DATA EVALUATION RECORD

1. Chemical: Cypermethrin

2. Test Material: Technical, 91.5% AI
   EC formulation, 37.2% AI

3. Study Type: Honey bee acute contact and oral LD_{50}

   Species Tested: Apis mellifera

4. Study ID: Bull, J.M., and W. Wilkinson. 1980. Cypermethrin:
   Laboratory determination of the acute oral and
   contact toxicity to honeybees of technical
   material and an emulsifiable concentrate (GFU
   061). Submitted by ICI, Plant Protection
   Division. Reg. NO. 10182-65. ACC. NO. 260647.

5. Reviewed By:

   Allen W. Vaughan   Signature: _Allen W. Vaughan_
   Entomologist
   EEB/HED   Date: _2/28/86_

6. Approved By:

   Norman Cook   Signature: _Norman Cook_
   Supervisory Biologist
   EEB/HED   Date: _2.28.86_

7. Conclusions:

   This study is scientifically sound. Toxicity values
   for the technical material were as follows:

   24-hr contact LD_{50} = 0.037 ug/bee
   48-hr contact LD_{50} = 0.023 ug/bee
   24-hr oral LD_{50} = 0.181 ug/bee
   48-hr oral LD_{50} = 0.172 ug/bee

   Toxicity values for the formulation were as follows:

   24-hr contact LD_{50} = 0.180 ug a.i./bee
   48-hr contact LD_{50} = 0.088 ug a.i./bee
   24-hr oral LD_{50} = 0.130 ug a.i./bee
   48-hr oral LD_{50} = 0.103 ug a.i./bee

   On the basis of these figures, cypermethrin is considered
   "highly toxic" to honey bees. This study fulfills the
   guideline requirement for an acute contact toxicity
   determination on honey bees with the technical material.

8. Recommendations: N/A

9. <u>Background</u>: This study was submitted by ICI as part of a data call-in package.

10. <u>Discussion of Individual Test</u>: N/A

11. <u>Materials and Methods</u>

    A. <u>Test Animals</u> were worker bees obtained from research colonies.

    B. <u>Test System</u>: General: Bees were collected by sweeping them from the combs into a plastic bucket. Bees were anesthetized by feeding carbon dioxide gas into the bucket. They were then placed in cages and allowed to recover. During the test period, bees were kept in a controlled temperature room at 24-26°C and 60-65% R.H. Mortality was evaluated at 1, 2, 4, 24, and 48 hours after treatment.

    Oral Tests: Stock suspensions were prepared in aqueous 20% sucrose solution containing acetone to improve stability. Serial dilutions were made from the stock. Each group of 10 bees was fed 0.2 ml of a given concentration. Control bees were fed 0.2 ml per cage of the diluent alone. When all the test material had been taken, bees were fed sucrose solution. Any test material not taken by 22 hrs. posttreatment was measured, and the mean dose per bee recalculated by assuming equal sharing of the amount taken.

    Contact tests: Stock solutions were made up in acetone and serially diluted. After recovery from initial anesthetization, bees were reanesthetized, and a 1 ul drop of a given concentration was applied to the thorax of each bee with a microsyringe. Control bees were treated with acetone only.

    C. <u>Dose</u>: Oral application through feeding tube in sucrose solution; acetone diluent. Contact application using microapplicator; acetone solvent.

    D. <u>Design</u>: 30 bees per dose level and control, divided into 3 reps.; replicated 3 times over time. Six dose levels for contact tests (0.5, 0.2, 0.1, 0.05, 0.02, and 0.01 ug a.i. per bee). Six dose levels for oral test with technical (1.64, 0.87, 0.45, 0.2, 0.1, and 0.05 ug a.i. per bee). Seven dose levels for oral test with formulation (1.69, 0.88, 0.46, 0.2, 0.1, 0.05, and 0.02 ug a.i per bee).

E. Statistics: Results were analyzed by plotting logit transformation on percentage kill against the log dose in ug of a.i. per bee. Data were adjusted for control mortality using Abbott's formula.

12. Reported Results: Reported LD_{50} values are listed above under #7, "Conclusions."

13. Study Author's Conclusions/Q.A. Measures:

Reported LD_{50} values are listed above under #7, "Conclusions."

Protocol and final report audits were conducted by ICI's Quality Assurance Unit.

14. Reviewer's Discussion and Interpretation of the Study

A. Test Procedures: Procedures were in accordance with protocols recommended in the guidelines. There were no problems in this regard.

B. Statistical Analysis: Results of the analyses were validated using Stephan's LD_{50} program on the IBM-PC. Validation supports the results of the study author's analyses. Computer printouts are attached.

C. Discussion/Results: With acute LD_{50} values in all cases (contact and oral, 24-hr and 48-hr values) less than 0.2 ug/bee, cypermethrin is "highly toxic" to honeybees.

D. Adequacy of Study:

1. Classification: Core
2. Rationale: Guidelines protocol
3. Reparability: N/A

15. Completion of One-Liner: N/A

16. CBI Appendix: N/A

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Vaughan Cypermethrin Honeybee contact LD50 *(Technical, 24-hr.)*
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CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
.5	90	63	70	0
.2	90	73	81.11111	0
.1	90	65	72.22222	0
.05	90	51	56.66667	0
.02	90	46	51.11112	0
.01	90	15	16.66667	0

BECAUSE THE NUMBER OF ORGANISMS USED WAS SO LARGE, THE 95 PERCENT
CONFIDENCE INTERVALS CALCULATED FROM THE BINOMIAL PROBABILITY ARE
UNRELIABLE. USE THE INTERVALS CALCULATED BY THE OTHER TESTS.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS 1.959353E-02

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
SPAN   G   LC50   95 PERCENT CONFIDENCE LIMITS
  3   6.105566E-02   3.174646E-02
2.539636E-02   3.970448E-02

RESULTS CALCULATED USING THE PROBIT METHOD
ITERATIONS   G   H
GOODNESS OF FIT PROBABILITY
      3   .8289704   7.30774   0
A PROBABILITY OF 0 MEANS THAT IT IS LESS THAN 0.001.

SINCE THE PROBABILITY IS LESS THAN 0.05, RESULTS CALCULATED
USING THE PROBIT METHOD PROBABLY SHOULD NOT BE USED.

SLOPE   =   .8396579
95 PERCENT CONFIDENCE LIMITS = 7.516771E-02   AND   1.604148

LC50 =   3.743089E-02
95 PERCENT CONFIDENCE LIMITS = 6.887538E-05 AND .1598425

LC10 =   1.150031E-03
95 PERCENT CONFIDENCE LIMITS = 2.447041E-21 AND 9.244459E-03
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NOTE: BECAUSE THERE WAS CONTROL MORTALITY, AND NONE
 OF THE LOWER CONCENTRATIONS PRODUCED ZERO MORTALITY,
 THE DATA HAS BEEN SUBJECTED TO ABBOTT'S CORRECTION.

Vaughan Cypermethrin honeybee contact LD50 (Technical, 48-hr.)
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CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
.5	84	79	94.0476	0
.2	84	84	100	0
.1	84	77	91.6667	0
.05	84	60	71.4286	0
.02	84	42	50	0
.01	84	15	17.8571	0

THE BINOMIAL TEST SHOWS THAT .02 AND .02 CAN BE
USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT
CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL
ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS .02

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
SPAN   G   LC50   95 PERCENT CONFIDENCE LIMITS
 3   3.143355E-02   2.420538E-02
2.034118E-02   2.830822E-02

RESULTS CALCULATED USING THE PROBIT METHOD
ITERATIONS   G   H
GOODNESS OF FIT PROBABILITY
    3   .4961499   8.78426   0
A PROBABILITY OF 0 MEANS THAT IT IS LESS THAN 0.001.

SINCE THE PROBABILITY IS LESS THAN 0.05, RESULTS CALCULATED
USING THE PROBIT METHOD PROBABLY SHOULD NOT BE USED.

SLOPE =   1.802394
95 PERCENT CONFIDENCE LIMITS = .5328254   AND   3.071962

LC50 =   2.364122E-02
95 PERCENT CONFIDENCE LIMITS = 4.527049E-03 AND 5.125151E-02

LC10 =   4.667146E-03
95 PERCENT CONFIDENCE LIMITS = 2.814436E-05 AND .0131581
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NOTE: BECAUSE THERE WAS CONTROL MORTALITY, AND NONE
OF THE LOWER CONCENTRATIONS PRODUCED ZERO MORTALITY,
THE DATA HAS BEEN SUBJECTED TO ABBOTT'S CORRECTION.

Vaughan Cypermethrin Honeybee contact LD50 (Formulation, 24-hr.)
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CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
.5	80	48.00001	60.00001	0
.2	80	51	63.75	0
.1	80	37	46.25	0
.05	80	14	17.5	0
.02	80	5.000001	6.25	0
.01	90	8	8.888889	0

THE BINOMIAL TEST SHOWS THAT .1 AND .2 CAN BE
USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT
CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL
ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS .1158548

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
3	.1126155	.1490988	.1112192	.2029691

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H

GOODNESS OF FIT PROBABILITY

3	.3255352	4.237194

1.97804E-03

SINCE THE PROBABILITY IS LESS THAN 0.05, RESULTS CALCULATED
USING THE PROBIT METHOD PROBABLY SHOULD NOT BE USED.

SLOPE =   1.204534
95 PERCENT CONFIDENCE LIMITS = .5172787   AND   1.891789

LC50 =   .1851058
95 PERCENT CONFIDENCE LIMITS = 9.190557E-02 AND .741458

LC10 =   1.633317E-02
95 PERCENT CONFIDENCE LIMITS = 1.325924E-03 AND 3.840888E-02
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NOTE: BECAUSE THERE WAS CONTROL MORTALITY, AND NONE
OF THE LOWER CONCENTRATIONS PRODUCED ZERO MORTALITY,
THE DATA HAS BEEN SUBJECTED TO ABBOTT'S CORRECTION.

Vaughan Cypermethrin Honeybee contact LD50 *(Formulation, 48-hr.)*
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
.5	68	67	98.52939	0
.2	68	57	83.8235	0
.1	68	37	54.4118	0
.05	68	12	17.6471	0
.02	68	3.000001	4.4118	0
.01	90	17	18.88889	0

THE BINOMIAL TEST SHOWS THAT .05 AND .1 CAN BE
USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT
CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL
ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS 9.254191E-02   *— Closest to study labs LD 50*

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS
4	3.008724E-02	9.417432E-02	
7.995928E-02		.1110773	

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
5	.6301673	12.33032	0

A PROBABILITY OF 0 MEANS THAT IT IS LESS THAN 0.001.

SINCE THE PROBABILITY IS LESS THAN 0.05, RESULTS CALCULATED
USING THE PROBIT METHOD PROBABLY SHOULD NOT BE USED.

SLOPE   =   1.762497
95 PERCENT CONFIDENCE LIMITS = .3633725   AND   3.161621

LC50 =   7.544199E-02
95 PERCENT CONFIDENCE LIMITS = 1.944337E-02 AND .4129889

LC10 =   1.435636E-02
95 PERCENT CONFIDENCE LIMITS = 2.569502E-05 AND 3.963985E-02
****

NOTE: BECAUSE THERE WAS CONTROL MORTALITY, AND NONE
  OF THE LOWER CONCENTRATIONS PRODUCED ZERO MORTALITY,
  THE DATA HAS BEEN SUBJECTED TO ABBOTT'S CORRECTION.

Vaughan Cypermethrin Honeybee oral LD50 (Technical ~~Formulation~~, 24-hr.)
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CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
1.64	86	71	82.5581	0
.87	86	69	80.2326	0
.45	86	68	79.0698	0
.2	86	54	62.7907	0
.1	86	33	38.3721	0
.05	86	6	6.9767	0

BECAUSE THE NUMBER OF ORGANISMS USED WAS SO LARGE, THE 95 PERCENT
CONFIDENCE INTERVALS CALCULATED FROM THE BINOMIAL PROBABILITY ARE
UNRELIABLE. USE THE INTERVALS CALCULATED BY THE OTHER TESTS.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS .1390601

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS		
4	2.808105E-02		.1757647	.14728	.207734

RESULTS CALCULATED USING THE PROBIT METHOD
    ITERATIONS   G   H
GOODNESS OF FIT PROBABILITY
        3   .3794768   6.330628   0
    A PROBABILITY OF 0 MEANS THAT IT IS LESS THAN 0.001.

SINCE THE PROBABILITY IS LESS THAN 0.05, RESULTS CALCULATED
USING THE PROBIT METHOD PROBABLY SHOULD NOT BE USED.

SLOPE   =   1.427236
95 PERCENT CONFIDENCE LIMITS = .5480045   AND   2.306437

LC50 =   .1953675
95 PERCENT CONFIDENCE LIMITS = 6.649614E-02 AND .4146634

LC10 =   2.517794E-02
95 PERCENT CONFIDENCE LIMITS = 5.224738E-04 AND 7.150764E-02
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NOTE: BECAUSE THERE WAS CONTROL MORTALITY, AND NONE
 OF THE LOWER CONCENTRATIONS PRODUCED ZERO MORTALITY,
 THE DATA HAS BEEN SUBJECTED TO ABBOTT'S CORRECTION.

Vaughan Cypermethrin Honeybee oral LD50 (Technical, 48-hr.)
****
CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
1.64	82	72	87.8049	0
.87	82	70	85.3659	0
.45	82	64	78.0488	0
.2	82	54	65.8537	0
.1	82	30	36.5854	0
.05	82	4.999999	6.0976	0

THE BINOMIAL TEST SHOWS THAT .1 AND .2 CAN BE
USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT
CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL
ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS .1372782

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
4	2.466242E-02	.1742073	.1476236	.203749

RESULTS CALCULATED USING THE PROBIT METHOD
ITERATIONS   G   H
GOODNESS OF FIT PROBABILITY
      4   .2760765   5.118893   0
A PROBABILITY OF 0 MEANS THAT IT IS LESS THAN 0.001.

SINCE THE PROBABILITY IS LESS THAN 0.05, RESULTS CALCULATED
USING THE PROBIT METHOD PROBABLY SHOULD NOT BE USED.

SLOPE   =   1.639701
95 PERCENT CONFIDENCE LIMITS = .7781531   AND   2.501249

LC50 =   .1856336
95 PERCENT CONFIDENCE LIMITS = 8.388003E-02 AND .3381524

LC10 =   3.119789E-02
95 PERCENT CONFIDENCE LIMITS = 2.822932E-03 AND .0728207
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NOTE: BECAUSE THERE WAS CONTROL MORTALITY, AND NONE
OF THE LOWER CONCENTRATIONS PRODUCED ZERO MORTALITY,
THE DATA HAS BEEN SUBJECTED TO ABBOTT'S CORRECTION.

Vaughan Cypermethrin Honeybee oral LD50 (Formulation, 24-hr.)
****
CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
1.69	26	14	53.8462	0
.88	78	64	82.0513	0
.46	78	61	78.2051	0
.2	78	56	71.7949	0
.1	78	34.00001	43.5897	0
.05	78	18	23.0769	0
.02	52	4.000001	7.6923	0

THE BINOMIAL TEST SHOWS THAT .1 AND .2 CAN BE
USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT
CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL
ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS .1166311

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
5	2.992786E-02		.1332396	.1070805	.164084₄

RESULTS CALCULATED USING THE PROBIT METHOD
ITERATIONS   G   H
GOODNESS OF FIT PROBABILITY
     4   .6327073   9.050471   0
A PROBABILITY OF 0 MEANS THAT IT IS LESS THAN 0.001.

SINCE THE PROBABILITY IS LESS THAN 0.05, RESULTS CALCULATED
USING THE PROBIT METHOD PROBABLY SHOULD NOT BE USED.

SLOPE =   1.146267
95 PERCENT CONFIDENCE LIMITS = .2344931   AND   2.058041

LC50 =   .1503364
95 PERCENT CONFIDENCE LIMITS = 2.281468E-02 AND .5952761

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LC10 =   .0117252
95 PERCENT CONFIDENCE LIMITS = 2.619412E-07 AND 4.805056E-02
****

NOTE: BECAUSE THERE WAS CONTROL MORTALITY, AND NONE
 OF THE LOWER CONCENTRATIONS PRODUCED ZERO MORTALITY,
 THE DATA HAS BEEN SUBJECTED TO ABBOTT'S CORRECTION.

Vaughan Cypermethrin Honeybee oral LD50 (Formulation, 48-hr.)
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CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
1.69	24.66667	21.66667	87.8378	0
.88	74	66	89.1892	0
.46	74	60	81.0811	0
.2	74	55	74.3243	0
.1	74	34.00001	45.946	0
.05	74	19	25.6757	0
.02	49.33334	6.333333	12.8378	0

THE BINOMIAL TEST SHOWS THAT .1 AND .2 CAN BE
USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT
CONFIDENCE LIMITS, BECAUSE THE ACTUAL CONFIDENCE LEVEL
ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS .1100301

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
5	2.974246E-02		.1112774	8.839982E-02
.1371221				

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H
GOODNESS OF FIT PROBABILITY		
4	3.268955E-02	1
.1724523		

SLOPE   =   1.444022
95 PERCENT CONFIDENCE LIMITS = 1.182939   AND   1.705105

LC50 =   .1138401
95 PERCENT CONFIDENCE LIMITS = 9.040253E-02 AND .1405582

LC10 =   1.502476E-02
95 PERCENT CONFIDENCE LIMITS = 8.571998E-03 AND 2.251832E-02
****