UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

009330

MAR 2 1992

MEMORANDUM

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

Subject: EPA ID # 081301: Captan Technical - Review of metabolism study in rats (MRID Nos. 415054-01 to 415054-04)

Tox. Chem. Number: 159
Project Number: 1-1267
Submission Number: S396142

From: Paul Chin, PhD 2/18/92
Section 2
Toxicology Branch I
Health Effects Division (H7509C)

To: Carol Peterson/Walter Waldrop, PM 27
Reregistration Division (H7508W)

Thru: Joycelyn Stewart, Ph.D. 2/20/92
Acting Section Head
Section 2, Toxicology Branch I
Health Effects Division (H7509C) 2/21/92

Registrant: ICI Americas, Inc.

CONCLUSIONS:

The Toxicology Branch I has reviewed four metabolism studies of ^{14}C-Captan in the Rat (MRID Nos. 415054-01 to 415054-04) listed in Section II. **ACTION REQUESTED.** Data evaluation records are attached.

All studies are acceptable and the toxicology requirement (guideline 85-1) for a metabolism study in rats is satisfied.

SUMMARY OF FOUR STUDIES:

The absorption, distribution, metabolism, and excretion of captan were studied in groups of rats administered a single oral gavage of 10 or 500 mg/kg ^{14}C-captan (labeled at 2-C and 7-C positions), or repeated oral dosing of 10 mg/kg unlabeled captan followed by a single dose of 10 mg/kg ^{14}C-captan on day 15. Captan was rapidly absorbed, metabolized, and eliminated in rats for all dosing regimens. There were no remarkable sex-, dose- or treatment-related differences in the absorption, distribution, and elimination of captan in rats. The urine was the main route of elimination regardless of dosing regimen. Total recovery of radioactivity in the urine and feces was 69.3-90.8% and 7.3-25.0%

0001 8124

of the administered dose, respectively in the various groups. The tissues, expired air, and cage washes contained less than 0.8% for all dose groups. A total of 7 urinary metabolites were confirmed and the metabolites excreted in the urine were not significantly different among groups. The primary metabolite is 4,5-cyclohexene-1,2-dicarboximide (THPI), formed from the cleavage of the trichloromethylthio moiety and subsequently converted to its hydroxide, epoxide, and diol. The amount of some of the fecal metabolites (i.e., hydroxylated derivatives and unidentified polar metabolites) were sex and dose-level related. There was an increase in an unidentified compound in the feces of the high-dose group (42.5%) compared to the low-dose group (7%). The unidentified compound is suggested to be the parent compound, however, data were inadequate to indicate that it was an unmetabolized captan.

REQUESTED ACTION:

The Reregistration Division requested that the Toxicology Branch review the following **four** metabolism studies (MRID Nos. 415054-01 to 415054-04):

1. Captan: Excretion and tissue excretion of a single oral dose (10 mg/kg) in the rat. Report No. CTL/P/2820. MRID No. 415054-01.
2. Captan: Excretion and tissue excretion of a single oral dose (500 mg/kg) in the rat. Report No. CTL/P/2862. MRID No. 415054-02.
3. Captan: Biotransformation study in the rat. Report No. CTL/P/2951. MRID No. 415054-03.
4. Captan: Repeat Dose study (10 mg/kg/day) in the rat. Report No. CTL/P/2958. MRID No. 415054-04.

DOC 920143

[redacted]

FINAL

009330

DATA EVALUATION REPORT

CAPTAN

Metabolism Study in Rats

Prepared for:

Health Effects Division
Office of Pesticide Programs
Environmental Protection Agency
1921 Jefferson Davis Highway
Arlington, VA 22202

Prepared by:

Clement International Corporation
9300 Lee Highway
Fairfax, VA 22031-1207

Principal Author _____ Date 1/6/92

Reviewer _____ Date 1/6/92

QA/QC Manager _____ Date 1/6/92

Contract Number: 68D10075
Work Assignment Number: 1-05
Clement Number: 91-10, 91-11, 91-12, 91-13
Project Officer: James Scott

009330

Guideline Series 85-1: Metabolism in Rats

EPA Reviewer: Paul Chin, Ph.D. Signature: Paul Chin
Review Section II, Toxicology Branch I, Date: 1/14/92
Health Effects Division

EPA Section Head: Joycelyn Steward, Ph.D. Signature: Joycelyn Steward
Review Section II, Toxicology Branch I, Date: 1/15/92
Health Effects Division

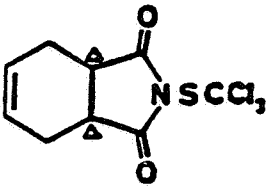
DATA EVALUATION REPORT

STUDY TYPE: Metabolism in Rats

EPA IDENTIFICATION NO.:

Tox. Chem. No.: 159
MRID No.: 415054-01, 415054-02, 415054-03, 415054-04

TEST MATERIAL: Captan (purity 99.9%)
($C_9O_2NSH_8Cl_3$; MW = 300.57)



▲ denotes the position of the [^{14}C] label

SYNONYM: N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide

SPONSOR: ICI Americas Inc., Wilmington, DE

TESTING FACILITY: ICI Central Toxicology Laboratory
Alderley Park, Macclesfield,
Cheshire, UK

TITLE OF REPORTS: 1. Trivedi, S. Captan: Excretion and Tissue Retention of a Single Oral Dose (10 mg/kg) in the Rat. Volume 1. May 2, 1990. Study No. UR0282. Report No. CTL/P/2820.

2. Trivedi, S. Captan: Excretion and Tissue Retention of a Single Oral Dose (500 mg/kg) in the Rat. Volume 2. May 16, 1990. Study No. UR0283. Report No. CTL/P/2862.

0004

3. Lappin, G.J. and M.L. Havell. Captan: Biotransformation Study in the Rat. Volume 3. May 8, 1990. Study No. UR0285. Report No. CTL/P/2951.

4. Bratt, H. Captan. Repeat Dose Study (10 mg/kg) in the Rat. Volume 4. May 17, 1990. Study No. UR0284. Report No. CTL/P/2958.

CONCLUSIONS:

The absorption, distribution, metabolism, and excretion of Captan were studied in groups of male and female Sprague-Dawley rats administered a single oral gavage dose of 10 or 500 mg/kg [^{14}C]Captan or a 14-day repeated oral dosing of 10 mg/kg unlabeled Captan followed by a single dose of 10 mg/kg [^{14}C]-labeled Captan on day 15.

[^{14}C]Captan was rapidly absorbed and eliminated in rats for all dosing regimens. Most of the radioactivity was recovered within 48 hours in the urine (77.2%) and feces (5.5%) of the 10-mg/kg dose groups, whereas the highest activity (70.6% and 23%, respectively) was recovered within 72 hours in the 500-mg/kg group. The tissues, expired air, and cage washes contained minimal levels of radioactivity (<0.8%) for all dose groups. Blood levels, which were measured only at 7 days postexposure, were found to be slightly higher in the high-dose group than the low-dose groups. Because peak blood levels of radioactivity were not measured, absorption rates could not be determined. Repeated dosing with 10 mg/kg Captan showed that the bioaccumulation/retention of Captan and/or its metabolites in the tissues was low. Captan was rapidly and completely metabolized following oral administration. However, there was an increase in an unidentified compound (suggested to be the parent compound) in the feces of the high-dose group (42.5%) compared to the low-dose group (7%). If this unknown compound is Captan, then absorption saturation has occurred at the high dose of 500 mg/kg; however, data were inadequate to indicate that it was unmetabolized Captan. A total of 7 urinary metabolites were confirmed. The primary metabolite of Captan is 4,5-cyclohexene-1,2-dicarboximide (THPI), formed from the cleavage of the trichloromethylthio moiety and subsequently converted to its hydroxide, epoxide, and diol. There were no remarkable sex-, dose-, or treatment-related differences in the absorption, distribution, and elimination of [^{14}C]Captan in rats. The metabolites excreted in the urine were not significantly different among groups; however, the amount of some of the fecal metabolites (i.e., hydroxylated derivatives and unidentified polar metabolites) were sex and dose-level related. These studies also showed that single oral administration of 10 and 500 mg/kg Captan, as well as repeated dosing with 10 mg/kg/day, did not induce any apparent treatment-related clinical effects.

CLASSIFICATION: Acceptable

The study met the minimum requirement set forth under Guidelines 85-1 (and Addendum 7) for a metabolism study in rats. Therefore, it was judged to be acceptable. Although there were minor deficiencies in the study, they do not affect the overall study results and conclusions.

I. MATERIALS

A. Test Substance

The test material was described as an off-white powder (CTL Reference Y01716/012/001). The presence of contaminants or impurities was not reported. The compound was purified by acetonitrile then passed through a silica gel equilibrated with chloroform/formic acid (19:1 v/v). The collected fractions with the highest radioactivity were pooled and the solvent was evaporated. The purity of unlabeled Captan was 99.9%.

Captan was labeled with [^{14}C]at the C-2 and C-7 positions. The radiochemical purity was reported to be >95% in the single-dose studies and 99.6% (w/w) in the repeated-dose study. Determinations were made by thin-layer chromatography (TLC) using the following solvent systems: (1) acetone:dichloromethane (4:5 v/v); (2) chloroform:acetic acid (19:1 v/v); and (3) butanol:acetic acid:water (75:40:15 v/v/v).

B. Test Animals

Young adult Sprague-Dawley rats were obtained from Charles River, Margate, Kent, UK. A single oral dose of Captan was administered to 5 males and 5 females, weighing 202-243 grams, while 8 males and 8 females, weighing 192-260 grams, were given repeated oral doses of Captan.

II. METHODS

A. Animals were initially housed together by sex in stock rat cages. They were acclimatized for 4-5 days prior to the dosing. The diet (Porton Combined Diet (PCD); Special Diets Services Ltd, Stepfield, Witham, Essex, UK) and water were given ad libitum both prior to and during the study. The composition and contaminants in this special diet were presented. However, drinking water analysis was not conducted. Although there was no indication that animals were fasted prior to dosing, maximum absorption of the test substance probably occurred because of the high recovery of radioactivity. Following the dosing, animals were individually housed in steel metabolism cages (Modular Systems and Developments Company Ltd., Woolwich, London, UK).

One of the 10-mg/kg females was dosed incorrectly. This error was discovered after the female rat had greater than 100% radioactivity recovery in the excreta. One of the 500-mg/kg males was killed after developing severe nasal hemorrhage at 12 hours postexposure. To replace these two animals, an additional female and male rat were dosed and housed in a glass metabolism cage to

evaluate excretion of radioactivity in the expired air as carbon dioxide.

B. Oral dosing solutions were prepared to produce the appropriate amount of test material with 0.7% carboxymethyl cellulose (CMC) in 0.5% Tween 80. Tween 80 was added because of the insolubility of Captan in CMC. Additional steps were taken in the preparation of high-dose and repeated-dosing solutions. For the 500-mg/kg dose preparation, the labeled and unlabeled Captan solutions were dissolved in an excess of acetonitrile followed by evaporation of the solvent in vacuo to produce the dry homogenous mixture. In the repeated-dosing study, the Captan solution was sonicated and continuously stirred to reach the desired concentration. Animals were given [^{14}C]Captan at the rate of 1.9-2.1 MBq (51-57 µCi)/kg.

Groups of 10 rats (5/sex) were given a single oral dose of 10 or 500 mg/kg [^{14}C]Captan. Groups of 16 rats (8/sex) were given an oral dose of 10 mg/kg/day of unlabeled Captan for 14 days followed by the administration of [^{14}C]Captan in 5 rats/sex on day 15. Captan was administered to rats by oral gavage using a gas tight syringe (Hamilton, Bonaduz) fitted with a metal catheter. The labeled test material was given at a dose volume of 4 mL/kg. The dose amount was determined by weighing the syringe-catheter assembly prior to and immediately after dosing. All animals were observed for 7 days following the administration of the labeled Captan.

C. The urine and feces were collected, over dry ice, in the animals at 6, 12, 24, 36, and 48 hours postexposure and then every 24 hours until 7 days postexposure. Excreta were retained at -20°C prior to analysis. The animal cages were rinsed with ethanol:water (1:1) and the washings were collected together with the urine. Animals were sacrificed by exsanguination after asphyxiation with carbon dioxide. All major tissues were removed and stored at -20°C. Blood was stored in heparin at 4°C. Liquid scintillation counting was conducted in duplicate in the samples of urine, feces, cage washing, tissue, and plasma using a Tricarb Model 2000 CA instrument (Canberra Packard Ltd). The exhaled carbon dioxide was collected from a male and a female rat at 24 and 48 hours postexposure. To absorb the carbon dioxide, air that was purged of carbon dioxide was drawn into the cage using a diaphragm pump (Metal Bellows Corp., MA) and 2 Nilox columns (Wencons Ltd., Heme, Hempsted, UK) containing sodium hydroxide.

D. For the biotransformation assay, urine and fecal samples were pooled by dose levels, dosing regimen, and sex. The pooled 6-72-hour feces and 6-36-hour urine of the 10- and 500-mg/kg males and females were analyzed for metabolites. The 48-72-hour urine and the 6-72-hour urine of the high-dose groups were also collected and evaluated because radioactivity was excreted in these animals over a longer period of time.

The 6-72-hour pooled urine was extracted then the chloroform extract and aqueous phase were appropriately separated and reduced for semi-purification. The fecal and urine extracts, urine samples, and reference compounds were applied to silica gel or C-18 reverse phase TLC plates (Merk, Darmstadt, GFR), developed in different solvent systems, and radioactive bands were isolated. The semi-purified metabolites were derivatized through trimethylsilane derivatives (TMS), methylation, or boronate derivatives. To quantify most of the radioactive metabolites, the linear plate scanner and autoradiography were used. The 5OH-THPI (5-hydroxy-3,4-cyclohexene-1,2-dicarboximide) and 3OH-THPI metabolites were quantified from GC peaks using the pooled 6-72-hour urine of the high-dose males and females because these metabolites could not be adequately separated by TLC. The OH-acid amide metabolite reportedly remains near the origin in all TLC systems and cannot be resolved from other unidentified polar metabolites by the TLC method. Therefore, the unknown polar metabolites were extracted, then methylated with diazomethane. The quantity of water-soluble metabolites after methylation was calculated.

E. Protocols: The study protocol for the metabolism study is presented in the appendix of this report (CBI Volume 3, pp. 11-17).

III. REPORTED RESULTS

A. Urinary and Fecal Excretion

In the single and repeated oral dose studies, the mean total recoveries of radioactivity ranged from 91.2% to 98.8% (Table 1). There was, however, great variation in the recoveries, which the authors attributed to administering Captan as a suspension. Following a single dose of Captan, the mean total radioactivities measured in urine and feces were 82% and 9%, respectively, in the low-dose animals, while activities were approximately 71% and 24%, respectively, in the high-dose animals 7 days after dosing. At 48 hours postexposure, excretion of Captan was essentially complete. The expired air contained less than 0.14% and 0.06% of the administered dose as carbon dioxide in the 10-mg/kg female and 500-mg/kg male, respectively. In the repeated dose study, the [^{14}C] activity measured in the urine and feces was 87.7%-90% and 6.8%-8.6%, respectively, during the first 48 hours.

B. Tissue Distribution

The mean total percentages of administered radioactivity were <0.06% in the tissues and <0.45% in the carcass of all dose groups 7 days after the end of dosing (Table 1). The kidneys had the highest radioactivity in the 10-mg/kg groups; 0.079-0.099 µg/g (0.009%) in single dosing and 0.039-0.043 µg/g (0.004%) in repeated dosing. The activities in the blood were 0.054 and 0.050 µg equivalents/g in low-dose males and females, respectively, after 7 days. In the high-dose group, activities in the blood were 2.649 and 1.974 µg/g, respectively. Overall, most tissues had negligible activities (i.e., below 0.01%). The carcass contained 0.25%-0.44% of the administered activity.

C. Metabolism

A total of 7 urinary metabolites were confirmed. The primary metabolite of Captan is 4,5-cyclohexene-1,2-dicarboximide (THPI), formed from the cleavage of the trichloromethylthio moiety and subsequently converted to its hydroxide, epoxide, and diol. The urinary metabolite profile was not significantly different for all animals, regardless of the dose, treatment regimen, or sex (Table 2). The quantification of the metabolites using solvent system (i) produced a better separation, and therefore the percentage of urinary metabolites identified hereafter refers to the average of males and females for all 3 dosing regimens using this solvent system. Eight urinary metabolites were isolated (U1-U9). The hydroxide derivatives of THPI, 3OH-THPI (U2) and 5OH-THPI (U3), were derivatized to form TMS adducts representing 49% (42.3% and 5.9%, respectively) of the total urinary metabolites. A polar region accounted for 20.4% of the urinary metabolites, 13.4%

represented OH-cyclohexene acid amide (U7); and 7% were unknown polar metabolites. Other metabolites, that were isolated and matched to their Captan standards, were THPI (U1) (derivatized to TMS adduct), cyclohexene acid amide (U6) (methylated), THPI-diol (U5) (derivatized to boronate adduct), and THPI-epoxide (U4) (derivatized to TMS adduct). These four urinary metabolites accounted for 10.6%, 7.2%, 5.5%, and 4.8%, respectively, of the urinary metabolites. An unknown metabolite (U8) represented 4% as quantified by linear scan data. The linear scan data showed another unidentified compound that accounted for less than 1.6%; however, the authors believed that it may be the unmetabolized parent compound. They did not explain how they came to this conclusion.

The fecal metabolites had Rf values on the TLC analysis comparable to those in the urine, although the separation was not as sharp and there were sex- and dose-related differences for some metabolites (Table 2). The unidentified compound (U9), possibly unmetabolized Captan, was 42.5% of the fecal metabolites in the 500-mg/kg animals but only 7% in the 10-mg/kg animals. THPI (U1) and cyclohexene acid amide (U6) averaged 35% and 3.5%, respectively. THPI-diol (U5) was 3.9% in feces of the 10-mg/kg animals, but was not detected in the 500-mg/kg animals. There was a smaller amount of the alcohol derivatives of THPI (U2, U3) in the high-dose animals (10.6%) compared to the low-dose animals (26.8). Furthermore, the total alcohol metabolites were 14.9% and 30.6% in males and females, respectively, following repeated dosing with 10 mg/kg/day Captan. The male rats had a greater quantity of polar metabolites in the feces than the female rats; 10.8%, 6.7%, and 31% in the low-, high-, and repeated-dose males, respectively, and 3.5%, 2.9%, and 11.4% in the females, respectively. THPI-epoxide (U4) could not be separated in the feces by the methods used. The proposed metabolic pathway for Captan in rats is presented in Figure 1.

IV. STUDY AUTHORS'S CONCLUSIONS/QUALITY ASSURANCE MEASURES

The author concluded that Captan is rapidly eliminated in the urine and feces of rats--approximately 48 hours and 96 hours for complete elimination with the low and high doses, respectively. There were no sex- or dose-related differences in rate and route of elimination. Exhalation of carbon dioxide appeared to be a minor excretion route of Captan in rats. The distribution of Captan in the rat tissues was highest in the kidneys 7 days following single or repeated oral dosing of 10 mg/kg Captan. Overall, most tissues showed negligible activities. There were no sex- or dose-related differences in the tissue distribution pattern. The author reported that the high degree of individual variation in the total recoveries of radioactivity was due to difficulties in suspending Captan in the dosing vehicle. The

pattern of metabolites in the urine was similar for all dose groups. However, sex and dose-level related differences were seen in the hydroxyl derivatives and unidentified polar metabolites in the feces. Saturation of Captan may occur at the high dose as indicated by the high amount of unmetabolized Captan in the feces with 500 mg/kg compared to the 10 mg/kg dosing. The authors suggest that biliary excretion may have occurred because many of the urinary metabolites were detected in the feces.

The quality assurance statements, signed and dated May 3, 9, 17, and 18, 1990, and statements of compliance with Good Laboratory Practices, signed and dated April 23, May 3, 11, 17, 1990, were included for all 4 study volumes.

V. CONCLUSIONS BASED ON REVIEWERS DISCUSSION AND INTERPRETATION OF DATA

The study adequately described the absorption, distribution, metabolism, and excretion of [^{14}C]Captan in rats following single and repeated oral exposure. The data indicate that gastrointestinal absorption of labeled Captan is nearly complete and that the urine is the primary elimination route, with the feces as a minor route. Elimination of Captan in expired air is probably minimal, although the data were limited (i.e., only 2 animals were evaluated). Absorption occurs readily since there is a rapid appearance of activity in the urine within 48-72 hours. However, the absorption rate of Captan could not be determined because the peak blood activity levels were measured only at the end of the study. The low tissue levels of radioactivity demonstrate that bioaccumulation and retention of Captan and/or its metabolites is low. Recovery of the radioactivity is acceptable (≥91.2%) for all dose groups. There are no sex- or dose-related differences in absorption, distribution, or excretion. The appropriate methods were used to measure the urinary and fecal metabolites and all of the major metabolites were identified Some compounds of low activity were unidentified; one possibly being the parent compound. All the identified metabolites were formed from the hydroxylation of the primary metabolite, THPI. As noted by the authors, the excretion and metabolism data suggest that absorption saturation of Captan occurred with the administration of a single high dose of 500 mg/kg/day since the parent compound (U9) accounted for a large portion of the activity in the feces (42.5%) but was barely detectable with 10 mg/kg Captan (6.9%). Repeated-dosing data demonstrated that Captan did not bioaccumulate to an appreciable extent in the rats. The study author's conclusions were supported by the individual data provided.

The authors did not discuss the rationale for choosing the low dose level for this protocol. However, the low dose (10 mg/kg)

was the same order of magnitude of a no-effect-level, 25 mg/kg/day, in rats (cited in HED Doc. No. 4520). The high dose was based on signs of toxicity produced (Study No. URO 283, MRID 415054-02). There was no indication that animals were fasted for the recommended 4-6 hours prior to the beginning of dosing. Although mass units were reported for tissue, the dpm and/or µCi values were not presented. There was no discussion regarding the potential interference of the dosing vehicle to the kinetics of Captan. The elimination of Captan via the expired air was not examined in a sufficient number of animals and was not adequately characterized for the presence of metabolites. The analytical methods used failed to definitively identify one of the compounds found in the urine and feces as the unmetabolized parent compound.

TABLE 1. Mean Percent Recovery of Radioactivity 7 Days After Oral Administration of Captan to Rats

Dose Group	Sex	Percent of Administered Dose				
		Urine	Feces	Cage Wash	Tissues (+ carcass)	Total[a] Recovery
10 mg/kg (single)	Male[b]	81.9	9.5	<0.1	0.391	91.8
	Female	82.0	8.5	0.2	0.496	91.2
500 mg/kg (single)	Male	69.3	23.7	0.1	0.371	93.5
	Female	73.4	25.0	0.1	0.316	98.8
10 mg/kg[c] (repeated)	Male	88.3	9.3	NR[d]	0.441	98
	Female	90.8	7.3	NR	0.262	98.3

[a]Based on individual means. The recovery of expired carbon dioxide was <0.14% and 0.06% in a female rat (10 mg/kg) and a male rat (500 mg/kg), respectively, exposed to a single oral dose.

[b]5 animals/sex

[c]Animals were given 10 mg/kg/day unlabeled Captan for 14 days and a single dose of 10 mg/kg [^{14}C]-Captan on day 15.

[d]Not reported

Source: CBI Tables 1, 2, and 4 in CBI Volumes 1 (pp. 23-26), 2 (pp. 23-26), and 3 (pp. 21-24)

TABLE 2. Distribution of Metabolites in Urine and Feces 6-36 Hours After Oral Administration of Captan[a]

(values given as % of urinary or fecal radioactivity)

	10 mg/kg (single)				10 mg/kg (repeated)				500 mg/kg (single)			
	Male		Female		Male		Female		Male		Female	
Metabolites	Urine	Feces	Urine	Feces	Urine	Feces	Urine	Feces	Urine	Feces	Urine	Feces
THPI (U1)	15.4	29.5	7.0	38.5	12.4	37.6	6.1	35.7	5.7	30.0	7.0	38.4
3OH THPI (U2) 5OH THPI (U3)	36.1	36.2	50.5	25.5	51.4	14.9	51.7	30.6	53.5	11.8	52.3	9.4
THPI-Epoxide (U4)	4.6	NS	4.7	NS	4.6	NS	3.4	NS	4.3	NS	4.3	NS
THPI-Diol (U5)	7.1	2.7	4.7	1.3	5.2	7.7	5.7	3.9	5.9	ND	5.1	ND
Cyclohexene Acid Amide (U6)	7.4	8.5	6.2	3.9	10.4	2.6	5.3	5.7	5.8	ND	6.4	ND
(Polar Region) OH-Cyclohexene Acid Amide (U7)	26.7	10.8	23.6	3.5	14.4	31.0	24.2	11.4	20.7	6.7	20.9	2.9
Unknown (U9)	ND	6.5	ND	16.8	ND	ND	0.7	4.6	1.3	44.1	1.3	40.9

[a] Characterized by TLC plates developed in glacial acetic acid-acetonitrile (1:99) (v/v) (solvent system i)

NS - not separated ND - not detected

Source: CBI Tables 1 and 2 in Volume 3; CBI pp. 40 and 41.

Page _____ is not included in this copy.

Pages __16__ through __20__ are not included in this copy.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product inert impurities.

_____ Description of the product manufacturing process.

_____ Description of quality control procedures.

_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

__x__ FIFRA registration data.

_____ The document is a duplicate of page(s) _____.

_____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.
