ANNEX B

Ziram

B.8 Environmental fate and behaviour

B.8.1 Route and rate of degradation in soil (Annex IIA 7.1.1; Annex IIIA 9.1.1)

B.8.1.1.1 Aerobic degradation in soil (Annex IIA 7.1.1.1.1)

Degradation rate of 14C-ziram in three soils incubated under aerobic conditions (Mamouni, 2001)
Guidelines :
SETAC (Europe), Procedures for assessing the environmental fate and ecotoxicity of pesticides, March 1995;;
OECD draft guideline (Aerobic Anaerobic transformation in soil), October 1999
GLP :
Yes
Material and Methods :
Test substance :
14C-ziram, radiochemical purity 100 %
Soil :
Table B.8.1.1-1- 1 : Characteristics of the soils

Origin	Speyer 2.2	Pappelacker	Namsheim France
pH	5.8 (CaCl2)	7.5 (KCl)	7.5 (KCl); 8.2 (H2O)
Organic carbon (g/ 100 g soil)	2.28	1.2	2.0
Cation exchange capacity (meq/ 100 g soil)	11	7.3	15.31
Particle size analyses, mm (USDA)	Loamy sand	Sandy loam	Silt loam
Clay (%)	8.2	6.4	18.0
Silt (%)	17.0	21.9	51.3
Sand (%)	74.8	71.7	26.8
Maximum water holding capacity (MWC, pF 1.0, g/100 g soil)	51	44.1	48.0
40% MWC (g/100 g soil)	20	17.6	19.2
Biomass (mg carbon/kg dry soil)			
Start of incubation	319	204	225
Completion of incubation	459 (20°C); 187 (10 °C)	264	333

Analytical methods :
All samples were subjected to extraction with acetonitrile/ Na_2HPO_4 - NaH_2PO_4 buffer (2/1 v/v) 4 times, soxhlet acetonitrile/water (9/1 v/v) once, reflux with acetonitrile/ 0.1 N HCl (1/1 v/v) once (reflux only performed on day 28 with sample A).
The concentrated extracts were analyzed by HPLC and TLC. Radioactivity was quantified by LSC.
Determination of the fraction bound to humin, fulvic and humic acids has been performed on sample A, day 28)

Experimental design :
The test item was applied at the concentration of 2.99 mg a.s./kg dry soil. The soils were incubated under aerobic conditions, at 40-50% MWC, 20°C (3 soils) and 10°C (1 soil). The incubation was prolonged up to day 120. The samples which were taken on days 60, 100 and 120 were not analyzed due to the rapid degradation of the a.s. and metabolites.
Findings :

Table B.8.1.1-1- 2 : Aerobic soil metabolic study – Balance of radioactivity in Speyer 2.2 soil, 20°C

	Incubation time in days							
	0	**0.25**	**1**	**2**	**3**	**7**	**14**	**28**
Total extractable	75.0	62.7	47.7	34.3	29.6	18.3	7.4	6.8
Ziram	41.6	25.3	12.7	3.6	2.1	3.0	1.9	0.2
M1 (thiram)	22.7	26.8	21.3	20.1	2.3	4.4	1.6	0.7
M2	*	*	*	*	*	*	0.7	*
M3 (CS_2)	*	*	*	*	*	*	*	*
M6	*	*	*	*	1.1	*	*	*
M7	*	3.0	1.6	0.8	1.6	*	*	*
M8	*	1.4	0.9	1.0	1.3	*	*	*
M9	*	5.0	6.1	6.5	1.2	*	*	*
M10	0.6		0.9	1.0	2.4	*	*	1.8
M11	4.4	1.1	0.6	1.3	3.5	5.2	1.3	1.1
M12	3.2	*	3.7	*	3.7	4.9	1.2	1.8
M13	1.5	*	*	*	1.2	*	0.7	0.3
M14	0.9	*	*	*	*	*	*	*
M15	*	*	*	*	5.3	0.8	*	0.8
M16	*	*	*	*	14.3	*	*	0.3
M17	*	*	*	*	2.7	*	*	*
Non extractable	19.1	26.7	35.1	36.5	41.8	40.4	42.6	36.5
CO_2	-	4.4	10.7	21.1	20.5	31.7	44.3	54.3
Other volatiles	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mass balance	94.1	93.9	93.7	92.0	92.0	90.4	94.3	97.6

Table B.8.1.1-1- 3 : Aerobic soil metabolism study – Balance of radioactivity in Pappelacker soil, 20°C

	Incubation time in days							
	0	**0.25**	**1**	**2**	**3**	**7**	**14**	**28**
Total extractable	78.5	69.5	57.9	49.5	43.2	24.3	14.3	8.1
Ziram	30.9	22.4	17.9	11.2	9.2	4.8	6.9	0.6
M1 (thiram)	36.4	35.2	30.9	25.7	13.0	11.0	2.2	0.6
M2	*	5.8	*	*	*	*	*	*
M3 (CS_2)	1.1	*	*	*	*	*	*	*
M6								
M7								
M8	*	*	*	0.9	5.6	*	0.4	*
M9	*	*	*	1.0	*	*	0.6	*
M10	*	*	*	3.5	*	*	0.4	2.4
M11	5.4	6.1	6.3	7.2	3.9	3.7	0.6	1.0
M12	2.7	*	2.8	*	3.6	3.6	2.6	2.4
M13	1.2	*	*	*	2.4	1.2	0.5	0.2
M14	0.8	*	*	*	*	*	*	*
M15	*	*	*	*	5.5	*	*	1.0
M16								
M17								
Non	18.0	22.5	23.4	32.5	34.0	36.5	38.9	32.4

extractable								
CO_2	-	2.1	8.8	14.8	16.0	29.3	40.8	51.4
Other volatiles	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mass balance	96.6	94.4	90.2	96.8	93.2	90.1	93.9	91.9

Table B.8.1.1-1- 4 : Aerobic soil metabolism study – Balance of radioactivity in Nambsheim soil, 20°C

	Incubation time in days							
	0	**0.25**	**1**	**2**	**3**	**7**	**14**	**28**
Total extractable	86.6	77.9	64.4	54.4	43.8	21.7	9.3	4.8
Ziram	28.2	24.3	15.5	14.4	9.9	4.3	1.1	0.1
M1 (thiram)	49.4	39.1	30.8	14.0	12.7	8.2	2.5	0.2
M2	*	2.7	*	*	*	*	*	*
M3 (CS_2)	*	*	*	*	*	*	*	*
M6	*	*	*	1.4	*	*	*	*
M7	*	1.6	*	1.8	1.4	*	*	*
M8	*	*	4.3	2.3	1.1	*	*	*
M9	*	3.4	6.9	9.3	7.4	*	*	*
M10	*	*	*	1.3	2.4	1.0	1.3	1.0
M11	3.7	1.2	1.9	3.9	1.3	3.7	2.6	1.4
M12	3.1	2.3	3.5	2.1	3.8	3.1	*	1.4
M13	0.9	3.4	1.5	3.0	2.1	1.4	0.2	*
M14	1.3	*	*	*	*	*	*	0.2
M15	*	*	*	0.7	1.7	*	1.4	0.5
M16	*	*	*	*	*	*	*	0.2
M17								
Non extractable	11.6	17.5	19.8	25.5	31.0	34.3	35.9	31.0
CO_2	-	1.2	7.8	14.7	17.8	36.5	49.2	57.6
Other volatiles	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mass balance	98.2	96.7	92.1	94.7	92.7	92.5	94.5	93.5

Table B.8.1.1-1- 5 : Aerobic soil metabolism study – Balance of radioactivity in Speyer 2.2 soil, 10°C

	Incubation time in days							
	0	**0.25**	**1**	**2**	**3**	**7**	**14**	**28**
Total extractable	75.0	71.6	56.3	48.4	43.2	24.5	16.2	9.2
Ziram	41.8	15.0	18.7	6.8	5.7	4.4	4.0	0.4
M1 (thiram)	22.8	49.8	26.8	25.2	4.4	6.3	7.5	1.1
M2	0.9	*	*	*	*	*	1.0	*
M3 (CS_2)	1.0	*	*	*	*	*	1.4	*
M6								
M7	*	*	*	2.7	3.9	*	*	*
M8	*	*	*	*	2.9	*	*	*
M9	*	*	*	7.8	5.3	*	*	*

M10	0.7	*	*	2.9	0.7	*	*	1.1
M11	4.4	6.7	6.9	1.0	2.1	7.3	1.2	2.3
M12	3.2	*	3.9	2.0	7.6	3.4	1.1	0.2
M13	2.4	*	*	*	1.8	0.8	*	0.5
M14	*	*	*	*	2.8	*	*	2.3
M15	*	*	*	*	6.1	2.3	*	1.5
M16	*	*	*	*	*	*	*	*
M17								
Non extractable	19.1	25.8	27.8	35.0	36.1	42.5	43.9	43.5
CO_2	-	1.1	6.5	10.5	12.4	22.2	31.6	40.4
Other volatiles	-	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	1.3
Mass balance	94.1	98.4	90.6	93.9	91.7	89.5	91.7	93.7

Table B.8.1.1-1- 6 : Aerobic soil metabolism study – First order degradation rates

	Speyer 2.2 soil, 20°C	Pappelacker soil, 20°C	Nambsheim soil, 20°C	Speyer 2.2 soil, 10°C
Ziram (DT_{50})	< 1 h	< 1 h	< 1 h	< 1 h
Ziram (DT_{90})	1.2 d	2.8 d	3.1 d	2.1 d
Thiram (DT_{50})	3.0 d	3.1 d	1.4 d	1.7 d
Thiram (DT_{90})	10.0 d	10.3 d	4.8 d	5.7 d

Conclusions :
Ziram was rapidly degraded, converted to bound residue (31-36% AR after 28 d, at 20°C) and mineralized to carbon dioxide (51-57% AR after 28 d, at 20°C). Thiram is the major metabolite (≈10-40% AR at days 1-3, at 20°C; max 50% at 0.25 day at 10°C)

B.8.2 Adsorption, desorption and mobility in soil (Annex IIA 7.1.2 and 7.1.3; Annex IIIA 9.1.2)

B.8.2.3 Aged residue column leaching (Annex IIA 7.1.3.2; Annex IIIA 9.1.2.1)

14C-ziram: Leaching characteristics of aged residues in one soil (Mamouni, 2001)
Guidelines :
SETAC (Europe), Procedures for assessing the environmental fate and ecotoxicity of pesticides, March 1995; OECD draft guideline (Leaching in soil columns), October 1999
GLP :
Yes
Material and Methods :
Test substance :
^{14}C-ziram, radiochemical purity 100 %
Soil :
Table B.8.2.3- 1 : Characteristics of the soil

Origin	Itingen/Switzerland
pH	7.3 (KCl)
Organic carbon (g/ 100 g soil)	1.17
Cation exchange capacity (meq/ 100 g soil)	10.3
Particle size analyses, mm (USDA)	Sandy loam
Clay (%)	9.0
Silt (%)	20.0
Sand (%)	71.0
Maximum water holding capacity (MWC, pF 1.0, g/100 g soil)	39.5
Field capacity (g/100 g soil)	23.8
Biomass (mg carbon/kg dry soil)	41.5

Analytical methods :
Aged soil samples were extracted with acetonitrile/ Na_2HPO_4 - NaH_2PO_4 buffer (2/1 v/v) 3 times
The soil cores were extracted with acetonitrile/ Na_2HPO_4 - NaH_2PO_4 buffer (2/1 v/v) 2 times.
The concentrated soil extracts were analyzed by HPLC and TLC. Radioactivity was quantified by LSC.

The concentrated leachates were analyzed by HPLC. Radioactivity in water samples was quantified by LSC.

Experimental design :

- Ageing : The active substance was applied at the concentration of 11.92 mg a.s./kg dry soil. The soils were incubated under aerobic conditions, at 50% MWC, 20°C, in the dark, for 5 days. Soil analyses were performed at days 0, 0.25, 1, 2 and 5.

- Leaching experiment : The soil sample which had been aged for 1 day in the metabolism flasks was quantitatively placed as a 2 cm layer onto the top of the 28 cm soil columns (experiment in triplicate). 393 ml 0.01 M $CaCl_2$ (experiment 1) and pure water (experiment 2), corresponding to 200 mm rainfall, were delivered onto the top of the saturated columns over a period of 2 days.

Findings :
- Ageing : The DT50 of ziram in this soil has been estimated to be about 1 day. The main metabolite is thiram which amounted to a maximum level of 25.4% AR at day 1. It decreased to 18.5% AR on day 5.The second most important metabolite M11 (unknown) never exceeded 3.1% AR. Other metabolites were detected at levels < 1.5% AR.

Table B.8.2.3- 2 : Aged column leaching study – Balance of radioactivity

	Columns leached with water			Columns leached with 0.01 M $CaCl_2$		
	Column I	Column II	Column III	Column I	Column II	Column III
Soil layers						
Extractable	38.04	-	38.49	40.73	-	40.85
Ziram	7.1	-	7.4	15.7	-	18.5
M1 (thiram)	24.1	-	25.3	22.3	-	18.1
M9 (unknown)	0.9	-	0.9	n.d.	-	n.d.
M11 (unknown)	1.4	-	1.5	1.6	-	0.9
M15 (unknown)	0.8	-	0.8	1.1	-	3.4
Non extractable	34.55	-	35.68	30.16	-	30.66
Leachates						
Extractable	5.47	-	4.25	4.70	-	4.26
Ziram	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
M1 (thiram)	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
M8 (unknown)	0.6	0.6	0.5	0.4	0.2	0.7
M9 (unknown)	1.4	1.1	0.8	1.3	1.2	0.7
M10 (unknown)	3.3	2.6	2.8	2.8	3.0	2.9
M11 (unknown)	0.1	0.1	0.1	n.d.	0.5	n.d.
CO_2 (formed during ageing)	3.91	-	3.84	1.09	-	1.15
Washing of glass columns	0.09	-	0.04	0.15	-	0.08
Mass balance	82.06	-	81.01	77.83	-	77.00

- : not performed
-

The low recovery of AR would be due to continuous mineralisation of ziram and evaporation of CO_2.
Only the top soil layer extracts where enough radioactivity was available were analyzed by HPLC.

Conclusions :
Ziram and thiram were not recovered in the leachates, indicating the low leaching potential of both compounds.
4 non-characterised metabolites (M8, M9,M10 M11) were recovered at low level in the leachates (< 3.3% AR)

B.8.3 Predicted environmental concentration in soil (PECs) Annex IIIA 9.1.3)

Method of calculation	1st order ; DT50 = 6 days

Application rate	2.28 kg a.s./ha (single treatment), 50% interception

PEC$_{(s)}$		Single application Actual	Single application Time weighted average
Initial		1.52 mg a.s./kg soil	1.52
Short term	24h	1.354	1.435
	2d	1.206	1.357
	4d	0.958	1.217
Long term	7d	0.677	1.806
	28d	0.134	0.782
	50d	0.060	0.454
	100d	0.012	0.228

B.8.4 Fate and behaviour in water (Annex IIA 7.2.1; Annex IIIA 9.2)

B.8.4.4 Water/sediment study (Annex IIA 7.2.1.3.2)

14C-ziram: Route and rate of degradation in aerobic aquatic systems (Völkl, 2001)
Guidelines :
SETAC (Europe), Procedures for assessing the environmental fate and ecotoxicity of pesticides, March 1995;;
GLP :
Yes
Material and Methods :
Test substance :
14C-ziram, radiochemical purity 98.8 %
Sediments - waters :
The water/sediment systems were sampled from a river (Rhine/ Switzerland) and from a pond (Ormalingen/ Switzerland).
Table B.8.4.4-1 : Parameters measured for river and pond water phases before acclimation and at the end of the incubation period.

Parameters		**River**		**Pond**	
		Water		**Water**	
		During sampling	**end²**	**During sampling**	**end²**
Temperature (°C)	surface	17.7	n.d.	11.6	n.d.
5 cm above sediment		17.5		10.7	
PH		8.20	8.25	7.29	7.97
5 cm above sediment		8.18		7.02	
Redox potential (mV)	surface	200	187	200	204
5 cm above sediment		200		130	
Oxygen content (mg/l)	surface	10.0	7.6	10.9	6.2
5 cm above sediment		10.6		7.1	
NO_{2-} -N (mg/l)		0.03	< d.l.	< d.l.	< d.l.
NO_{3+} -N (mg/l)		1.45	1.40	1.70	1.50
NH_4 –N (mg/l)		0.05	0.06	0.09	0.07
Total inorganic N³ (mg/l)		1.53	1.46	1.79	1.57

Total-N (mg/l)[4]	4.1	2.5	1.6	1.8
Ortho-phosphorus (mg/l)	0.08	0.08	0.08	0.07
Total-P (mg/l)	0.12	0.08	< d.l.	0.04
TOC (total organic carbon; mg C/l)[1]	2.5	12.9	3.6	10.3
Hardness (°dH)1	13	16	24	37

n.d. : Not determined
<d.I. : below limit of detection
1 : Parameters determined in the laboratory before acclimation.
2 : Parameters determined in the laboratory at the end of the study (controls; compare Tables 3 and 4).
3: Sum of NO_2 -N, NO_3 -N and NH_4^+-N.
4: Parameters determined in the laboratory after disintegration of the matrix in a microwave oven.

Table B.8.4.4-2 : Parameters measured for sediment phases before acclimation and at the end of the incubation period.

Parameters	River		Pond	
	Sediment		Sediment	
	Before acclimation	End[1]	Before acclimation	End[2]
pH ($CaCl_2$)	7.83	n.d.	7.61	n.d.
Redox potential (mV)	-36	n.d.	-79	n.d.
N-total (g/kg sediment)	0.84	n.d.	15.64	n.d.
P-total (g/kg sediment)	<0.01	n.d.	0.35	n.d.
Organic carbon (g C/100 g dry sediment)	0.97	n.d.	6.13	n.d.
Microbial biomass (g microbial C/kg dry sediment)	0.14	0.14	0.32	0.29
Catin exchange capacity (m Val/kg dry sedimen)	75.9	n.d.	215.2	n.d.
Particle size distribution USDA classification	Sandy loam		Clay loam	
Clay (%; < 2 µm)	11.30		27.15	
Slilt (%; 2-50 µm)	27.65		34.50	
Sand (%; > 50 µm)	61.05		38.35	
Dry weight (g wet sediment/g dry sediment)	1.23	1.7	2.32	3.66

n.d. : Not determined
1 : Parameters determined at the end of the incubation period in control flasks

Analytical methods :
Water samples were analyzed by HPLC and TLC. Radioactivity was quantified by LSC.
Sediment samples were subjected to extraction with acetonitrile/ Na_2HPO_4 - NaH_2PO_4 buffer (8/2 v/v) 3 times, with acetonitrile once.The concentrated extracts were analyzed by HPLC and TLC. Radioactivity was quantified by LSC.
The amount of CS_2 was determined by difference of the total radioactivity after precipation of CO_2 as barium carbonate.
Experimental design :
Sediment was added to a depth of 2.5-3.5 cm, corresponding to a wet weight of 200 g for river and 250 g for pond sediment. The respective water (600 ml for river and 550 ml for pond) was added to the sediment to reach a depth of about 6 cm. The test item was applied at the concentration of 0.29 mg a.s./l. The samples were incubated in the dark at 20°C for 101 days. The water was gently agitated during incubation.

Findings :
Table B.8.4.4-3 : Sediment/water study – Balance of radioactivity in the river system

	Incubation time in days							
	0	1	5	7	14	31	60	101
Water								
Extractable	101.1	61.3	33.0	29.2	26.6	4.8	1.2	0.3
Ziram	97.0	3.4	0.4	-	-	-	-	-
M1 (thiram)	2.7	30.3	4.2	0.6	1.0	-	-	-
M2 (unknown)	-	3.9	-	0.4	-	-	-	-
M3 (unknown)	-	3.5	1.5	2.1	4.7	0.2	-	-
M4 (unknown)	-	-	5.4	1.9	2.0	0.3		
M6 (unknown)	-	7.5	11.6	4.8	2.6	-	-	-
M8 (unknown)	-	4.2	3.4	5.5	6.0	1.5	-	-
-M9 (unknown)	-	5.3	3.8	7.5	3.8	-	-	
M10 (unknown)	-	-	-	3.5	2.6	0.5	0.5	-
M11 (start)	1.3	3.1	2.7	2.0	2.3	1.7	0.5	-
Sediment								
Extractable	0.5	15.6	26.1	17.4	20.0	4.3	2.5	1.0
Ziram	-	-	-	-	-	-	-	-
M1 (thiram)	-	1.6	4.6	2.6	-	-	-	-
M2 (unknown)	-	2.2	3.2	3.3	1.1	1.1	0.5	-
M3 (unknown)	-	-	3.0	1.5	2.9	0.3	-	-
M4 (unknown)	-	1.4	1.5	-	-	-	-	-
M6 (unknown)	-	5.0	2.3	3.5	5.9	-	0.5	-
M8 (unknown)	-	1.1	1.7	1.6	-	0.7	0.1	-
M9 (unknown)	-	2.9	4.4	2.1	1.6	-	-	-
M10 (unknown)	-	-	0.7	0.9	1.2	0.3	0.4	-
M11 (start)	-	1.2	2.4	2.0	4.0	1.4	1.0	-
Non extractable (sediment)	0.6	19.4	27.2	29.3	28.7	28.3	24.9	19.2
CO_2 (evolved + dissolved in water)	-	3.6	11.9	18.1	23.4	59.9	73.2	82.3
CS_2 (evolved)	-	-	-	-	0.2	1.0	1.7	1.9
Mass balance	102.2	99.8	98.2	94.0	98.9	98.3	103.4	104.7

Table B.8.4.4-4 : Sediment/water study – Balance of radioactivity in the pond system

	Incubation time in days							
	0	1	5	7	14	31	60	101
Water								
Extractable	98.9	61.0	37.5	24.5	25.7	2.4	2.8	1.7
Ziram	93.7	-	-	-	-	-	-	-
M1 (thiram)	3.9	29.5	2.9	0.6	-	-	-	-
M2 (unknown)	-	-	-	-	-	-	-	-
M3 (unknown)	-	3.5	2.8	2.8	4.8	0.1	0.1	-
M4 (unknown)	-	1.3	1.8	-	-	-	-	-
M6 (unknown)	-	8.3	13.1	5.3	2.5	0.3	-	-
M8 (unknown)	-	-	7.0	5.8	6.7	-	0.8	-
M9 (unknown)	-	-	6.8	4.0	8.9	1.5	1.0	-
M10 (unknown)	-	7.2	-	1.7	1.2	0.1	0.2	-
M11 (start)	-	8.6	3.2	2.3	1.8	0.5	0.2	-
Sediment								
Extractable	0.1	4.6	10.4	10.1	10.9	4.7	2.8	1.8

Ziram	-	-	-	-	-	-	-	-
M1 (thiram)	-	0.5	1.0	1.7	-	-	-	-
M2 (unknown)	-	-	-	-	4.9	0.6	0.2	-
M3 (unknown)	-	0.3	-	-	1.2	0.3	-	-
M4 (unknown)	-	-	1.5	-	-	-	-	-
M6 (unknown)	-	2.1	-	3.3	-	0.4	-	-
M8 (unknown)	-	0.8	3.2	2.3	0.8	-	0.7	-
M9 (unknown)	-	0.5	2.8	1.0	1.3	2.1	0.7	-
M10 (unknown)	-	0.4	1.8	0.6	0.6	-	0.2	-
M11 (start)	-	-	-	1.1	1.8	0.9	1.1	-
Non extractable (sediment)	0.4	22.6	33.9	37.1	32.9	38.8	49.3	37.8
CO_2 (evolved + dissolved in water)	-	10.5	13.8	19.4	22.6	45.4	40.9	47.3
CS_2 (evolved)	-	-	-	-	0.3	1.1	1.1	1.3
Mass balance	99.4	98.7	95.6	91.1	92.3	98.7	96.9	90.0

*: Some metabolites (M5, M7, M13) were found at low level at one sampling times. These data were not included in the tables)
*: The results of the a.s. and metabolites identification after 6 hours were not included in the tables.

Table B.8.4.4-5 : Water/sediment study – First order degradation rates

		DT_{50} (days)	DT_{90} (days)
Ziram	river (water and whole system)	0.3	1.0
Ziram	Pond (water and whole system)	0.2	0.7
Thiram	river (water)	1.6	5.5
Thiram	Pond (water)	1.1	3.7
Thiram	river (whole system)	2.2	7.4
Thiram	Pond (whole system)	1.2	4.1
Metabolite M6	river (whole system)	16.8	55.7
Metabolite M6	Pond (whole system)	3.7	12.3
Metabolite M8	Pond (whole system)	21.1	70.0
Metabolite M9	pond (whole system)	12.9	43.0

Conclusions :
Ziram was rapidly degraded to thiram and further to the metabolites M6, M8 and M9. Ziram is extensively converted to bound residue (19-38 % AR after 101 d, at 20°C) and mineralized to carbon dioxide (47-82% AR after 101 d, at 20°C).
Thiram is the major metabolite (≈ 30% AR at days 0-1, at 20°C). (37-47% at 6 hours)
Metabolites M6 (molecular weight : 176), M8 and M9 are major metabolites (Total level of 10-13% AR in the water+sediment extracts at days 1 to 14). Detailed investigations were made by LC/MS in order to characterize these unknown fractions. It cannot be excluded that M6, M8 M9 consist each of several fractions. The possible structure of M6 would be $(CH_3)_2$-N-CO-S-CO-N-$(CH_3)_2$.

B.8.6.1 Predicted environmental concentrations in surface water (PECsw, PECgw) (Annex IIIA 9.21)

PECsurface water of ziram

Method of calculation	First order kinetics; DT50 = 0.3 d
Application rate	2.28 kg a.s./ha, orchard, early growth stage, 3m, 29.2 % drift

Main routes of entry	Spray drift

PEC$_{(sw)}$		Single application Actual	Single Application Time weighted average	Multiple application Actual	Multiple Application Time weighted average
Initial		0.222 mg a.s./l (based on the parameters mentioned above)	0.222 mg a.s./l	*	*
Short term	24h	0.022	0.087		
	2d	0.002	0.048		
	4d	<0.001	0.024		
Long term	7d	<0.001	0.014		
	14d	<0.001	0.007		
	21d	<0.001	0.005		
	28d	<0.001	0.003		
	42d	<0.001	0.002		

* not relevant : DT50 << spray interval

PECsurface water of thiram

Method of calculation	First order kinetics; DT50 = 1.6 d, max AR level 47.5 % at 6 hours. The molar ratio thiram/ziram is 240.4/305.8
Application rate	2.28 kg a.s./ha, orchard, early growth stage, 3m, 29.2 % drift
Main routes of entry	Spray drift

PEC$_{(sw)}$		Single application Actual	Single Application Time weighted average	Multiple application Actual	Multiple Application Time weighted average
Initial		0.083 mg a.i./l	0.083 mg a.i./l	*	*
Short term	24h	0.054	0.067		
	2d	0.035	0.055		
	4d	0.015	0.039		
Long term	7d	0.004	0.026		
	14d	<0.001	0.014		
	21d	<0.001	0.009		
	28d	<0.001	0.007		

42d	<0.001	0.005		

* not relevant : DT50 << spray interval

(PECs for thiram are based on PEC initial of Ziram x 47.5% formation rate x 240.4/305.8)

Ziram and its metabolites are mainly present in the water phase; PEC calculation for sediment is therefore not relevant.

B.8.6.2 Predicted environmental concentrations in ground water (PECgw) (Annex IIIA 9.2.3)

Estimation of the leaching potential of ziram by model calculations with PELMO 3.0 (Pesticide leaching model) (Gross, 2000)
Modelling software :
PELMO 3.0
Modelling assumptions :
The European critical GAPs are :
4 x 2.70 kg a.s./ ha with 7 days interval for apple and pear
3 x 3.04 kg a.s./ ha with 7 days interval for peach, cherry an plum.

The scenario meadow was chosen as in orchards the space between trees is covered by grass. It is assumed that 50% of the a.s. reaches the soil. Applications are made in April-June

- input data for the application rates : 4 X 1.35 kg a.s./ha and 3 X 1.52 kg a.s./ha
- 3 soil scenarios were considered : Borstel (sandy loam), Hörstel (sand), Jülich (silty loam). (Soil characteristics are listed in the report).
-The scenario Hamburg wet (872 mm rainfall/year) was chosen for all the simulation runs.
- The Koc values were found in the range 314-3732 ml/g. **314** has been taken as worst case.
- DT50 field was found in the range 5.2-6.7 days (DT50 laboratory (DT50 laboratory were shorter). **6.7** days has been taken as worst case.
- 10 year simulation period.

Findings and conclusions :
The calculated PEC of each individual years were 0.000 µg/l. It can be concluded that the risk of water contamination by ziram is negligible.