C)	27.6 (0.25 d)	14.6 (0.04 d)	34.4(0.04 d)	1.0	0.98
Marine (10 C)	**33 (0.25 d)**	**2.8(0.04 d)**	**35.8(0.25 d)**	**3.2**	0.99
Marine & copper (10 C)	1.9 (0.04 d)	4.4(1d)	5.7(1 d)	NC	NC
ETU					
Brackish (20 C)	**38.3 (2 d)**	**6.5 (7 d)**	**41.3 (2 d)**	8.0	0.99
River (20 C)	36.9 (1 d)	4.8(7 d)	39.4 (1 d)	**33.4**	0.71
Marine (10 C)	19.2 (1 d)	3.0(14 d)	21.4 (1 d)	12.0	0.97
Marine & copper (10 C)	16.5 (0.04 d)	8.2 (14 d)	17.3 (0.04 d)	22.4	0.94
EU					
Brackish (20 C)	**52.9 (29 d)**	**12.4 (14 d)**	**65.2 (29 d)**	**28.6**	0.91
River (20 C)	26.8 (14 d)	4.8 (7 d)	31 (14 d)	15.2	0098
Marine (10 C)	38.2 (103 d)	11.1(14 d)	46.2 (63 d)	*	*
Marine & copper (10 C)	40.2 (103 d)	10.7 (63 d)	50 (103 d)	*	*

Note
Marine & copper = system was treated with copper (II) sulfate at a target concentration of 100 mg/L.
NC = Not calculated due to low values
* No degradation was observed during the incubation period
pH of the water phase ranged from 7.94 to 8.27 pH of the sediment phase ranged from 7.4 to 8.3.

Kinetic analysis was performed for the metabolites using the decline curve starting at the time point where the maximum amount of metabolite was seen.

Observed levels of DIDT
In this study one-dimensional thin-layer chromatography (TLC) was used to characterise and/or quantify Zineb and its main metabolite fractions. Caution should be exercised when interpreting these results, as the observed amount of DIDT found on the TLC plate does not reflect the composition in the conical flask as a result of air oxidation.

Route and Rate of Degradation in Soil

Mineralization (aerobic)

% mineralisation to CO_2 (cumulative) after 93 days:

25 % in a silt loam treated with 10 ppm Mancozeb

27.5 % in a silt loam treated with 20 ppm Mancozeb

Note
In these studies mancozeb was used as a surrogate for zineb.

(Source: Aerobic and Anaerobic Soil Metabolism of Mancozeb. Randazzo, D.J., 1986.)

Laboratory studies (range or median, with number of measurements, with regression coefficient)

Mancozeb (surrogate for zineb)

Soil type	Degradation parameters (20-21 °C)		
	DT_{50}[hr]	**DT_{90}[wks]**	**Kinetics**
Soil 1 = sand (pH 6.3, 1.1% oc)	ca. 2	7	Estimated
Soil 2 = sand (pH 6.8, 1.34% oc)	1 – 2	6	
Soil 3:Loamy sand(pH 7.2, 0.83% oc)	2 – 3	4 – 5	
Silt loam (pH 6.1, 2 % OM)	< 1	25 hr	Estimated

Note
The longest DT_{50} normalised to 12°C is -0.2568 d.

DIDT (metabolite)

Soil type	Degradation parameters (20-21 °C, SFO kinetics)		
	DT_{50lab} [hr]	**DT_{90lab}[d]**	**r^2**
Sandy loam(pH7.7)*	2.1	0.29	0.979
Humic sand (pH 5.9)*	3.1	0.43	0.937
Loam (pH 7.9) *	3.6	0.50	0.990
Silt loam treated with 20 ppm mancozeb**	7.14 d	---	0.76
Range of reliable DT_{50}s (d)	0.09-7.14 d		
Maximum observed DT_{50} normalised to 12°C	14.67 d		

Note:

*In these studies the metabolite was applied as the test substance

An approximate DT_{50} for DIDT was calculated from the mancozeb soil metabolism study by following the DIDT soil concentration decline after the peak level has been obtained (which assumes little or no more DIDT will be produced after that point). Best fit modelling gives a DT_{50} of 7.14 d.**

ETU metabolite

70% NMHC

Soil type	Degradation parameters (20-21 °C, SFO kinetics)		
	DT_{50}[d]	DT_{90}[d]	r^2
Silt loam (pH 6.1)	1.6 (38.4 hr)	5.3	0.98998
Sand (pH 6.8)	1.4 (33.6 hr)	4.5	0.9782

40% NMHC

Soil type	Degradation parameters (20-21 °C, SFO kinetics)		
	DT_{50}[d]	DT_{90}[d]	r^2
Silt loam (pH 6.1)	3.2 (76.8 hr)	10.5	0.9877
Sand (pH 6.8)	---	---	

Note:
In these studies the metabolite was applied as the test substance
Degradation rates were calculated from a plot of the natural Log of the concentration of ETU (corrected for analytical recovery) versus incubation time.
Range of reliable DT_{50}s (d) 1.4-3.2d
Maximum observed DT_{50} normalised to 12°C 9.05 d

EU (metabolite)
The soil degradation data provided was considered unreliable by the CA.

An approximate DT_{50} for EU was calculated from the mancozeb soil metabolism study by following the ETU soil concentration decline after the peak level has been obtained (which assumes little or no more DIDT will be produced after that point). Best fit modelling gives a DT_{50} of 29 d (r^2=0.80). This corresponds to 59.58 d at 12°C

DT_{50lab} (10°C, aerobic): Not available.

DT_{50lab} (20°C, anaerobic): Not required.

Degradation in the saturated zone: Not required.

Field studies (state location, range or median with number of measurements)

Field studies are not required on the basis of available laboratory data ($DT_{50\ Soil\ lab}$ < 3 hr).

Anaerobic degradation

Mancozeb was completely or almost completely degraded before anaerobic conditions were established in the anaerobic study and, therefore, the results of this study are not appropriate for discussion.

Soil photolysis

No study submitted. Not considered required.

Non-extractable residues

70 % of the available radioactivity in a silt loam treated with 10 ppm Mancozeb

74 % of the available radioactivity in a silt loam treated with 20 ppm Mancozeb

Relevant metabolites - name and/or code, % of

Levels of metabolites arising in soils treated with 20 ppm

applied a.i. (range and maximum)	mancozeb DIDT 14.8 %AR (0 d) ETU 5.6 %AR (0 d) EU 19 %AR (6 d) Levels of metabolites arising in soils treated with 10 ppm mancozeb DIDT 10.5 %AR (0 d) ETU 9.1 %AR (0 d) EU 18.9 %AR (6d) Source: Doc. III7.2.1-2 and 7.2.2.3.1(Randazzo 1986)
Soil accumulation and plateau concentration	Field soil accumulation tests are required in two soil types if the $DT_{90field}$ is over one year and the $DT_{50field}$ is greater than 3 months, or if during laboratory tests non-extractable residues are formed in amounts exceeding 70% of the initial dose after 100 days with a mineralization rate of less than 5% in 100 days. In laboratory soil degradation studies, the DT_{90} for macozeb ranged from 4-7 weeks. In view of the structural and physico-chemical similarities between Mancozeb and Zineb, zineb is not expected to accumulate in soil
Mineralization (aerobic)	% mineralisation to CO_2 (cumulative) after 93 days: 25 % in a silt loam treated with 10 ppm Mancozeb 27.5 % in a silt loam treated with 20 ppm Mancozeb Note In these studies mancozeb was used as a surrogate for zineb. (Source: Aerobic and Anaerobic Soil Metabolism of Mancozeb. Randazzo, D.J., 1986.)

Adsorption/Desorption

Ka , Kd
Ka_{oc} , Kd_{oc}
pH dependence (yes / no) (if yes type of dependence)

Mancozeb (surrogate for zineb)

Soil	K_a L/kg	K_{aOC} (=K_{foc}) L/kg	1/n	K_{des} L/kg	K_{desOC} L/kg
Sand 0.9 % OM, pH5.7	11.67	2,334	0.753	52.71	10,542
Sandy loam 2.8 % OM, pH 2.8	9.89	618	0.749	40.84	2,552

Silt loam 3.5 %OM, pH 6.4	7.26	363	0.686	27.82	1,391
Clay loam 2.5 %OM, pH 7.4	10.13	675	0.77	41.42	2,761
Average	9.74	**997.5**	0.74	40.70	4,311

Note: the adsorption/desorption behaviour described is actually for mancozeb and its degradates, taken together. Since the active substance is subject to rapid hydrolysis

The average Ka_{OC} was used in PEC calculations

DIDT metabolite

Koc: 40.02 L/kg (US EPA EPIWIN v 3.12).

ETU metabolite

Soil	**K_a L/kg**	**K_{aOC} L/kg**	**1/n**	**K_d L/kg**	**K_{dOC} L/kg**
Sand 0.9 %on, pH 5.7	0.73	146	0.52	2.85	570
Sandy loam 2.8 % om, pH 5.9	0.67	41.9	0.47	3.07	192
Silt loam 3.5 % om, pH 6.4	1.14	57.0	0.33	3.09	154
Clay loam 2.5 5om, pH 7.4	0.51	34.0	0.41	1.44	196
Average	0.76	**~70**	0.43	2.61	278

The average Ka_{OC} was used in PEC calculations

EU metabolite

Soils	**K_a L/kg**	**K_{aOC} L/kg**	**1/n**	**K_d L/kg**	**K_{dOC} L/kg**
Clay loam 4.6 %oc, pH 7.6	0.22	5	1.0464	0.40	9
Loam 3.8 %OC, pH 5.6	0.16	4	1.0099	0.20	5
Loamy sand 0.8 %oc, pH 4.2	0.15	19	0.9152	0.29	36
Clay loam 2.1 %OC pH7.3	0.22	11	0.9772	0.42	20
Average	0.19	**9.75**	0.98	0.33	17.5

	The average Ka_{OC} was used in PEC calculations.

Fate and Behaviour in Air

Direct photolysis in air	Zineb has a very low vapour pressure of 3.6×10^{-5} Pa. It is therefore considered that there is no potential for significant quantities of zineb to reach the troposphere and that it is not necessary to carry out an experimental determination of phototransformation in air. The half-live for reaction of zineb ($EDBC^{2-}$) with hydroxyl radicals in air is estimated to be 0.109 days (24 hour day; 0.5×10^5 $OH^{\bullet}/cm^3$, AOPWIN, USEPA EPIWIN v. 3.12). However, this model may not be suitable for an organometallic based substance such as zineb.
Quantum yield of direct photolysis	Not determined
Photo-oxidative degradation in air	Zineb is not subject to photo-oxidative degradation.
Volatilization	Zineb has very low volatilization potential. Vapour pressure: $< 3.6 \times 10^{-5}$ Pa at 20°C (Purity: 96.8%) Henry's Law Constant: 0.046 Pa m^3mol^{-1} at 20°C

Monitoring Data, if available

Soil (indicate location and type of study)	No monitoring data are available.
Surface water and Marine (indicate location and type of study)	Neither zineb nor ETU were detected in the dissolved aqueous phase of the water samples collected from in two Norwegian small craft marine harbours (Oslo motorbåtforening (Bestumkilen, Oslo) and Bergens seilforening (Kviturspollen, Bergen). Skånevikfjorden was used as the reference location.) In the particulate phase ETU was detected at concentrations of between 1.3 and 2.2 ng/L in the samples collected from Bestumkilen, Oslo and between 3.3 and 15.5 ng/L in the samples collected at Kviturspollen, Bergen. The concentrations in the particulate samples collected from Skånevikfjorden were below the limit of detection (< 1 ng/L) as were the levels of zineb in all particulate samples. The concentrations of zineb and ETU were also below the limit of detection in the sediment samples collected.
Ground water (indicate location and type of study)	No monitoring data are available.
Air (indicate location and type of study)	No monitoring data are available.

CHAPTER 5: EFFECTS ON NON-TARGET SPECIES

Toxicity Data for Aquatic Species (most sensitive species of each group)

Species	Time-scale	Endpoint	Toxicity
Fish			
Poecilia reticulata	96 hour	LC_{50}	7.2 mg/l (nominal)
Oncorhynchus mykiss	60 day	NOEC	≤0.032 mg/l (nominal)
P. promelas Mancozeb (equivalent to zineb)	34 days (28 days post-hatch)	NOEC	0.00219 mg/l (measured)
Invertebrates			
Daphnia magna	48 hour	EC_{50}	0.97 mg/l (nominal)
Daphnia magna	21 day	NOEC	0.032 mg/l (nominal)
Daphnia magna Mancozeb (equivalent to zineb)	21 day	NOEC	0.0073 mg/l (measured)
Algae			
Skeletonema costatum	72 hour	EC_{50}	0.055 mg/l (nominal) 0.036 mg/l (measured)
Skeletonema costatum	72 hour	NOEC	0.02 (nominal) 0.011 mg/l (measured)
Selenastrum Capricornutum Mancozeb (equivalent to zineb)	120 hour	NOEC	0.033 mg/l (nominal) 0.022 mg/l (measured)
Aquatic plants			
Lemna minor	7 days	EC_{50}	>0.098 mg/l (measured)
Lemna minor	7 days	NOEC	0.098 mg/l (measured)
Microorganisms			
Activated sludge	30 minutes	EC_{50}	> 1000 mg/l (nominal)

Effects on Earthworms or other Soil Non-target Organisms

Acute toxicity to earthworms	No tests performed, data not required.
Reproductive toxicity to earthworms	No tests performed, data not required.

Effects on Soil Micro-organisms

Nitrogen mineralisation	No tests performed, data not required.
Carbon mineralisation	No tests performed, data not required.

Effects on Terrestrial Vertebrates

Acute toxicity to mammals	Rat LD_{50} oral > 2000 mg/kg bw.
Acute toxicity to birds	No tests performed, data not required.
Dietary toxicity to birds	No tests performed, data not required.
Reproductive toxicity to birds	No tests performed, data not required.

Effects on Honeybees

Acute oral toxicity	No tests performed, data not required.
Acute contact toxicity	No tests performed, data not required.

Effects on other Beneficial Arthropods

Acute oral toxicity	No tests performed, data not required.
Acute contact toxicity	No tests performed, data not required.
Acute toxicity to…	No tests performed, data not required.

Bioconcentration

Bioconcentration factor (BCF)	34 (measured) 1.41 (estimted using EUSES 2.0.3)
Depuration time (DT50) (DT90)	75% elimination after 16 days depuration. Depuration half-life = 9.9 days.
Level of metabolites (%) in organisms accounting for > 10 % of residues	Metabolites were not identified during this study.

CHAPTER 6: OTHER ENDPOINTS

Acute toxicity of metabolites to fish (most sensitive species)	DIDT: 96 h LC_{50} in *Poecilia reticulata* 0.49 mg/l. ETU: 96 h LC_{50} in *Onchrhynchus mykiss* > 500 mg/l. EU: 96 h LC_{50} in *Onchrhynchus mykiss* > 122 mg/l.
Acute toxicity of metabolites to daphnia (most sensitive species)	DIDT: 48 h EC_{50} 0.21 mg/l. ETU: 48 h EC_{50} 21.6 mg/l. EU: 48 h EC_{50} > 985 mg/l.
Acute toxicity of metabolites to algae (most sensitive species)	DIDT: 96 h EC_{50} in *Chlorella pyrenoidosa* 0.18 mg/l. ETU: 72 h EC_{50} in *Selenastrum capricornutum* 23.7 mg/l; NOEC 12.5 mg/l. EU: 96 h EC_{50} in *Selenastrum capricornutum* > 119 mg/l; NOEC 119 mg/l.
Toxicity of metabolites to soil micro-organisms	**Nitrogen transformation:** ETU: NOEC >5.6 mg/kg dry soil. EU: NOEC >5.6 mg/kg dry soil. **Carbon transformation:** ETU: NOEC >5.6 mg/kg dry soil. EU: NOEC >5.6 mg/kg dry soil.

Acute toxicity of metabolites to earthworms	ETU: LC_{50} >1000 mg/kg soil dry weight. EU: LC_{50} >886 mg/kg soil dry weight.

APPENDIX II: LIST OF INTENDED USES

Product-type:

PT21 – Antifouling products

Claim of the participant:

Intended as an antifouling coating for use in both marine and freshwater applications. Interspeed 340 is proposed for use on parts of ferries, fishing vessels, tankers, cruise liners, liners, super-yachts, container ships, pleasure craft in order to protect submerged surfaces from attack, by fouling organisms including algae, diatoms (slimes) and invertebrate fouling organisms.

Target organisms:

Broad range of marine fouling species, e.g. Red and Green algae, diatoms (slimes), mollusca, crustacea, Tube worms, sponges and Tunicates (sea squirts).

Concentration:

Proposed product concentrations for Interspeed 340 are:

(professional and amateur use) 4.53% w/w zineb
(professional use only) 10.0 %w/w zineb

Proposed application rates are:

28.1 g/m^2 (airless spray)
8.57 g/m^2 (brush and roller)
Note: The application rates given above correspond to the application of two coats of paint, with each application providing 125 μm Dry Film Thickness (DFT) (i.e. airless spray – the 28.1 g zineb/m^2 application rate is derived from two applications of 14.15 g zineb/m^2 applied to produce a final DFT of 250 μm).

Categories of users:

The product is intended for use by:

Professionals
Non-professionals (Amateurs/General public)

Type of application:

Applied by brush and roller (professional and general public)

Applied by airless spray (professional only).

All surfaces are treated while they are out of the water.

APPENDIX III: LIST OF STUDIES

Data protection is claimed by the applicant in accordance with Article 12.1(c) (i) and (ii) of Council Directive 98/8/EC for all study reports marked "Y" in the "Data Protection Claimed" column of the table below. These claims are based on information from the applicant. It is assumed that the relevant studies are not already protected in any other Member State of the European Union under existing national rules relating to biocidal products. It was however not possible to confirm the accuracy of this information.

IIIA Reference List by Data Point

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
2_6	Kool P and Rodriguez C	2002	Zineb Nautec Manufacturing Process Dequisa, Sabiñángio	Cerexagri B.V.	Final Report No. DL 02-065	N	Y	Y	Y	Cerexagri SA
2_7	Felperlaan MR	2002a	Zineb Nautec, Manufactured at Dequisa, Sabinanigo Site, Certified Limits	Cerexagri B.V.	Final Report No. DL 02-064	Y	Y	Y	Y	Cerexagri SA
2_7	Felperlaan MR	2002b	Zineb Nautec, Manufactured at Dequisa, Sabinanigo Site, Analytical Profile of Five Representatvie Batches	Cerexagri B.V.	Final Report No. DL 02-036	Y	Y	Y	Y	Cerexagri SA
2_8	Felperlaan MR	2002a	Zineb Nautec, Manufactured at Dequisa, Sabinanigo Site, Certified Limits	Cerexagri B.V.	Final Report No. DL 02-064	Y	Y	Y	Y	Cerexagri SA
2_8	Felperlaan MR	2002b	Zineb Nautec, Manufactured at Dequisa, Sabinanigo Site, Analytical Profile of Five Representatvie Batches	Cerexagri B.V.	Final Report No. DL 02-036	Y	Y	Y	Y	Cerexagri SA
3_1_1	Felperlaan MR	2000	Zineb Active Ingredient Melting Point	Development Laboratory Elf Atochem Agri BV	Final Report No. DL 00-011	Y	Y	Y	N	Cerexagri SA
3_1_3	Van Beijnen AJM	1999	Bulk Density of Zineb TC, Dequisa product	Elf Atochem Agri BV	Report No. DL 99-049	Y	Y	Y	N	Cerexagri SA
3_2(1)	Diepenhorst PC	2000	Zineb Active Substance Vapour Pressure	Development Laboratory Elf Atoche	Final Report No. DL 00-018	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
				m Agri BV						

3_2(2)	Diepenhorst PC	1999	Zineb Product Chemistry: Determination of Vapour Pressure	Development Laboratory Elf Atochem Agri BV	Amendment Report 121	Y	Y	Y	N	Cerexagri SA
3_2(3)	Diepenhorst P C	2006a	DIDT product properties water solubility, vapour pressure, log Pow, Henry's law constant	Cerexagri B.V.	Study number DL 05-080	Y	Y	Y	N	Cerexagri SA
3_2_1(1)	Diepenhorst PC	2006b	Zineb Dissociation Constant and Henry's law constant	Cerexagri B.V.	Study No. DL 06-020	Y	Y	Y	N	Cerexagri SA
3_2_1(2)	Diepenhorst P C	2006a	DIDT product properties water solubility, vapour pressure, log Pow, Henry's law constant	Cerexagri B.V.	Study number DL 05-080	Y	Y	Y	N	Cerexagri SA
3_3_1	Felperlaan MR	2002c	Zineb Nautec manufactured at Dequisa, Sabinanigo, Appearance (Physical State, Colour and Odour)	Cerexagri B.V.	Report No. DL02-059	Y	Y	Y	N	Cerexagri SA
3_3_2	Felperlaan MR	2002c	Zineb Nautec manufactured at Dequisa, Sabinanigo, Appearance (Physical State, Colour and Odour)	Cerexagri B.V.	Report No. DL02-059	Y	Y	Y	N	Cerexagri SA
3_3_3	Felperlaan MR	2002c	Zineb Nautec manufactured at Dequisa, Sabinanigo, Appearance (Physical State, Colour and Odour)	Cerexagri B.V.	Report No. DL02-059	Y	Y	Y	N	Cerexagri SA
3_4_1	Diepenhorst PC	2001a	Zineb Purified Active Substance, Absorption Spectra (UV/VIS, IR, NMR and Mass Spectrum)	Cerexagri B.V.	Report No. DL01-042	Y	Y	Y	N	Cerexagri SA
3_4_2	Diepenhorst PC	2001a	Zineb Purified Active Substance, Absorption Spectra (UV/VIS, IR, NMR and Mass Spectrum)	Cerexagri B.V.	Report No. DL01-042	Y	Y	Y	N	Cerexagri SA
3_4_3	Diepenhorst PC	2001a	Zineb Purified Active Substance, Absorption Spectra (UV/VIS, IR, NMR and Mass Spectrum)	Cerexagri B.V.	Report No. DL01-042	Y	Y	Y	N	Cerexagri SA
3_4_4	Diepenhorst PC	2001a	Zineb Purified Active Substance, Absorption Spectra (UV/VIS, IR, NMR and Mass Spectrum)	Cerexagri B.V.	Report No. DL01-042	Y	Y	Y	N	Cerexagri SA

3_5(1)	Diepenhorst PC	2001b	Zineb Active Substance Solubility in Water.	Development Laboratory Elf Atochem Agri BV	Final Report No. DL 00-055	Y	Y	Y	N	Cerexagri SA
3_5(2)	Diepenhorst P C	2006a	DIDT product properties water solubility, vapour pressure, log Pow, Henry's law constant	Cerexagri B.V.	Study number DL 05-080	Y	Y	Y	N	Cerexagri SA
3_6	Diepenhorst PC	2006b	Zineb Dissociation Constant and Henry's law constant	Cerexagri B.V.	Study No. DL 06-020	Y	Y	Y	N	Cerexagri SA
3_7	Felperlaan MR	2006	Zineb Nautec solubility in organic solvents	Cerexagri B.V.	Final Report No. DL 05-081	Y	Y	Y	N	Cerexagri SA
3_8	Diepenhorst PC	2006c	Zineb Nautec stability in organic solvents	Cerexagri B.V.	Final Report No. DL 05-082	Y	Y	Y	N	Cerexagri SA
3_9(1)	Diepenhorst PC	2001c	Zineb Purified Active Substance: Partition Coefficient n-Octanol/Water (Including Effect of pH (5-9) and Temperature)	Cerexagri B.V.	Final Report No. DL 01-009	Y	Y	Y	N	Cerexagri SA
3_9 (2)	Diepenhorst P C	2006a	DIDT product properties water solubility, vapour pressure, log Pow, Henry's law constant	Cerexagri B.V.	Study number DL 05-080	Y	Y	Y	N	Cerexagri SA
3_10	Felperlaan MR	2001	Zineb Nautec manufactured at Solbiate Olona site, Thermal Stability	Cerexagri B.V.	Report No. DL01-041	Y	Y	Y	N	Cerexagri SA
3_11(1)	Van Beijnen AJM	2001a	Zineb Nautec manufactured at Solbiate Olona site, Hazard Assessment Studies (Flammability, Explosive and Oxidizing Properties, etc.)	Cerexagri B.V.	Report No. DL01-010		Y	Y	N	Cerexagri SA
3_11(2)	Bal EA	1995	Determination of the Flammability of Zineb TC. TNO Defence Research	TNO Defence Research	PML 1995-C15	Y	Y	Y	N	Cerexagri SA
3_11(3)	Mak WA	1997	Flammability of a Sample of Zineb Technical	TNO	Report No. PML 1997-C3	?	Y	Y	N	Cerexagri SA

3_11(4)	Mak WA	2000	Flammability in Contact with Water of Zineb TC	TNO	Report No. PML 1999-C131	Y	Y	Y	N	Cerexagri SA
3_11(5)	Van Beijnen AJM	2001a	Zineb Nautec manufactured at Solbiate Olona site, Hazard Assessment Studies (Flammability, Explosive and Oxidizing Properties, etc.)	Cerexagri B.V.	Report No. DL01-010		Y	Y	N	Cerexagri SA
3_11(6)	Mak WA	2002	Relative Self-Ignition Temperature of Zineb Nautec, Manufactured at Dequisa, Sabinanigo	TNO	Report PML 2002-C108	Y	Y	Y	N	Cerexagri SA
3_13	Van Beijnen AJM	2001b	Zineb Nautec manufactured at Solbiate Olona site, Surface Tension	Cerexagri B.V.	Report No. DL01-021		Y	Y	N	Cerexagri SA
3_15	Van Beijnen AJM	2001a	Zineb Nautec manufactured at Solbiate Olona site, Hazard Assessment Studies (Flammability, Explosive and Oxidizing Properties, etc.)	Cerexagri B.V.	Report No. DL01-010		Y	Y	N	Cerexagri SA
3_16	Van Beijnen AJM	2001a	Zineb Nautec manufactured at Solbiate Olona site, Hazard Assessment Studies (Flammability, Explosive and Oxidizing Properties, etc.)	Cerexagri B.V.	Report No. DL01-010		Y	Y	N	Cerexagri SA
3_17	Felperlaan MR	2005	Zineb Nautec, Manufactured at Cerexagri Dequisa 2 Years Shelf-Life in Commercial Bag	Cerexagri B.V.	Final Report No. DL 02-100	?	Y	Y	N	Cerexagri SA
4_1	Felperlaan MR	1999	Zineb Technical: Preliminary Analyses of Five Representative Samples	Development Laboratory Elf Atochem Agri BV	Final Report No. DL 99-001	Y	Y	Y	Y	Cerexagri SA
4_2a(1)	Gottschalk R	2002a	Validation of the Analytical Method MS 270 for the Analysis of Mancozeb in Soil	Enviro-Test Laboratories	Report No. 02MTF01.REP	Y	Y	Y	N	Cerexagri SA
4_2a(2)	Gottschalk R	2002b	Validation of the Method for the Analysis of Ethylenethiourea (ETU) in Soil by	Enviro-Test Laboratories	ETL Report No. 2CER01.REP	Y	Y	Y	N	Cerexagri SA

			LC/MS/MS, using 2 European soils.							
4_2b	Mueller-Kallert HM	1995	Analytical Method For The Determination of Mancozeb And Its Metabolite ETU in Air	RCC Umweltchemie AG	Report No. TR 34-94-160	Y	Y	Y	N	Cerexagri SA
4_2c(1)	Hanauer R	2001	Validation of The Method: Determination of Mancozeb in Surface Water - LOQ, 0.1 ppb (µg/Liter)	Morse Laboratories, Inc.	Report No. TR 34-00-112	Y	Y	Y	N	Cerexagri SA
4_2c(2)	Connolly P	2000	Independent Laboratory Validation of Analytical Method "Method for the Analysis of Ethylenethiourea (ETU) in Water by LC/MS/MS (MS 178.00) Revision 2	Centre Analytical Laboratories Inc	Centre Analytical Study No. 002-342	Y	Y	Y	N	Cerexagri SA
4_2d(1)	Reed RL	2000	Validation of the Residue Analytical Method for Ethylenethiourea (ETU) in Meat	Morse Laboratories, Inc.	Report No, TR34-00-102	Y	Y	Y	N	Cerexagri SA
4_2d(2)	Diepenhorst PC	2001d	Validation of draft SOP DLA-0041 Version 0 ETU determination by HPLC in urine	Elf Atochem Agri B.V.	Final Report DL 00-061	Y	Y	Y	N	Cerexagri SA
5_3_1(3)	Hunter J and Evans L	1990	The toxicity of the biocides zineb, nabam and their derivatives to the ship-fouling diatom Amphora coffeaeformis	Biofouling (2), pp. 267-287	-	N	N	N	N	-
6_1_1	Richeux F	2005a	Zineb Nautec: Assessment of Acute Oral Toxicity in Rats: Acute Toxic Class Method.	Phycher Bio-Development	Final Report No. TAO423-PH-05/0005	Y	Y	Y	N	Cerexagri SA
6_1_2(1)	Richeux F	2005b	Zineb Nautec: Assessment of Acute Dermal Toxicity in Rats	Phycher Bio-Development	Final Report No. TAD-PH-05/0005	Y	Y	Y	N	Cerexagri SA
6_1_2(2)	Leuschner J	2001a	Acute Toxicity Study of ETU (Ethylene Thiourea) in Sprague-Dawley Rats by Dermal Administration	LPT Lab	Laboratory Report No. 13986/01	Y	Y	Y	N	Cerexagri SA

6_1_3(1)	Blagden SM	1997	Technical Zineb (92-94%): Acute Inhalation Toxicity (Nose Only) Study in the Rat.	Safepharm Laboratories Ltd	SPL Project No. 764/074	Y	Y	Y	N	Cerexagri SA
6_1_3(2)	Leuschner J	2002	Acute Inhalation Toxicity Study of Milled Ethylene Thiourea (ETU) in Sprague-Dawley Rats	LPT Lab	Laboratory Report No. 15283/02	Y	Y	Y	N	Cerexagri SA
6_1_4(1)	Richeux F	2005c	Zineb Nautec: Assessment of Acute Dermal Irritation	Phycher Bio-Development	Final Report No. IO-OCDE-PH-05/0005	Y	Y	Y	N	Cerexagri SA
6_1_4(2)	Richeux F	2005d	Zineb Nautec: Assessment of Acute Eye Irritation	Phycher Bio-Development	Final Report No. IO-OCDE-PH-05/0005	Y	Y	Y	N	Cerexagri SA
6_1_4(3)	Leuschner J	2001b	Acute Skin Irritation Test (Patch Test) of ETU (Ethylene Thiourea) in Rabbits	LPT Lab	Laboratory Report No. 13987/01	Y	Y	Y	N	Cerexagri SA
6_1_4(4)	Leuschner J	2001c	Acute Eye Irritation Study of ETU (Ethylene Thiourea) by Instillation Into the Conjunctival Sac of Rabbits	LPT Lab	Laboratory Report No. 13988/01	Y	Y	Y	N	Cerexagri SA
6_1_5	Ollivier E	2004	Zineb Technical: Skin Sensitization Test in Guinea Pigs (Maximization Method of Magnusson and Kligman)	CIT Safety & Health Research Laboratories	Laboratory Study No. 26847 TSG	Y	Y	Y	N	Cerexagri SA
6_2(1)	DiDonato LJ, Longacre SL	1986	Mancozeb Pharmokinetic Study in Rats	Rohm and Haas Company Toxicology Department	Report No. 85R-123	Y	Y	Y	N	Rohm & Haas Company
6_2(1)	Longacre SL	1986	Summary of Ethylenethiourea (ETU) and Ethylene-bis-Dithiocarbamate (EBDC) Analysis in Plasma, Liver, and Thyroid after Mancozeb administration	Rohm and Haas Company	Analytical supplement to : Report No. 85R-123	Y	Y	Y	N	Cerexagri SA

6_2(1)	Nelson SS	1986a	Metabolism of 14C Mancozeb in Rat	Rohm and Haas Company	Technical Report No 31H-86-02 (Analytical supplement to: Report No. 85R-123)	Y	Y	Y	N	Cerexagri SA
6_2(1)	Nelson SS	1986b	Bioconversion of Mancozeb to ETU in Rat	Rohm and Haas Company	Technical report No. 31C-87-02 (Report supplement to: Report No. 85R-123	Y	Y	Y	N	Cerexagri SA
6_2(2)	Cameron BD, Speirs G, Clydesdale K	1990	The Disposition of [14C]-Mancozeb in the Mouse	Inveresk Research International	Report No. 4909	Y	Y	Y	N	Cerexagri SA
6_2(3)	Piccirillo VJ, Wu D, Speirs G	1992	Metabolism of [Ethylene-U-14C]-Mancozeb in the Mouse	Inveresk Research International Ltd. And XenoBiotic Laboratories Inc.	NPC Project No. T91-3413	Y	Y	Y	N	Cerexagri SA
6_2(4)	Fisher L	2002	[14C]-Mancozeb In Vivo Dermal Absorption Study in the Male Rat	Huntingdon Life Sciences Ltd.	Laboratory Report No. EFA 041/022 683	Y	Y	Y	N	Rohm & Haas Company
6_3_1	Chevalier G	2002	Zineb Nautec: 4-Week Toxicity Study by Oral Route (Dietary Admixture) in Rats	CIT	Laboratory Study No. 22521 TSR	Y	Y	Y	N	Cerexagri SA
6_3_2(1)	Trutter JA	1988	Mancozeb: 4-Week Repeat Dermal Toxicity Study in Rats	Hazleton Laboratories America	HLA Study No. 417-432	Y	Y	Y	N	Rohm & Haas Company
6_3_2(2)	Smith C, Crook D, Gibson WA,	1988	Mancozeb Technical: Twenty-One Day Dermal Toxicity Study in	Huntingdon Research	Report No. 62/8796 4	Y	Y	Y	N	Cerexagri SA

	Hadley J, Gopinath C		Rabbits	Centre Ltd.						
6_4_1(1)	Dean GA, Crook D, Gibson WA, Gopinath C, Imm S, Anderson A, Dawe IS	1989	Mancozeb Technical: Toxicity to Rats by Dietary Administration for 13 Weeks with 4 Week Recovery Period	Huntingdon Research Centre Ltd	Report No. PWT 46/87924	Y	Y	Y	N	Cerexagri SA
6_4_1(2)	Goldman PR, Bernaski HJ, Quinn DL	1986	Mancozeb: Three-Month Dietary Toxicity Study in Rats	Rohm and Haas Toxicology Department	Report No. 85R-167	Y	Y	Y	N	Rohm & Haas Company
6_4_1(3)	Cox RH	1986	Mancozeb: Three-Month Dietary Toxicity in Dogs	Hazleton Laboratories America	Project No. 417-416	Y	Y	Y	N	Rohm & Haas Company
6_4_1(4)	Broadmeadow A	1988	Mancozeb Technical: Toxicity Study by Oral (Capsule) Administration To Beagle Dogs for 13 Weeks Followed by a 6 Week Reversibility Period	Life Science Research Ltd.	LSR Report No. 87/PTC003/444	Y?	Y	Y	N	Cerexagri SA
6_4_1(5)	Briffaux JP	1991	ETU 13 Week oral (dietary) toxicity study in the beagle dog	Hazelton France	Laboratory Project identification: 616/504	Y	Y	Y	N	Cerexagri SA
6_4_3	Hagan JV, Fisher JR, Baldwin RC	1986	Mancozeb: Subchronic Inhalation Toxicity Study in Rats	Rohm and Haas Company Toxicology Department	Report No. 86R-0003	Y?	Y	Y	N	Rohm & Haas Company
6_5(1)	Broadmeadow A	1991	Mancozeb Technical: Toxicity Study by Oral (Capsule) Administration to Beagle Dogs for 52 Weeks	Life Science Research Ltd	LSR Report No. 89/PTc004/0015	Y	Y	Y	N	Cerexagri SA
6_5(2)	Briffaux JP	1992	ETU 52 Week oral (dietary) toxicity study in the beagle dog	Hazelton France	Laboratory Project identification: 616/505	Y	Y	Y	N	Cerexagri SA

6_5(2)	Eckert JA	1992	Supplemental Report: ETU 52 Week Oral (Dietary) Toxicity Study in the Beagle Dog, Analytical Report on ETU Content in Dog Feed to Support ETU Toxicology Study 616/505	Enviro-Bio-Tech Ltd	Report No. TF-01-90	Y	Y	Y	N	Cerexagri SA
6_5(3)	Hooks WN, Offer JM, Hadley JC, Gibson WA, Gopinath C, Dawe IS	1992	Mancozeb Technical: Potential Tumorigenic and Toxic Effects in Prolonged Dietary Administration to Rats	Huntingdon Research Centre Ltd.	Report No. PWT/29	Y	Y	Y	N	Cerexagri SA
6_5(4)	Stadler JC	1990	Combined Chronic Toxicity/Oncogenicity Study with Mancozeb: Two-Year Feeding Study with Rats	Haskell Laboratory for Toxicology and Industrial Medicine, E.I. DuPont de Nemours	Haskell Laboratory Report No. 259-89	Y	Y	Y	N	Cerexagri SA
6_5(5)	Schmid H, Tennekes H, Janiak T, Probst D, Luetkemeier H, Pappritz G, Märki U, Vogel O, Heusner W	1992	Ethylene Thiourea: 104 Week Chronic Toxicity (Feeding) Study in Rats	Research and Consulting Company (RCC)	RCC Project No. 256803	Y	Y	Y	N	Cerexagri SA
6_5(6)	Shellenberger TE	1991	Mancozeb: 18-Month Dietary Oncogenicity Study in Mice	Tegeris Laboratories Inc	TL Project No. 85051	Y	Y	Y	N	Cerexagri SA
6_6_1	Wilmer JWGM	1982	Examination of “Penncozeb Technisch” for Mutagenic Activity in the Ames Test	TNO	Report No. V 82.388/ 220064	Y	Y	Y	N	Cerexagri SA
6_6_3	Foxall S, Byers MJ	1985	Dithane M-45 CHO/HGPRT Gene Mutation Assay	Rohm and Haas Company Toxicology Department	Report No. 84R-207	Y	Y	Y	N	Rohm & Haas Company

6_6_4(1)	Sames, JL, McLeod, PL, Doolittle DJ	1984	Dithane M-45 In Vivo Cytogenetic Study in Fischer-344 Rats	Rohm and Haas Company Toxicology Department	Report No. 84R-246	Y ?	Y	Y	N	Rohm & Haas Company
6_6_4(2)	Holmstrom LM, Innes DC	1997	Sanachem Mancozeb 85% Technical Micronucleus Test in Bone Marrow of CD-1 Mice	Inveresk Research	Inveresk Report No. 14823	Y	Y	Y	N	Cerexagri SA
6_6_5	Farrow MG	1984	Host Mediated Assay in Mice With Compound Dithane M-45	Hazleton Laboratories America Inc.	Report No. 84RC-025B	Y	Y	Y	N	Rohm & Haas Company
6_7(1)	Hooks WN, Offer JM, Hadley JC, Gibson WA, Gopinath C, Dawe IS	1992	Mancozeb Technical: Potential Tumorigenic and Toxic Effects in Prolonged Dietary Administration to Rats	Huntingdon Research Centre Ltd.	Report No. PWT/29	Y	Y	Y	N	Cerexagri SA
6_7(2)	Stadler JC	1990	Combined Chronic Toxicity/Oncogenicity Study with Mancozeb: Two-Year Feeding Study with Rats	Haskell Laboratory for Toxicology and Industrial Medicine, E.I. DuPont de Nemours	Haskell Laboratory Report No. 259-89	Y	Y	Y	N	Cerexagri SA
6_7(3)	Shellenberger TE	1991	Mancozeb: 18-Month Dietary Oncogenicity Study in Mice	Tegeris Laboratories Inc	TL Project No. 85051	Y	Y	Y	N	Rohm & Haas Company
6_8_1(1)	Tesh JM, McAnulty PA, Willoughby CR, Enticott J, Wilby OK, Tesh SA	1988	Mancozeb: Teratology Study in the Rat	Life Science Research	LSR Study No. 87/PTC007/365, LSR Report No. 87/0365	Y	Y	Y	N	Cerexagri SA
6_8_1(2)	Müller W	1991	Penncozeb Technical: Oral (gavage) Teratogenicity Study in the Rabbit	Hazleton Laboratories Deutschland GmbH	HLD Report No. 853-683-002	Y	Y	Y	N	Cerexagri SA

6_8_2(1)	Müller W	1992	Penncozeb Technical: Two Generation (Dietary Administration) Reproduction Toxicity Study in the Rat (One Litter Per Generation)	Hazleton Laboratories Deutschland GmbH	HLD Report No. 852-683-001	Y	Y	Y	N	Cerexagri SA
6_8_2(2)	Dotti A, Kinder J, Wright J	1992	Ethylene Thiourea (ETU) Two-Generation Reproduction Study in the Rat	Research and Consulting Company AG	RCC Project No. 252360	Y	Y	Y	N	Cerexagri SA
6_9	Stadler JC	1991	Neuropathology Study in Rats with Mancozeb	Haskell Laboratory for Toxicology and Industrial Medicine, E.I. DuPont de Nemours	Haskell Laboratory Report No. 217-89	Y	Y	Y	N	Cerexagri SA
6_12_1	Vogel W	1990	Dermal and Inhalation Exposure to Workers Involved in the Manufacturing of EBDC Fungicides	RCC Umweltchemie AG	RCC Project No. 238860	Y	Y	Y	N	Cerexagri SA
7_1_1_1_1	Ampofo SA, Reibach P	2003	Hydrolysis of Polymeric Zinc 14C-ethylenebis(dithiocarbamate)Zineb) in Aqueous Media	Cerexagri Inc Residue Chemistry Laboratory	Study No. KP-2001-10	**Y**	Y	Y	N	Cerexagri SA
7_1_1_1_2	Yeh, S.M.	1985	Water Photolyis Study of Mancozeb	Biospherics, Inc.	Report No. 31L-85-13	N	Y	Y	N	Rohm & Haas Company
7_1_1_2_1	Desmares-Koopmans MJE	2006	Determination of 'Ready' Biodegradability: Carbob Dioxide (CO_2) Evolution Test (Modified Sturm Test) of Zineb	NOTOX B.V.	Notox Project No. 457324	Y	Y	Y	N	Cerexagri SA
7_1_1_2_3	Thompson RS	2001a	Zineb Nautec: Determination of Biodegradability in Seawater (Closed Bottle Test)	Brixham Environmental Laboratory	Report No. BL7220/B	Y	Y	Y	N	Cerexagri SA
7_1_2_2_2	Völkel W	2003	[14C]-Zineb: Route and Rate of Degradation in Aerobic Marine Aquatic Systems Addressing the	RCC Ltd.	RCC Study No. 814566	Y	Y	Y	N	Cerexagri SA

			Effects of Copper Ions on the Degradation							
7_1_2_2_2	Völkel W	2005	[14C]-Zineb: Route and Rate of Degradation in Aerobic Marine Aquatic Systems Addressing the Effects of Copper Ions on the Degradation. First Amendment to Report.	RCC Ltd.	RCC Study No. 814566	Y	Y	Y	N	Cerexagri SA
7_2_1(1)	Bieber, W.D. and Kröhn, R.	1989	Degradation of Mancozeb in soil II	NATEC Institut für naturwissenschaftlich-technische Dienste GmbH	Report No. NA 88 9119	N	Y	Y	N	Cerexagri SA
7_2_1(2)	Randazzo, D.J.	1986	Aerobic and Anaerobic Soil Metabolism of Mancozeb	Rohm and Haas Company	Technical Report No. 310-86-23	Y	Y	Y	N	Rohm & Haas Company
7_2_2_1(1)	Todt, K. and Conradt, H.	1989	Degradation of Mancozeb in Soil I	NATEC Institut für naturwissenschaftlich-technische Dienste GmbH	Report No. NA 88 9683	N	Y	Y	N	Cerexagri SA
7_2_2_1(2)	De Vette HQM and Cremers RKH	2002	A Study on the Rate of Degradation of EBIS (Metabolite of BAS 222 F, Metiram) in Three Aerobic Soils	TNO Chemistry	Study No. 02-4047/01		Y	Y	N	Cerexagri SA/Dow/ BASF
7_2_2_1(3)	Wright, MC	2000	Aerobic Soil Metabolism Degradation Rate Determination for Ethylenethiourea (ETU) on Soil	XenoBiotic Laboratories Inc	XBL Report No. RPT00643	Y	Y	Y	N	Cerexagri SA
7_2_2_3	Randazzo, D.J.	1986	Aerobic and Anaerobic Soil Metabolism of Mancozeb	Rohm and Haas Company	Technical Report No. 310-86-23	Y	Y	Y	N	Rohm & Haas Company
7_2_3_1(1)	Yeh, S.M.	1986a	Batch Soil Adsorption/Desorption of Mancozeb	Biospherics, Inc.	Report No. 310-86-62	Y	Y	Y	N	Rohm & Haas Company

7_2_3_1(2)	Yeh, S.M.	1986b	Batch Soil Adsorption/Desorption of Ethylenethiourea	Biospherics, Inc.	Report No. 310-86-83	Y	Y	Y	N	Rohm & Haas Company
7_2_3_1(3)	Cooke J	2003	A Metabolite of Mancozeb: Adsorption/Desorption in Soil	Covance Laboratories Inc	Covance Report No. 295/162-D2149	Y	Y	Y	N	Cerexagri SA/Dow/ BASF
7_2_3_2	Daly, D.	1988	Leaching characteristics of soil incorporated mancozeb following aerobic aging.	Analytical Bio-Chemistry Laboratories, Inc.	Report No. 36291	Y	Y	Y	N	Rohm & Haas Company
7_4_1_1(1)	Thompson RS	2001b	Zineb Nautec: Acute Toxicity to Plaice (*Pleuronectes platessa*)	Brixham Environmental Laboratory	Report No. BL7217/B	Y	Y	Y	N	Cerexagri SA
7_4_1_1(2)	van Leeuwen, C.J., Maas-Diepeveen, J.L., Niebeek, G., Vergouw, W.H.A., Griffioen, P.O and Luijken, M.W.	1985a	Aquatic toxicological apsects of dithiocarbamates and related compounds. I. Short-term toxicity tests.	Aquatic Toxicology, 7: 145-164	-	N	N	N	N	-
7_4_1_1(3)	Zok S	2001	Acute Toxicity Study on the Rainbow Trout (Oncorhynchus mykiss WALBAUM 1792) in a Static System (96 Hours)	BASF Experimental Toxicology and Ecology Laboratory	Laboratory Project ID 12F0533/005042	Y	Y	Y	N	BASF
7_4_1_1(4)	Palmer SJ, Kendall TZ, Krueger HO	2001a	Ethylene Urea: A 96-Hour Static Acute Toxicity Test with the Rainbow Trout (*Oncorhynchus mykiss*)	Wildlife International Ltd.	Project No. 299A-115	Y	Y	Y	N	EBDC/ETU Taskforce: BASF/Elf Atochem/ Griffin/Rohm & Haas Company
7_4_1_2(1)	Thompson RS	2001c	Zineb Nautec: Acute Toxicity to the Marine Copepod (*Tisbe battagliai*)	Brixham Environmental Laboratory	Report No. BL7218/B	Y	Y	Y	N	Cerexagri SA

7_4_1_2(2)	van Leeuwen, C.J., Maas-Diepeveen, J.L., Niebeek, G., Vergouw, W.H.A., Griffioen, P.O and Luijken, M.W.	1985a	Aquatic toxicological apsects of dithiocarbamates and related compounds. I. Short-term toxicity tests.	Aquatic Toxicology, 7: 145-164	-	N	N	N	N	-
7_4_1_2(3)	Hisgen Mr.	2000	Determination of the Acute Effect on the Swimming Ability of the Water Flea Daphnia magna STRAUS	BASF Experimental Toxicology and Ecology Lab	Laboratory Project ID 00/0533/50/1	Y	Y	Y	N	BASF
7_4_1_2(4)	Palmer SJ, Kendall TZ, Krueger HO	2001b	Ethylene Urea: A 48-Hour Static Acute Toxicity Test with the Cladoceran (*Daphnia magna*)	Wildlife International Ltd.	Project No. 299A-114	Y	Y	Y	N	EBDC/ETU Taskforce: BASF/Elf Atochem/ Griffin/Rohm & Haas Company
7_4_1_3(1)	Thompson RS	2001d	Zineb Nautec: Acute Toxicity to the Marine Alga (*Skeletonema costatum*)	Brixham Environmental Laboratory	Report No. BL7219/B	Y	Y	Y	N	Cerexagri SA
7_4_1_3(2)	van Leeuwen, C.J., Maas-Diepeveen, J.L., Niebeek, G., Vergouw, W.H.A., Griffioen, P.O and Luijken, M.W.	1985a	Aquatic toxicological apsects of dithiocarbamates and related compounds. I. Short-term toxicity tests.	Aquatic Toxicology, 7: 145-164	-	N	N	N	N	-
7_4_1_3(3)	Reuschenbach Dr.	2000	Determination of the Inhibitory Effect on the Cell Multiplication of Unicellular Green Algae	BASF Experimental Toxicology and Ecology Lab	Laboratory Project ID 00/0533/60/1	Y	Y	Y	N	BASF

7_4_1_3(4)	Palmer SJ, Kendall TZ, Krueger HO	2001c	Ethylene Urea: A 96-Hour Toxicity Test with the Freshwater Alga (*Selenastrum capricornutum*)	Wildlife International Ltd.	Project No. 299A-116	Y	Y	Y	N	EBDC/ETU Taskforce: BASF/Elf Atochem/ Griffin/Rohm & Haas Company
7_4_1_4	Desmares-Koopmans MJE	2005	Activated Sludge Respiration Inhibition Test with Zineb (Contact Time: 30 Minutes)	NOTOX B.V.	Notox Project No. 447018	Y	Y	Y	N	Cerexagri SA
7_4_3_2	van Leeuwen, C.J., Espeldoorn, A. and Mol, F.	1986a	Aquatic toxicological apsects of dithiocarbamates and related compounds. III. Embryolarval studies with Rainbow Trout (*Salmo gairdneri*).	Aquatic Toxicology, 9: 129-145	-	N	N	N	N	-
7_4_3_3_1	van Leeuwen, C.J., van Hameren, P., Bogers, M. and Griffioen, P.S.	1986b	Uptake, distribution and retention of Zineb and Ziram in Rainbow Trout (Salmo Gairdneri)	Toxicology, 42:33-46.	-	N	N	N	N	-
7_4_3_4	van Leeuwen CJ, Moberts F and Niebeek G	1985b	Aquatic toxicological aspects of dithiocarbamates and related compounds. II. Effects on survival, reproduction and growth of Daphnia magna.	Aquatic Toxicology, 7: 165-175	-	N	N	N	N	-
7_5_1_1(1)	Krieg W	2001a	Effect of BF 222-ETU on Carbon Transformation of the Soil Microflora	BASF Ecology and Environmental Analytics Lab	Study Code No. 97479	Y	Y	Y	N	BASF
7_5_1_1(2)	Krieg W	2001b	Effect of BF 222-ETU on Nitrogen Transformation of the Soil Microflora	BASF Ecology and Environmental Analytics Lab	Study Code No. 97481	Y	Y	Y	N	BASF
7_5_1_1(3)	Krieg W	2001c	Effect of BF 222-EU on Carbon Transformation of the Soil Microflora	BASF Ecology and Environmental Analyti	Study Code No. 99453	Y	Y	Y	N	BASF

				cs Lab						
7_5_1_1(4)	Krieg W	2001d	Effect of BF 222-EU on Nitrogen Transformation of the Soil Microflora	BASF Ecology and Environmental Analytics Lab	Study Code No. 99455	Y	Y	Y	N	BASF
7_5_1_2(1)	Staab F	2001a	Effect of Metabolite ETU on the Mortality of the Earthworm *Eisenia foetida*	BASF Ecology and Environmental Analytics Laboratory	Study Code 96317	Y	Y	Y	N	BASF
7_5_1_2(2)	Staab F	2001b	Effect of BF 222-EU on the Mortality of the Earthworm *Eisenia foetida*	BASF Ecology and Environmental Analytics Laboratory	Study Code 99457	Y	Y	Y	N	BASF

IIIA Reference List by Author

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
7_1_1_1_1	Ampofo SA, Reibach P	2003	Hydrolysis of Polymeric Zinc 14C-ethylenebis(dithiocarbamate)(Zineb) in Aqueous Media	Cerexagri Inc Residue Chemistry Laboratory	Study No. KP-2001-10	**Y**	Y	Y	N	Cerexagri SA
3_11(2)	Bal EA	1995	Determination of the Flammability of Zineb TC. TNO Defence Research	TNO Defence Research	PML 1995-C15	Y	Y	Y	N	Cerexagri SA
7_2_1 (1)	Bieber, WD and Kröhn, R	1989	Degradation of Mancozeb in soil II	NATEC Institut für naturwissenschaftlich-technische Dienste GmbH	Report No. NA 88 9119	N	Y	Y	N	Cerexagri SA
6_1_3 (1)	Blagden SM	1997	Technical Zineb (92-94%): Acute Inhalation Toxicity (Nose Only) Study in the Rat.	Safepharm Laboratories Ltd	SPL Project No. 764/074	Y	Y	Y	N	Cerexagri SA
6_4_1 (5)	Briffaux JP	1991	ETU 13 Week oral (dietary) toxicity study in the beagle dog	Hazelton France	Laboratory Project identification: 616/504	Y	Y	Y	N	Cerexagri SA
6_5(2)	Briffaux JP	1992	ETU 52 Week oral (dietary) toxicity study in the beagle dog	Hazelton France	Laboratory Project identification: 616/505	Y	Y	Y	N	Cerexagri SA
6_4_1 (4)	Broadmeadow A	1988	Mancozeb Technical: Toxicity Study by Oral (Capsule) Administration To Beagle Dogs for 13 Weeks Followed by a 6 Week Reversibility Period	Life Science Research Ltd.	LSR Report No. 87/PTC 003/444	Y ?	Y	Y	N	Cerexagri SA
6_5(1)	Broadmeadow A	1991	Mancozeb Technical: Toxicity Study by Oral (Capsule) Administration to Beagle Dogs for 52 Weeks	Life Science Research Ltd	LSR Report No. 89/PTc0 04/0015	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
6_2(2)	Cameron BD, Speirs G, Clydesdale K	1990	The Disposition of [14C]-Mancozeb in the Mouse	Inveresk Research International	Report No. 4909	Y	Y	Y	N	Cerexagri SA
6_3_1	Chevalier G	2002	Zineb Nautec: 4-Week Toxicity Study by Oral Route (Dietary Admixture) in Rats	CIT	Laboratory Study No. 22521 TSR	Y	Y	Y	N	Cerexagri SA
4_2c(2)	Connolly P	2000	Independent Laboratory Validation of Analytical Method "Method for the Analysis of Ethylenethioureа (ETU) in Water by LC/MS/MS (MS 178.00) Revision 2	Centre Analytical Laboratories Inc	Centre Analytical Study No. 002-342	Y	Y	Y	N	Cerexagri SA
7_2_3_1(3)	Cooke J	2003	A Metabolite of Mancozeb: Adsorption/Desorption in Soil	Covance Laboratories Inc	Covance Report No. 295/162-D2149	Y	Y	Y	N	Cerexagri SA/Dow/BASF
6_4_1(3)	Cox RH	1986	Mancozeb: Three-Month Dietary Toxicity in Dogs	Hazleton Laboratories America	Project No. 417-416	Y	Y	Y	N	Rohm & Haas Company
7_2_3_2	Daly, D.	1988	Leaching characteristics of soil incorporated mancozeb following aerobic aging.	Analytical Bio-Chemistry Laboratories, Inc.	Report No. 36291	Y	Y	Y	N	Rohm & Haas Company
7_2_2_1(2)	De Vette HQM and Cremers RKH	2002	A Study on the Rate of Degradation of EBIS (Metabolite of BAS 222 F, Metiram) in Three Aerobic Soils	TNO Chemistry	Study No. 02-4047/01		Y	Y	N	Cerexagri SA/Dow/BASF
6_4_1(1)	Dean GA, Crook D, Gibson WA, Gopinath C, Imm S, Anderson A, Dawe	1989	Mancozeb Technical: Toxicity to Rats by Dietary Administration for 13 Weeks with 4 Week Recovery	Huntingdon Research Centre Ltd	Report No. PWT 46/87924	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
	IS		Period							
7_4_1_4	Desmares-Koopmans MJE	2005	Activated Sludge Respiration Inhibition Test with Zineb (Contact Time: 30 Minutes)	NOTOX B.V.	Notox Project No. 447018	Y	Y	Y	N	Cerexagri SA
7_1_1_2_1	Desmares-Koopmans MJE	2006	Determination of 'Ready' Biodegradability: Carbob Dioxide (CO2) Evolution Test (Modified Sturm Test) of Zineb	NOTOX B.V.	Notox Project No. 457324	Y	Y	Y	N	Cerexagri SA
6_2(1)	DiDonato LJ, Longacre SL	1986	Mancozeb Pharmokinetic Study in Rats	Rohm and Haas Company Toxicology Department	Report No. 85R-123	Y	Y	Y	N	Rohm & Haas Company
3_2(3)	Diepenhorst P C	2006a	DIDT product properties water solubility, vapour pressure, log Pow, Henry's law constant	Cerexagri B.V.	Study number DL 05-080	Y	Y	Y	N	Cerexagri SA
3_2_1(2)	Diepenhorst P C	2006a	DIDT product properties water solubility, vapour pressure, log Pow, Henry's law constant	Cerexagri B.V.	Study number DL 05-080	Y	Y	Y	N	Cerexagri SA
3_5(2)	Diepenhorst P C	2006a	DIDT product properties water solubility, vapour pressure, log Pow, Henry's law constant	Cerexagri B.V.	Study number DL 05-080	Y	Y	Y	N	Cerexagri SA
3_9(2)	Diepenhorst P C	2006a	DIDT product properties water solubility, vapour pressure, log Pow, Henry's law constant	Cerexagri B.V.	Study number DL 05-080	Y	Y	Y	N	Cerexagri SA
3_2(2)	Diepenhorst PC	1999	Zineb Product Chemistry: Determination of Vapour Pressure	Development Laboratory Elf Atochem Agri BV	Amendment Report 121	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
3_2(1)	Diepenhorst PC	2000	Zineb Active Substance Vapour Pressure	Development Laboratory Elf Atochem Agri BV	Final Report No. DL 00-018	Y	Y	Y	N	Cerexagri SA
3_4_1	Diepenhorst PC	2001a	Zineb Purified Active Substance, Absorption Spectra (UV/VIS, IR, NMR and Mass Spectrum)	Cerexagri B.V.	Report No. DL01-042	Y	Y	Y	N	Cerexagri SA
3_4_2	Diepenhorst PC	2001a	Zineb Purified Active Substance, Absorption Spectra (UV/VIS, IR, NMR and Mass Spectrum)	Cerexagri B.V.	Report No. DL01-042	Y	Y	Y	N	Cerexagri SA
3_4_3	Diepenhorst PC	2001a	Zineb Purified Active Substance, Absorption Spectra (UV/VIS, IR, NMR and Mass Spectrum)	Cerexagri B.V.	Report No. DL01-042	Y	Y	Y	N	Cerexagri SA
3_4_4	Diepenhorst PC	2001a	Zineb Purified Active Substance, Absorption Spectra (UV/VIS, IR, NMR and Mass Spectrum)	Cerexagri B.V.	Report No. DL01-042	Y	Y	Y	N	Cerexagri SA
3_5(1)	Diepenhorst PC	2001b	Zineb Active Substance Solubility in Water.	Development Laboratory Elf Atochem Agri BV	Final Report No. DL 00-055	Y	Y	Y	N	Cerexagri SA
3_9(1)	Diepenhorst PC	2001c	Zineb Purified Active Substance: Partition Coefficient n-Octanol/Water (Including Effect of pH (5-9) and Temperature)	Cerexagri B.V.	Final Report No. DL 01-009	Y	Y	Y	N	Cerexagri SA
3_2_1 (1)	Diepenhorst PC	2006b	Zineb Dissociation Constant and Henry's law constant	Cerexagri B.V.	Study No. DL 06-020	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
3_6	Diepenhorst PC	2006b	Zineb Dissociation Constant and Henry's law constant	Cerexagri B.V.	Study No. DL 06-020	Y	Y	Y	N	Cerexagri SA
3_8	Diepenhorst PC	2006c	Zineb Nautec stability in organic solvents	Cerexagri B.V.	Final Report No. DL 05-082	Y	Y	Y	N	Cerexagri SA
4_2d(2)	Diepenhorst PC	2001d	Validation of draft SOP DLA-0041 Version 0 ETU determination by HPLC in urine	Elf Atochem Agri B.V.	Final Report DL 00-061	Y	Y	Y	N	Cerexagri SA
6_8_2 (2)	Dotti A, Kinder J, Wright J	1992	Ethylene Thiourea (ETU) Two-Generation Reproduction Study in the Rat	Research and Consulting Company AG	RCC Project No. 252360	Y	Y	Y	N	Cerexagri SA
6_5(2)	Eckert JA	1992	Supplemental Report: ETU 52 Week Oral (Dietary) Toxicity Study in the Beagle Dog, Analytical Report on ETU Content in Dog Feed to Support ETU Toxicology Study 616/505	Enviro-Bio-Tech Ltd	Report No. TF-01-90	Y	Y	Y	N	Cerexagri SA
6_6_5	Farrow MG	1984	Host Mediated Assay in Mice With Compound Dithane M-45	Hazleton Laboratories America Inc.	Report No. 84RC-025B	Y	Y	Y	N	Rohm & Haas Company
3_1_1	Felperlaan MR	2000	Zineb Active Ingredient Melting Point	Development Laboratory Elf Atochem Agri BV	Final Report No. DL 00-011	Y	Y	Y	N	Cerexagri SA
3_10	Felperlaan MR	2001	Zineb Nautec manufactured at Solbiate Olona site, Thermal Stability	Cerexagri B.V.	Report No. DL01-041	Y	Y	Y	N	Cerexagri SA
3_17	Felperlaan MR	2005	Zineb Nautec, Manufactured at Cerexagri Dequisa 2 Years Shelf-Life in Commercial Bag	Cerexagri B.V.	Final Report No. DL 02-100	?	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
3_7	Felperlaan MR	2006	Zineb Nautec solubility in organic solvents	Cerexagri B.V.	Final Report No. DL 05-081	Y	Y	Y	N	Cerexagri SA
2_7	Felperlaan MR	2002a	Zineb Nautec, Manufactured at Dequisa, Sabinanigo Site, Certified Limits	Cerexagri B.V.	Final Report No. DL 02-064	Y	Y	Y	Y	Cerexagri SA
2_8	Felperlaan MR	2002a	Zineb Nautec, Manufactured at Dequisa, Sabinanigo Site, Certified Limits	Cerexagri B.V.	Final Report No. DL 02-064	Y	Y	Y	Y	Cerexagri SA
2_7	Felperlaan MR	2002b	Zineb Nautec, Manufactured at Dequisa, Sabinanigo Site, Analytical Profile of Five Representatvie Batches	Cerexagri B.V.	Final Report No. DL 02-036	Y	Y	Y	Y	Cerexagri SA
2_8	Felperlaan MR	2002b	Zineb Nautec, Manufactured at Dequisa, Sabinanigo Site, Analytical Profile of Five Representatvie Batches	Cerexagri B.V.	Final Report No. DL 02-036	Y	Y	Y	Y	Cerexagri SA
3_3_1	Felperlaan MR	2002c	Zineb Nautec manufactured at Dequisa, Sabinanigo, Appearance (Physical State, Colour and Odour)	Cerexagri B.V.	Report No. DL02-059	Y	Y	Y	N	Cerexagri SA
3_3_2	Felperlaan MR	2002c	Zineb Nautec manufactured at Dequisa, Sabinanigo, Appearance (Physical State, Colour and Odour)	Cerexagri B.V.	Report No. DL02-059	Y	Y	Y	N	Cerexagri SA
3_3_3	Felperlaan MR	2002c	Zineb Nautec manufactured at Dequisa, Sabinanigo, Appearance (Physical State, Colour and Odour)	Cerexagri B.V.	Report No. DL02-059	Y	Y	Y	N	Cerexagri SA
4_1	Felperlaan MR	1999	Zineb Technical: Preliminary Analyses of Five Representative	Development Laboratory Elf Atochem Agri BV	Final Report No. DL 99-001	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
			Samples							
6_2(4)	Fisher L	2002	[14C]-Mancozeb In Vivo Dermal Absorption Study in the Male Rat	Huntingdon Life Sciences Ltd.	Laboratory Report No. EFA 041/022 683	Y	Y	Y	N	Rohm & Haas Company
6_6_3	Foxall S, Byers MJ	1985	Dithane M-45 CHO/HGPRT Gene Mutation Assay	Rohm and Haas Company Toxicology Department	Report No. 84R-207	Y	Y	Y	N	Rohm & Haas Company
6_4_1(2)	Goldman PR, Bernaski HJ, Quinn DL	1986	Mancozeb: Three-Month Dietary Toxicity Study in Rats	Rohm and Haas Toxicology Department	Report No. 85R-167	Y	Y	Y	N	Rohm & Haas Company
4_2a(1)	Gottschalk R	2002a	Validation of the Analytical Method MS 270 for the Analysis of Mancozeb in Soil	Enviro-Test Laboratories	Report No. 02MTF01.REP	Y	Y	Y	N	Cerexagri SA
4_2a(2)	Gottschalk R	2002b	Validation of the Method for the Analysis of Ethylenethioureа (ETU) in Soil by LC/MS/MS, using 2 European soils.	Enviro-Test Laboratories	ETL Report No. 2CER01.REP	Y	Y	Y	N	Cerexagri SA
6_4_3	Hagan JV, Fisher JR, Baldwin RC	1986	Mancozeb: Subchronic Inhalation Toxicity Study in Rats	Rohm and Haas Company Toxicology Department	Report No. 86R-0003	Y?	Y	Y	N	Rohm & Haas Company
4_2c(1)	Hanauer R	2001	Validation of The Method: Determination of Mancozeb in Surface Water - LOQ, 0.1 ppb (µg/Liter)	Morse Laboratories, Inc.	Report No. TR 34-00-112	Y	Y	Y	N	Cerexagri SA
7_4_1_2(3)	Hisgen Mr.	2000	Determination of the Acute Effect on the Swimming Ability of the Water Flea Daphnia magna STRAUS	BASF Experimental Toxicology and Ecology Lab	Laboratory Project ID 00/0533/50/1	Y	Y	Y	N	BASF
6_6_4(2)	Holmstrom LM, Innes DC	1997	Sanachem Mancozeb 85% Technical Micronucleus Test in Bone	Inveresk Research	Inveresk Report No. 14823	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
			Marrow of CD-1 Mice							
6_5(3)	Hooks WN, Offer JM, Hadley JC, Gibson WA, Gopinath C, Dawe IS	1992	Mancozeb Technical: Potential Tumorigenic and Toxic Effects in Prolonged Dietary Administration to Rats	Huntingdon Research Centre Ltd.	Report No. PWT/29	Y	Y	Y	N	Cerexagri SA
6_7(1)	Hooks WN, Offer JM, Hadley JC, Gibson WA, Gopinath C, Dawe IS	1992	Mancozeb Technical: Potential Tumorigenic and Toxic Effects in Prolonged Dietary Administration to Rats	Huntingdon Research Centre Ltd.	Report No. PWT/29	Y	Y	Y	N	Cerexagri SA
5_3_1(3)	Hunter J and Evans L	1990	The toxicity of the biocides zineb, nabam and their derivatives to the ship-fouling diatom Amphora coffeaeformis	Biofouling (2), pp. 267-287	#REF!	N	N	N	N	-
2_6	Kool P and Rodriguez C	2002	Zineb Nautec Manufacturing Process Dequisa, Sabiñángio	Cerexagri B.V.	Final Report No. DL 02-065	N	Y	Y	Y	Cerexagri SA
7_5_1_1(3)	Krieg W	2001c	Effect of BF 222-EU on Carbon Transformation of the Soil Microflora	BASF Ecology and Environmental Analytics Lab	Study Code No. 99453	Y	Y	Y	N	BASF
7_5_1_1(4)	Krieg W	2001d	Effect of BF 222-EU on Nitrogen Transformation of the Soil Microflora	BASF Ecology and Environmental Analytics Lab	Study Code No. 99455	Y	Y	Y	N	BASF
7_5_1_1(1)	Krieg W	2001a	Effect of BF 222-ETU on Carbon Transformation of the Soil Microflora	BASF Ecology and Environmental Analytics Lab	Study Code No. 97479	Y	Y	Y	N	BASF

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
7_5_1_1(2)	Krieg W	2001b	Effect of BF 222-ETU on Nitrogen Transformation of the Soil Microflora	BASF Ecology and Environmental Analytics Lab	Study Code No. 97481	Y	Y	Y	N	BASF
6_1_2(2)	Leuschner J	2001a	Acute Toxicity Study of ETU (Ethylene Thiourea) in Sprague-Dawley Rats by Dermal Administration	LPT Lab	Laboratory Report No. 13986/01	Y	Y	Y	N	Cerexagri SA
6_1_4(3)	Leuschner J	2001b	Acute Skin Irritation Test (Patch Test) of ETU (Ethylene Thiourea) in Rabbits	LPT Lab	Laboratory Report No. 13987/01	Y	Y	Y	N	Cerexagri SA
6_1_4(4)	Leuschner J	2001c	Acute Eye Irritation Study of ETU (Ethylene Thiourea) by Instillation Into the Conjunctival Sac of Rabbits	LPT Lab	Laboratory Report No. 13988/01	Y	Y	Y	N	Cerexagri SA
6_1_3(2)	Leuschner J	2002	Acute Inhalation Toxicity Study of Milled Ethylene Thiourea (ETU) in Sprague-Dawley Rats	LPT Lab	Laboratory Report No. 15283/02	Y	Y	Y	N	Cerexagri SA
6_2(1)	Longacre SL	1986	Summary of Ethylenethiourea (ETU) and Ethylene-bis-Dithiocarbamate (EBDC) Analysis in Plasma, Liver, and Thyroid after Mancozeb administration	Rohm and Haas Company	Analytical supplement to : Report No. 85R-123	Y	Y	Y	N	Cerexagri SA
3_11(3)	Mak WA	1997	Flammability of a Sample of Zineb Technical	TNO	Report No. PML 1997-C3	?	Y	Y	N	Cerexagri SA
3_11(4)	Mak WA	2000	Flammability in Contact with Water of Zineb TC	TNO	Report No. PML 1999-C131	Y	Y	Y	N	Cerexagri SA
3_11(6)	Mak WA	2002	Relative Self-Ignition	TNO	Report PML	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
			Temperature of Zineb Nautec, Manufactured at Dequisa, Sabinanigo		2002-C108					
4_2b(1)	Mueller-Kallert HM	1995	Analytical Method For The Determination of Mancozeb And Its Metabolite ETU in Air	RCC Umweltchemie AG	Report No. TR 34-94-160	Y	Y	Y	N	Cerexagri SA
6_8_1 (2)	Müller W	1991	Penncozeb Technical: Oral (gavage) Teratogenicity Study in the Rabbit	Hazleton Laboratories Deutschland GmbH	HLD Report No. 853-683-002	Y	Y	Y	N	Cerexagri SA
6_8_2 (1)	Müller W	1992	Penncozeb Technical: Two Generation (Dietary Administration) Reproduction Toxicity Study in the Rat (One Litter Per Generation)	Hazleton Laboratories Deutschland GmbH	HLD Report No. 852-683-001	Y	Y	Y	N	Cerexagri SA
6_2(1)	Nelson SS	1986a	Metabolism of 14C Mancozeb in Rat	Rohm and Haas Company	Technical Report No 31H-86-02 (Analytical supplement to: Report No. 85R-123)	Y	Y	Y	N	Cerexagri SA
6_2(1)	Nelson SS	1986b	Bioconversion of Mancozeb to ETU in Rat	Rohm and Haas Company	Technical report No. 31C-87-02 (Report supplement to: Report No. 85R-123	Y	Y	Y	N	Cerexagri SA
6_1_5	Ollivier E	2004	Zineb Technical: Skin Sensitization Test in Guinea Pigs (Maximization	CIT Safety & Health Research Laboratories	Laboratory Study No. 26847 TSG	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
			Method of Magnusson and Kligman)							
7_4_1_1(4)	Palmer SJ, Kendall TZ, Krueger HO	2001a	Ethylene Urea: A 96-Hour Static Acute Toxicity Test with the Rainbow Trout (*Oncorhynchus mykiss*)	Wildlife International Ltd.	Project No. 299A-115	Y	Y	Y	N	EBDC/ETU Taskforce: BASF/Elf Atochem/ Griffin/Rohm & Haas Company
7_4_1_2(4)	Palmer SJ, Kendall TZ, Krueger HO	2001b	Ethylene Urea: A 48-Hour Static Acute Toxicity Test with the Cladoceran (*Daphnia magna*)	Wildlife International Ltd.	Project No. 299A-114	Y	Y	Y	N	EBDC/ETU Taskforce: BASF/Elf Atochem/ Griffin/Rohm & Haas Company
7_4_1_3(4)	Palmer SJ, Kendall TZ, Krueger HO	2001c	Ethylene Urea: A 96-Hour Toxicity Test with the Freshwater Alga (*Selenastrum capricornutum*)	Wildlife International Ltd.	Project No. 299A-116	Y	Y	Y	N	EBDC/ETU Taskforce: BASF/Elf Atochem/ Griffin/Rohm & Haas Company
6_2(3)	Piccirillo VJ, Wu D, Speirs G	1992	Metabolism of [Ethylene-U-14C]-Mancozeb in the Mouse	Inveresk Research International Ltd. And XenoBiotic Laboratories Inc.	NPC Project No. T91-3413	Y	Y	Y	N	Cerexagri SA
7_2_1(2)	Randazzo, D.J.	1986	Aerobic and Anaerobic Soil Metabolism of Mancozeb	Rohm and Haas Company	Technical Report No. 310-86-23	Y	Y	Y	N	Rohm & Haas Company
7_2_2_3(1)	Randazzo, D.J.	1986	Aerobic and Anaerobic Soil Metabolism of Mancozeb	Rohm and Haas Company	Technical Report No. 310-86-23	Y	Y	Y	N	Rohm & Haas Company
4_2d(1)	Reed RL	2000	Validation of the Residue Analytical Method for	Morse Laboratories, Inc.	Report No, TR34-00-102	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
			Ethylenethiourea (ETU) in Meat							
7_4_1_3(3)	Reuschenbach Dr.	2000	Determination of the Inhibitory Effect on the Cell Multiplication of Unicellular Green Algae	BASF Experimental Toxicology and Ecology Lab	Laboratory Project ID 00/0533/60/1	Y	Y	Y	N	BASF
6_1_1	Richeux F	2005a	Zineb Nautec: Assessment of Acute Oral Toxicity in Rats: Acute Toxic Class Method.	Phycher Bio-Development	Final Report No. TAO423-PH-05/0005	Y	Y	Y	N	Cerexagri SA
6_1_2(1)	Richeux F	2005b	Zineb Nautec: Assessment of Acute Dermal Toxicity in Rats	Phycher Bio-Development	Final Report No. TAD-PH-05/0005	Y	Y	Y	N	Cerexagri SA
6_1_4(1)	Richeux F	2005c	Zineb Nautec: Assessment of Acute Dermal Irritation	Phycher Bio-Development	Final Report No. IC-OCDE-PH-05/0005	Y	Y	Y	N	Cerexagri SA
6_1_4(2)	Richeux F	2005d	Zineb Nautec: Assessment of Acute Eye Irritation	Phycher Bio-Development	Final Report No. IO-OCDE-PH-05/0005	Y	Y	Y	N	Cerexagri SA
6_6_4(1)	Sames, JL, McLeod, PL, Doolittle DJ	1984	Dithane M-45 In Vivo Cytogenetic Study in Fischer-344 Rats	Rohm and Haas Company Toxicology Department	Report No. 84R-246	Y?	Y	Y	N	Rohm & Haas Company
6_5(5)	Schmid H, Tennekes H, Janiak T, Probst D, Luetkemeier H, Pappritz G, Märki U, Vogel O, Heusner W	1992	Ethylene Thiourea: 104 Week Chronic Toxicity (Feeding) Study in Rats	Research and Consulting Company (RCC)	RCC Project No. 256803	Y	Y	Y	N	Cerexagri SA
6_5(6)	Shellenberger TE	1991	Mancozeb: 18-Month Dietary Oncogenicity Study in Mice	Tegeris Laboratories Inc	TL Project No. 85051	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
6_7(3)	Shellenberger TE	1991	Mancozeb: 18-Month Dietary Oncogenicity Study in Mice	Tegeris Laboratories Inc	TL Project No. 85051	Y	Y	Y	N	Rohm & Haas Company
6_3_2 (2)	Smith C, Crook D, Gibson WA, Hadley J, Gopinath C	1988	Mancozeb Technical: Twenty-One Day Dermal Toxicity Study in Rabbits	Huntingdon Research Centre Ltd.	Report No. 62/87964	Y	Y	Y	N	Cerexagri SA
7_5_1_2(1)	Staab F	2001a	Effect of Metabolite ETU on the Mortality of the Earthworm *Eisenia foetida*	BASF Ecology and Environmental Analytics Laboratory	Study Code 96317	Y	Y	Y	N	BASF
7_5_1_2(2)	Staab F	2001b	Effect of BF 222-EU on the Mortality of the Earthworm *Eisenia foetida*	BASF Ecology and Environmental Analytics Laboratory	Study Code 99457	Y	Y	Y	N	BASF
6_9	Stadler JC	1991	Neuropathology Study in Rats with Mancozeb	Haskell Laboratory for Toxicology and Industrial Medicine, E.I. DuPont de Nemours	Haskell Laboratory Report No. 217-89	Y	Y	Y	N	Cerexagri SA
6_5(4)	Stadler JC	1990	Combined Chronic Toxicity/Oncogenicity Study with Mancozeb: Two-Year Feeding Study with Rats	Haskell Laboratory for Toxicology and Industrial Medicine, E.I. DuPont de Nemours	Haskell Laboratory Report No. 259-89	Y	Y	Y	N	Cerexagri SA
6_7(2)	Stadler JC	1990	Combined Chronic Toxicity/Oncogenicity Study with Mancozeb: Two-Year Feeding Study with Rats	Haskell Laboratory for Toxicology and Industrial Medicine, E.I. DuPont de Nemours	Haskell Laboratory Report No. 259-89	Y	Y	Y	N	Cerexagri SA
6_8_1 (1)	Tesh JM, McAnulty PA, Willough by CR,	1988	Mancozeb: Teratology Study in the Rat	Life Science Research	LSR Study No. 87/PTC 007/365	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
	Enticott J, Wilby OK, Tesh SA				, LSR Report No. 87/0365					
7_1_1_2_3	Thompson RS	2001a	Zineb Nautec: Determination of Biodegradability in Seawater (Closed Bottle Test)	Brixham Environmental Laboratory	Report No. BL7220/B	Y	Y	Y	N	Cerexagri SA
7_4_1_1(1)	Thompson RS	2001b	Zineb Nautec: Acute Toxicity to Plaice (*Pleuronectes platessa*)	Brixham Environmental Laboratory	Report No. BL7217/B	Y	Y	Y	N	Cerexagri SA
7_4_1_2(1)	Thompson RS	2001c	Zineb Nautec: Acute Toxicity to the Marine Copepod (*Tisbe battagliai*)	Brixham Environmental Laboratory	Report No. BL7218/B	Y	Y	Y	N	Cerexagri SA
7_4_1_3(1)	Thompson RS	2001d	Zineb Nautec: Acute Toxicity to the Marine Alga (*Skeletonema costatum*)	Brixham Environmental Laboratory	Report No. BL7219/B	Y	Y	Y	N	Cerexagri SA
7_2_2_1(1)	Todt, K. and Conradt, H.	1989	Degradation of Mancozeb in Soil I	NATEC Institut für naturwissenschaftlich-technische Dienste GmbH	Report No. NA 88 9683	N	Y	Y	N	Cerexagri SA
6_3_2(1)	Trutter JA	1988	Mancozeb: 4-Week Repeat Dermal Toxicity Study in Rats	Hazleton Laboratories America	HLA Study No. 417-432	Y	Y	Y	N	Rohm & Haas Company
3_1_3	Van Beijnen AJM	1999	Bulk Density of Zineb TC, Dequisa product	Elf Atochem Agri BV	Report No. DL 99-049	Y	Y	Y	N	Cerexagri SA
3_11(1)	Van Beijnen AJM	2001a	Zineb Nautec manufactured at Solbiate Olona site, Hazard Assessment Studies (Flammability, Explosive and Oxidizing Properties, etc.)	Cerexagri B.V.	Report No. DL01-010		Y	Y	N	Cerexagri SA
3_11(5)	Van Beijnen AJM	2001a	Zineb Nautec manufactured at Solbiate Olona site, Hazard Assessment Studies (Flammability, Explosive and	Cerexagri B.V.	Report No. DL01-010		Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
			Oxidizing Properties, etc.)							
3_15	Van Beijnen AJM	2001a	Zineb Nautec manufactured at Solbiate Olona site, Hazard Assessment Studies (Flammability, Explosive and Oxidizing Properties, etc.)	Cerexagri B.V.	Report No. DL01-010		Y	Y	N	Cerexagri SA
3_16	Van Beijnen AJM	2001a	Zineb Nautec manufactured at Solbiate Olona site, Hazard Assessment Studies (Flammability, Explosive and Oxidizing Properties, etc.)	Cerexagri B.V.	Report No. DL01-010		Y	Y	N	Cerexagri SA
3_13	Van Beijnen AJM	2001b	Zineb Nautec manufactured at Solbiate Olona site, Surface Tension	Cerexagri B.V.	Report No. DL01-021		Y	Y	N	Cerexagri SA
7_4_1_1(2)	van Leeuwen, C.J., Maas-Diepeveen, J.L., Niebeek, G., Vergouw, W.H.A., Griffioen, P.O and Luijken, M.W.	1985a	Aquatic toxicological apsects of dithiocarbamates and related compounds. I. Short-term toxicity tests.	Aquatic Toxicology, 7: 145-164	-	N	N	N	N	-
7_4_1_2(2)	van Leeuwen, C.J., Maas-Diepeveen, J.L., Niebeek, G., Vergouw, W.H.A., Griffioen, P.O and Luijken, M.W.	1985a	Aquatic toxicological apsects of dithiocarbamates and related compounds. I. Short-term toxicity tests.	Aquatic Toxicology, 7: 145-164	-	N	N	N	N	-

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
7_4_1_3_(2)	van Leeuwen, C.J., Maas-Diepeveen, J.L., Niebeek, G., Vergouw, W.H.A., Griffioen, P.O and Luijken, M.W.	1985a	Aquatic toxicological apsects of dithiocarbamates and related compounds. I. Short-term toxicity tests.	Aquatic Toxicology, 7: 145-164	-	N	N	N	N	-
7_4_3_4	van Leeuwen CJ, Moberts F and Niebeek G	1985b	Aquatic toxicological aspects of dithiocarbamates and related compounds. II. Effects on survival, reproduction and growth of Daphnia magna.	Aquatic Toxicology, 7: 165-175	-	N	N	N	N	-
7_4_3_2	van Leeuwen, C.J., Espeldoorn, A. and Mol, F.	1986a	Aquatic toxicological apsects of dithiocarbamates and related compounds. III. Embryolarval studies with Rainbow Trout (*Salmo gairdneri*).	Aquatic Toxicology, 9: 129-145	-	N	N	N	N	-
7_4_3_3_1	van Leeuwen, C.J., van Hameren, P., Bogers, M. and Griffioen, P.S.	1986b	Uptake, distribution and retention of Zineb and Ziram in Rainbow Trout (Salmo Gairdneri)	Toxicology, 42:33-46.	-	N	N	N	N	-
6_12_1	Vogel W	1990	Dermal and Inhalation Exposure to Workers Involved in the Manufacturing of EBDC Fungicides	RCC Umweltchemie AG	RCC Project No. 238860	Y	Y	Y	N	Cerexagri SA
7_1_2_2_2	Völkel W	2003	[14C]-Zineb: Route and Rate of Degradation in Aerobic Marine Aquatic Systems Addressing the	RCC Ltd.	RCC Study No. 814566	Y	Y	Y	N	Cerexagri SA

TNG Ref	Author(s)	Year	Title	Source	Report No.	GLP	Unpublished	Data Protection Claimed	Confid	Owner
			Effects of Copper Ions on the Degradation							
7_1_2_2_2	Völkel W	2005	[14C]-Zineb: Route and Rate of Degradation in Aerobic Marine Aquatic Systems Addressing the Effects of Copper Ions on the Degradation. First Amendment to Report.	RCC Ltd.	RCC Study No. 814566	Y	Y	Y	N	Cerexagri SA
6_6_1	Wilmer JWGM	1982	Examination of "Penncozeb Technisch" for Mutagenic Activity in the Ames Test	TNO	Report No. V 82.388/ 220064	Y	Y	Y	N	Cerexagri SA
7_2_2_1(3)	Wright, MC	2000	Aerobic Soil Metabolism Degradation Rate Determination for Ethylenethioure a (ETU) on Soil	XenoBiotic Laboratories Inc	XBL Report No. RPT00643	Y	Y	Y	N	Cerexagri SA
7_1_1_1_2	Yeh, S.M.	1985	Water Photolyis Study of Mancozeb	Biospherics, Inc.	Report No. 31L-85-13	N	Y	Y	N	Rohm & Haas Company
7_2_3_1(1)	Yeh, S.M.	1986a	Batch Soil Adsorption/Des orption of Mancozeb	Biospherics, Inc.	Report No. 310-86-62	Y	Y	Y	N	Rohm & Haas Company
7_2_3_1(2)	Yeh, S.M.	1986b	Batch Soil Adsorption/Des orption of Ethylenethioure a	Biospherics, Inc.	Report No. 310-86-83	Y	Y	Y	N	Rohm & Haas Company
7_4_1_1(3)	Zok S	2001	Acute Toxicity Study on the Rainbow Trout (Oncorhynchus mykiss WALBAUM 1792) in a Static System (96 Hours)	BASF Experimental Toxicology and Ecology Laboratory	Laboratory Project ID 12F0533/005042	Y	Y	Y	N	BASF

IIIB Reference list of studies submitted (by Section.)

Section No / Reference No	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP (where relevant) / (Un)Published	Data Protection Claimed (Yes/No)	Owner
Section 1			No study reports submitted		
Section 2			No study reports submitted		
Section 3	Greenwood J, Wright E	2002	Interspeed 340 Antifouling Paint: Evaluation of Physical Properties and Storage Stability Covance Laboratories Ltd Report Number 1485-14-D2149 GLP/Unpublished	Yes (New First)	International Paint
Section 4 4.1/01	Wright E., Ristorcelli D	2001	Copper Compounds:Validation of the Analytical Method for the Analysis in Antifouling Paints Covance Laboratories Ltd Report Number 1485/010-D2149 GLP/Unpublished	Yes (New First)	International Paint
Section 4 4.1/02	Wright E., Greenwood J	2001	Zineb:Validation of the Analytical Method for the Analysis in Antifouling Paints Covance Laboratories Ltd Report Number 1485/008-D2149 GLP/Unpublished	Yes (New First)	International Paint
Section 5 B5.1-5.11 B5.10/01	Green G	2001	Antifouling Efficacy Report; Interspeed 340 Unpublished	Yes (New First)	International Paint
Section 5 B5.10/02	Callow ME	2006	Toxicity of Zineb University of Birmingham Report Number not specified Unpublished	Yes (First New)	International Paint
Section 5 B5.10/03	Callow ME	2005	Toxicity of Copper to Algae University of Birmingham Report number not specified Unpublished	Yes (First New)	International Paint
Section 6 B6.1.1	Hall T. Donald E	2001	Interspeed 340 – BQA344 Acute Oral Toxicity (Fixed Dose Procedure) Test in Rats Inveresk Research, UK. Report Number 19722 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.1.2	Hall T. Donald, E	2001	Interspeed 340 – BQA344 Acute Dermal Toxicity (Limit) Test in Rats Inveresk Research, UK. Report Number 19650 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.1.3	Anderson B T	2003	Interspeed 340 Topcoat (Red) Acute Inhalation Toxicity Study in Rats Inveresk Research, UK.. Report Number 21930 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.2/01	Hall T Donald, E	2001	Interspeed 340 – BQA344 Acute Dermal Irritation Test in Rabbits Inveresk Research, UK. Report Number 19637 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.2/02	Hall T Donald E	2001	Interspeed 340 – BQA344 Acute Eye Irritation Test in Rabbits Inveresk Research,UK. Report Number 19768 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.3	Hall T Donald E	2001	Interspeed 340 – BQA344 Magnusson Kligman Maximisation Test in Guinea Pigs for Delayed Skin Sensitisation Potential Inveresk Laboratories, UK. Report Number 19908 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.4/01	Roper C S, Sherratt R	2003	The In Vitro Percutaneous Absorption of Copper in Two Paint Preparations Through Human Skin Inveresk Research, UK. Report Number 23056 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.4/02	Roper C S	2005	The In Vitro Percutaneous Absorption of Copper in Two Paint Preparations Through Human Skin - Dermal Delivery Inveresk Research, UK. Report Number 24740 GLP/Unpublished	Yes (New First)	International Paint

Section No / Reference No	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP (where relevant) / (Un)Published	Data Protection Claimed (Yes/No)	Owner
Section 6 B6.4/03	Roper C S	2005	The In Vitro Percutaneous Absorption of Copper in Two Paint Preparations Through Human Skin - An Expert Report Inveresk Research, UK. Report Number 25631 GLP/Unpublished	Yes (New First)	International Paint
Section B6.4/04	Roper C S	2002`	The In Vitro Percutaneous Absorption of Radiolabelled Zineb in Two Antifouling Paint Formulations Through Human Skin Inveresk Research, UK. Report Number 20065 GLP/Unpublished	Yes (New First)	International Paint
Section 7			No study reports submitted		
Section 8			No study reports submitted		
Section 9			No study reports submitted		
Section 10			No study reports submitted		

IIIB Reference list of studies submitted (by Author.)

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Section 6 B6.1.3	Anderson B T	2003	Interspeed 340 Topcoat (Red) Acute Inhalation Toxicity Study in Rats Inveresk Research, UK.. Report Number 21930 GLP/Unpublished	Yes (New First)	International Paint
Section 5 B5.10/02	Callow ME	2006	Toxicity of Zineb University of Birmingham Report Number not specified Unpublished	Yes (First New)	International Paint
Section 5 B5.10/03	Callow ME	2005	Toxicity of Copper to Algae University of Birmingham Report number not specified Unpublished	Yes (First New)	International Paint
Section 5	Green G	2001	Antifouling Efficacy Report; Interspeed 340	Yes (New First)	International Paint
Section 3	Greenwood J, Wright E	2002	Interspeed 340 Antifouling Paint: Evaluation of Physical Properties and Storage Stability Covance Laboratories Ltd Report Number 1485-14-D2149 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.1.1	Hall T. Donald E	2001	Interspeed 340 – BQA344 Acute Oral Toxicity (Fixed Dose Procedure) Test in Rats Inveresk Research, UK. Report Number 19722 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.1.2	Hall T. Donald, E	2001	Interspeed 340 – BQA344 Acute Dermal Toxicity (Limit) Test in Rats Inveresk Research, UK. Report Number 19650 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.2/01	Hall T Donald, E	2001	Interspeed 340 – BQA344 Acute Dermal Irritation Test in Rabbits Inveresk Research, UK. Report Number 19637 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.2/02	Hall T Donald E	2001	Interspeed 340 – BQA344 Acute Eye Irritation Test in Rabbits Inveresk Research,UK. Report Number 19768 GLP/Unpublished	Yes (New First)	International Paint

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Section 6 B6.4/02	Roper C S	2005	The In Vitro Percutaneous Absorption of Copper in Two Paint Preparations Through Human Skin - Dermal Delivery Inveresk Research, UK. Report Number 24740 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.4/03	Roper C S	2005	The In Vitro Percutaneous Absorption of Copper in Two Paint Preparations Through Human Skin - An Expert Report Inveresk Research, UK. Report Number 25631 GLP/Unpublished	Yes (New First)	International Paint
Section B6.4/04	Roper C S	2002`	The In Vitro Percutaneous Absorption of Radiolabelled Zineb in Two Antifouling Paint Formulations Through Human Skin Inveresk Research, UK. Report Number 20065 GLP/Unpublished	Yes (New First)	International Paint
Section 6 B6.4/01	Roper C S, Sherratt R	2003	The In Vitro Percutaneous Absorption of Copper in Two Paint Preparations Through Human Skin Inveresk Research, UK. Report Number 23056 GLP/Unpublished	Yes (New First)	International Paint
Section 4 4.1/02	Wright E., Greenwood J	2001	Zineb:Validation of the Analytical Method for the Analysis in Antifouling Paints Covance Laboratories Ltd Report Number 1485/008-D2149 GLP/Unpublished	Yes (New First)	International Paint

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Section 1			No study reports submitted		
Section 2			No study reports submitted		
Section 7			No study reports submitted		
Section 8			No study reports submitted		
Section 9			No study reports submitted		
Section 10			No study reports submitted		