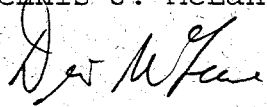# DATA EVALUATION RECORD
§ 70-1

1. **CHEMICAL**: Glyphosate   **S#.**: 417300 or 103601

2. **TEST MATERIAL**: Technical Glyphosate and Roundup® 360
   Purity: Not reported

3. **CITATION**

   Authors: Joseph R. Bidwell and John R. Gorrie
   Title: Acute Toxicity of a Herbicide to Selected Frog Species Final Report Curtin Ecotoxicology Program, Curtin University of Technology, Unit 7, R&D Centre, Technology Park, Bentley 6102
   Study Completion Date: June 1995
   Laboratory: (see above)
   Sponsor: Western Australian Department of Environmental Protection, Westralia Square, 141 St. George's Terrace, Perth, 6000
   Laboratory Report ID: N/A
   MRID No.: 43839601
   DP Barcode: D226164

4. **REVIEWED BY**: Dennis J. McLane, Wildlife, EEB, EFED

   Signature: _[signature]_   **Date**: 4-17-97

5. **APPROVED BY**: Les W. Touart, Head of Section 1, EEB, EFED

   Signature: **Date**:

6. **STUDY PARAMETERS**

Scientific Name of Test Organism:	*Crinia insignifera,* *Litoria moorei*
Age or Size of Test Organism:	Adult:*C. insignifera* Newly emerged: *C.insignifera* Tadpoles: *C.insignifera* & *L. moorei*
Definitive Test Duration:	24, 48, 72, 96 hours
Study Method:	Static
Type of Concentrations:	Nominal

7. **CONCLUSIONS**:

The study is scientifically sound but EPA does not have a guideline requirement for frog testing. Based on Brooks (1973) categories of toxicities, the lowest LC50 of 7.6 mg/L for *L.moorei* tadpoles, would be "moderately toxic" (.1-10 mg/L).

Results Synopsis

(In 12. Reported Results see tables 3, 6, and 8)

8. **ADEQUACY OF THE STUDY**

   A. **Classification:** Supplemental

   B. **Rationale:** Lack of frog testing requirement.

   C. **Repairability:** N/A

9. **GUIDELINE DEVIATIONS**

   N/A

10. **SUBMISSION PURPOSE:**

6(A)2 submission made in connection with this study and
Monsanto's response.

11. **MATERIALS AND METHODS**

11.1 Source of test animals

"Frogs and tadpoles were collected from sites within the Perth
metropolitan area and as far south as Mandurah, Western Australia
(~80 km from Perth)."

"Bioassays were initiated within two days of receiving the frogs
in order to minimis stress associated with being held in the
laboratory. Test protocols were reviewed and approved by the
Curtin University of Technology Animal Experimentation Ethics
Committee."

11.2 Test protocol

"Adult *C. insignifera* (15 to 23 mm S-V, Snout-vent length) and
L.adeaidensis (37 to 43 mm S-V) were tested in chambers which
facilitated individual exposure to test solutions (Figure 1). The
exposure chambers were constructed from short lengths (15 mm for
C. insignifera, 30 mm for *L. adelaidensis*) of PVC pipe (50 mm
diameter) which were covered on one end with 0.5 mm nylon mesh.
The opposite side was fitted with the lid of a 55 mm polystyrene
petri dish. Bioassays were initiated by placing the chambers into
glass beakers which contained the test solutions. The chambers
were placed in the beakers with the diameter vertical, allowing
the meshed side to remain unobstructed and facilitating passage
of test solution and air. Bioassays with *C. insignifera* were
conducted in 250 ml beakers containing 125 ml of test solution.

This provided a 15 mm air space within the exposure chamber. Tests with the larger *L. adelaidensis* were similarly conducted in 250-ml beakers, but with only 100 ml of test solution to allow a 20 mm air space. When undisturbed, the frogs would usually cling to the mesh side of the exposure chamber in the airspace. The volumes of test solution were chosen so that even in this resting position the animals would have some skin contact with the solution. Daily renewal of the bioassay was achieved by pouring off the old test solution and replacing it with new."

"Adult *L/ moorei* were too large (40 to 70 mm S-V) for the test chambers described above and so were exposed to the herbicides in replicate 5 l glass beakers containing 200 ml of test solution and holding three frogs each (n=6). The test solution was 1.5 cm deep and largely covered the hindquarters of a frog sitting upright. Each beaker covered with a Perspex plate through which a number of air holes were drilled."

"In contrast to *L. moorei*, newly emerged *c. insignifera* ranged 5 to 11 mm S-V and were too small to be effectively exposed in the test chambers used for full size adults. The bioassay with these frogs was conducted by placing individuals in glass test tubes (30 mm diameter x 120 mm length) with a 0.5 mm nylon mesh across one end. A large swab of glass fiber was inserted through the top of the tube, creating a chamber 10 to 15 mm high. Racks holding 10 tubes were then suspended in two replicates 3 L beakers containing enough test solution to immerse the tubes 5 mm deep. A frog sitting upright in a tube was partly covered in test solution without having to continuously swim. Daily renewal of the bioassay was accomplished by transferring the racks of tubes to alternate beakers containing fresh solution."

" Tests with *C. insignifera* and *L. moorei* tadpoles were conducted in 250 ml glass beakers containing 100 ml of test solution. Each beaker held five tadpoles with two or three replicates per concentration."

"Daily renewals of the bioassay were achieved by first draining the old test solution over a nylon mesh (in the event a tadpole was accidentally poured out during the change over) and replaced with new."
"All bioassay were conducted at 20±2°C under ambient laboratory light."

11.3 Test substance

" Technical grade glyphosate (N-(Phosphonomethyl) Glycine, 96%) was obtained from a local supplier on 23 June 1994. The formulated herbicide "Roundup 360" was purchased from a local retail outlet."

A 1 mg/ml stock solution of glyphosate was prepared by adding 1 g of powdered chemical to 1 L of distilled water. Levels of Roundup 360 were calculated and reported as glyphosate active (isopropylamine salt). Test solutions were prepared by serial dilution of the highest concentration tested. Test concentrations for initial screening studies were based on suggested application levels of the herbicide."

"Purity of the technical grade glyphosate and analyses of selected test solutions were conducted by the Chemistry Centre (WA) using high performance liquid chromatography (HPLC)."

11.4 Diluent

"Aged (three days), aerated laboratory tap water was used ass the diluent in the screening tests with *C. insignifera*, *L. adelaidensis*, and *L. moorei*. All other bioassay used filtered (30 mm) water collected from a lake on the Curtin University campus."

11.5 Statistical analyses

"Mortality data were used to generate LC50 values by the Spearman-Karber method (Hamilton et al. 1978). Reported values are based on target (nominal) rather than measured concentrations of glyphosate."

12. **REPORTED RESULTS**

A. General Results

Table 2. Toxicity of technical grade glyphosate and Roundup 360 (expressed as glyphosate active) to adult *C. insignifera* in a screening study conducted between 11 and 15 August 1994.

Concentration (ppm)	Number of Frog	Cumulative Number Dead			
		Hour of Study			
Nominal		24	48	72	96
Control	5	0	0	20	20
Roundup 360 11.1	5	0	0	0	0
Glyphosate 22.3	5	0	0	0	0
Roundup 360 22.3	5	0	0	0	0

Concentration (ppm)	Number of Frog	Cumulative Number Dead			
		Hour of Study			
Nominal		24	48	72	96
Glyphosate 45	5	0	0	0	0
Roundup 360 45	5	20	20	40	60
Glyphosate 67.6	5	20	40	40	40
Roundup 360 67.6	5	100	- - - -	- - - -	- - - -
Glyphosate 90	5	40	40	60	60
Roundup 360 90	5	80	100	- - - -	- - - -
Glyphosate 135	5	100	- - - -	- - - -	- - - -

Table 3. Preliminary LC50 values (95% confidence interval) for adult *C. insignifera* in screening bioassays with glyphosate or Roundup 360 (expressed as glyphosate active).

Time	LC50	
	Glyphosate	Roundup 360
24 h	89.6 (73.6-108.9)	52.6 (39.3-70.5)
48 h	83.6 (67.4-103.6)	49.4 (40.5-60.2)
72 h	72.0 (62.9-96.6)	44.2 (34.7-56.3)
96 h	78.0 (62.9-96.6)	39.7 (31.1-50.5)

Table 4. Toxicity of technical grade glyphosate and Roundup 360 (expressed as glyphosate active) in a screening test conducted between 21 and 25 September 1994.

Table 5. Toxicity of technical grade glyphosate and Roundup 360 (expressed as glyphosate active) in a screening test with *C. insignifera* tadpoles.

Toxicant		Cumulative % Mortality			
(mg/L)	# Exposed	24h	48h	72 h	96 h
0	10	0	0	0	0
Glyphosate 22.5	10	0	0	0	0
Roundup 360 22.5	10	20	100	- - -	- - -
Glyphosate 45	10	0	0	0	0
Roundup 360 45	10	100	- - -	- - -	- - -
Glyphosate 67.5	10	0	0	0	0
Roundup 360 67.5	10	100	- - -	- - -	- - -
Glyphosate 90	10	0	0	0	0
Roundup 360 90	10	100	- - -	- - -	- - -
Glyphosate 180	10	0	0	0	0
Roundup 360 180	10	100	- - -	- - -	- - - -

Table 6. Toxicity of Roundup 360 (expressed as glyphosate active) to newly emerged *C.insignifera*.

Roundup 360		Cumulative % Mortality		
(mg/L)	# Exposed	24h	48h	72 h
0	20	5	10	20
11.5	20	0	5	15
22.5	20	0	5	10
45	20	30	40	65
90	20	35	85	100
180	20	90	100	- - -
LC50 (95% confidence interval)		88.7 (68.14.6)	51.8 (42.1-63.8)	*

* - no LC50 calculated due to control mortality.

Toxicant		Cumulative % Mortality			
(mg/L)	# Exposed	24h	48h	72 h	96 h
0	15	0	0	0	0
Roundup 360 1.12	15	0	0	0	0
Roundup 360 2.25	15	0	13	0	0
Roundup 360 4.5	15	0	0	0	20
Roundup 360 9.0	15	0	- - -	40	53
Glyphosate 11.25	15	0	0	0	0

Roundup 360 18.0	15	100	- - -	- - -	- - -
Glyphosate 22.5	15	0	0	7	13
Roundup 360 36	15	100	7	- - -	- - -
Glyphosate 45	15	0	- - -	0	0
Glyphosate 90	15	0	- - -	13	27
Glyphosate 180	15	100	- - -	- - -	- - - -

Table 8. LC50 values (95% confidence intervals) for *L. moorei* tadpoles exposed to technical grade glyphosate or Roundup 360 (expressed as glyphosate active).

Time	LC50 (mg/L)	
	Glyphosate	Roundup 360
24 h	127.0 (90.0-180.0)	12.7 (9.0-18.0)
48 h	121.5 (111.2-132.9)	11.6 (10.3-13.1)
72 h	116.0 (102.2-131.8)	10.6 (9.0 - 12.4)
96 h	110.8 (95.2-128.4)	7.66 (6.1 - 9.6)

"..... The presence of a surfactant in the formulation that was tested may then explain why tadpoles which respire with gills, were significantly more sensitive to Roundup 360 than adult frogs."

13. **VERIFICATION OF STATISTICAL RESULTS**

The following tables was excerpted from the study (B&G95) and the values recalculated using toxanal (EPA).

Table 3. Preliminary LC50 values (95% confidence interval) for adult *C. insignifera* in screening bioassays with glyphosate or Roundup 360 (expressed as glyphosate active).

Time		LC50	
		Glyphosate	Roundup 360
24 h	B&G95[1]	89.6 (73.6-108.9)	52.6 (39.3-70.5)
	EPA[2]	88.4 (67.8-1245.7)	54.0 (29.4-74)
48 h	B&G95	83.6 (67.4-103.6)	49.4 (40.5-60.2)
	EPA	83.1 (61.7-116.1)	51.2 (0-∞)
72 h	B&G95	72.0 (62.9-96.6)	44.2 (34.7-56.3)
	EPA	78 (57.5-105.8)	47.4 (0-∞)
96 h	B&G95	78.0 (62.9-96.6)	39.7 (31.1-50.5)
	EPA	" " "	41.1 (0-∞)

[1] Reported values
[2] EPA calculated values

Table 6. Toxicity of Roundup 360 (expressed as glyphosate active) to newly emerged *C.insignifera*.

Roundup 360		Cumulative % Mortality		
(mg/L)	# Exposed	24h	48h	72 h
0	20	5	10	20
11.5	20	0	5	15
22.5	20	0	5	10
45	20	30	40	65
90	20	35	85	100
180	20	90	100	- - -
LC50 (95% confidence interval)		B&G95 88.7 (68.6- 114.6) EPA 87.8 (69-115.7)	B&G95 51.8 (42.1-63.8) EPA 51.6 (40.8-65.9)	*

* - no LC50 calculated due to control mortality.

Table 8. LC50 values (95% confidence intervals) for *L. moorei* tadpoles exposed to technical grade glyphosate or Roundup 360 (expressed as glyphosate active).

Time		LC50 (mg/L)	
		Glyphosate	Roundup 360

24 h	B&G95	127.0 (90.0-180.0)	12.7 (9.0-18.0)
	EPA	127.3 (90-180)	12.7 (9-18)
48 h	B&G95	121.5 (111.2-132.9)	11.6 (10.3-13.1)
	EPA	92.9 (45-180)	11.6 (9-18)
72 h	B&G95	116.0 (102.2-131.8)	10.6 (9.0 - 12.4)
	EPA	116.0 (90-180)	9.8 (4.5-18)
96 h	B&G95	110.8 (95.2-128.4)	7.66 (6.1 - 9.6)
	EPA	107.5 (45-180)	7.6 (6.0-9.6)

14. REVIEWER'S COMMENTS:

The statistical methods were acceptable.

The control mortality in the adult *C. insignifera* test for the
72 hour and 96 hour was 20%. The two day acclimation period was
probably not adequate to determine the health of the
C.insignifera population. Newly emerged *C.insignifera* also had
the same problem with control mortality 5% at 24 hours, 10% at 48
hours, and 20% at 72 hours. A longer acclimation period may have
provided more about the health and husbandry of *C.insignifera*.

Roundup 360 is 41% glyphosate the same a Roundup in this country.
As cited by the authors Folmar (et al. 1979) has shown that the
surfactant increased the toxicity of the product. The lowest LC50
derived for glyphosate in this study was 72 mg/L (62.9-96.6) mg/L
versus 7.6 mg/L for Roundup 360.

The study would indicate that tadpoles are the most sensitive to
Roundup 360 with an 96 hour *L.moorei* LC50 of 7.6 mg/L versus 96
hour LC50 *C.insignifera* of 39.7 mg/L for adults and 48 hour LC50
of 51.5 mg/L for newly emerged (*L.moorei*) (96 hours for newly
emerged was not available).

The screening study with Roundup 360 shows that *C.insignifera*
tadpoles may also be as sensitive as *L.moorei*. All of the
C.insignifera tadpoles died after 48 hours in a concentration of
22.5 mg/L.

MCLANE   ROUNDUP 360   TADPOLES 24 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
36	15	15	100	3.051758E-03
18	15	15	100	3.051758E-03
9	15	0	0	3.051758E-03
4.5	15	0	0	3.051758E-03
2.25	15	0	0	3.051758E-03
1.12	15	0	0	3.051758E-03

THE BINOMIAL TEST SHOWS THAT 9 AND 18 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 12.72792

WHEN THERE ARE LESS THAN TWO CONCENTRATIONS AT WHICH THE
PERCENT DEAD IS BETWEEN 0 AND 100, NEITHER THE MOVING AVERAGE
NOR THE PROBIT METHOD CAN GIVE ANY STATISTICALLY SOUND RESULTS.

****

MCLANE   ROUNDUP 360   TADPOLES 48 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
36	15	15	100	3.051758E-03
18	15	15	100	3.051758E-03
9	15	2	13.33333	.3692627
4.5	15	0	0	3.051758E-03
2.25	15	0	0	3.051758E-03
1.12	15	0	0	3.051758E-03

THE BINOMIAL TEST SHOWS THAT 9 AND 18 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 11.6006

WHEN THERE ARE LESS THAN TWO CONCENTRATIONS AT WHICH THE
PERCENT DEAD IS BETWEEN 0 AND 100, NEITHER THE MOVING AVERAGE
NOR THE PROBIT METHOD CAN GIVE ANY STATISTICALLY SOUND RESULTS.

****

MCLANE   ROUNDUP 360   TADPOLES 72 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
36	15	15	100	3.051758E-03
18	15	15	100	3.051758E-03

9	15	6	40	30.36194
4.5	15	0	0	3.051758E-03
2.25	15	0	0	3.051758E-03
1.12	15	0	0	3.051758E-03

THE BINOMIAL TEST SHOWS THAT 4.5 AND 18 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 9.817339

WHEN THERE ARE LESS THAN TWO CONCENTRATIONS AT WHICH THE
PERCENT DEAD IS BETWEEN 0 AND 100, NEITHER THE MOVING AVERAGE
NOR THE PROBIT METHOD CAN GIVE ANY STATISTICALLY SOUND RESULTS.

****

MCLANE   ROUNDUP 360   TADPOLES 96 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
36	15	15	100	3.051758E-03
18	15	15	100	3.051758E-03
9	15	8	53.33334	50
4.5	15	3	20	1.757813
2.25	15	0	0	3.051758E-03
1.12	15	0	0	3.051758E-03

THE BINOMIAL TEST SHOWS THAT 4.5 AND 18 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 8.428467

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
SPAN   G   LC50   95 PERCENT CONFIDENCE LIMITS
  5   7.146491E-02   7.326024   5.533304
9.912052

RESULTS CALCULATED USING THE PROBIT METHOD
ITERATIONS   G   H
GOODNESS OF FIT PROBABILITY
      6   .168964   1
.755761

SLOPE   =   4.833743
95 PERCENT CONFIDENCE LIMITS = 2.846822   AND   6.820664

LC50 =   7.55571
95 PERCENT CONFIDENCE LIMITS = 5.95973 AND 9.580359

LC10 =   4.126093

95 PERCENT CONFIDENCE LIMITS = 2.49076 AND 5.345227
****

MCLANE   GLYPHOSATE   TADPOLES 24 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
180	15	15	100	3.051758E-03
90	15	0	0	3.051758E-03
45	15	0	0	3.051758E-03
22.5	15	0	0	3.051758E-03
11.25	15	0	0	3.051758E-03

THE BINOMIAL TEST SHOWS THAT 90 AND 180 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 127.2792

WHEN THERE ARE LESS THAN TWO CONCENTRATIONS AT WHICH THE
PERCENT DEAD IS BETWEEN 0 AND 100, NEITHER THE MOVING AVERAGE
NOR THE PROBIT METHOD CAN GIVE ANY STATISTICALLY SOUND RESULTS.

****

MCLANE   GLYPHOSATE   TADPOLES 48 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
180	15	15	100	3.051758E-03
90	15	7	46.66667	50
45	15	0	0	3.051758E-03
22.5	15	0	0	3.051758E-03
11.25	15	0	0	3.051758E-03

THE BINOMIAL TEST SHOWS THAT 45 AND 180 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 92.87608

WHEN THERE ARE LESS THAN TWO CONCENTRATIONS AT WHICH THE
PERCENT DEAD IS BETWEEN 0 AND 100, NEITHER THE MOVING AVERAGE
NOR THE PROBIT METHOD CAN GIVE ANY STATISTICALLY SOUND RESULTS.

****

MCLANE   GLYPHOSATE   TADPOLES 72 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
180	15	15	100	3.051758E-03
90	15	2	13.33333	.3692627
45	15	0	0	3.051758E-03
22.5	15	1	6.666667	4.882813E-02
11.25	15	0	0	3.051758E-03

THE BINOMIAL TEST SHOWS THAT 90 AND 180 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 116.006

THE MOVING AVERAGE METHOD CANNOT BE USED WITH THIS DATA SET
BECAUSE NO SPAN WHICH PRODUCES MOVING AVERAGE ANGLES THAT
BRACKET 45 DEGREES ALSO USES TWO PERCENT DEAD BETWEEN 0 AND
100 PERCENT.

RESULTS CALCULATED USING THE PROBIT METHOD
ITERATIONS   G   H
GOODNESS OF FIT PROBABILITY
       8   7.593905   13.79384
  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   =   4.285732
95 PERCENT CONFIDENCE LIMITS =-7.524477   AND   16.09594

LC50 =   106.867
95 PERCENT CONFIDENCE LIMITS = 0 AND +INFINITY

LC10 =   54.01464
95 PERCENT CONFIDENCE LIMITS = 0 AND +INFINITY
****

MCLANE   GLYPHOSATE   TADPOLES 96 HOUR LC50
****
CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
180	15	15	100	3.051758E-03
90	15	4	26.66667	5.923462
45	15	0	0	3.051758E-03
22.5	15	2	13.33333	.3692627
11.25	15	0	0	3.051758E-03

THE BINOMIAL TEST SHOWS THAT 45 AND 180 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 107.4888

THE MOVING AVERAGE METHOD CANNOT BE USED WITH THIS DATA SET
BECAUSE NO SPAN WHICH PRODUCES MOVING AVERAGE ANGLES THAT
BRACKET 45 DEGREES ALSO USES TWO PERCENT DEAD BETWEEN 0 AND
100 PERCENT.

RESULTS CALCULATED USING THE PROBIT METHOD
ITERATIONS   G   H
GOODNESS OF FIT PROBABILITY
      5   3.053788   6.425535
  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   =   3.368341
95 PERCENT CONFIDENCE LIMITS =-2.517865   AND   9.254546

LC50 =   94.03784
95 PERCENT CONFIDENCE LIMITS = 0 AND +INFINITY

LC10 =   39.46956
95 PERCENT CONFIDENCE LIMITS = 0 AND +INFINITY
****

NOTE: THERE WAS CONTROL MORTALITY, BUT AT LEAST ONE
 OF THE LOWER CONCENTRATIONS HAD ZERO MORTALITY.
 THEREFORE, ABBOTT'S CORRECTION IS NOT APPLICABLE.

MCLANE   rOOUNDUP 360 NEWLY EMERGED FROGS 24 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB. (PERCENT)
180	20	18	90	2.012253E-02
90	20	7	35	13.1588
45	20	6	30	5.765915
22.5	20	0	0	9.536742E-05
11.25	20	0	0	9.536742E-05

THE BINOMIAL TEST SHOWS THAT 22.5 AND 180 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 107.0428

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
SPAN   G   LC50   95 PERCENT CONFIDENCE LIMITS
  3   7.602793E-02   84.87036   68.47653
110.2925

RESULTS CALCULATED USING THE PROBIT METHOD

```
       ITERATIONS              G              H
GOODNESS OF FIT PROBABILITY
       4                       .1275428        1
  .1351399


       SLOPE    =                  3.294123
       95 PERCENT CONFIDENCE LIMITS = 2.117689    AND    4.470558


       LC50 =     87.77271
       95 PERCENT CONFIDENCE LIMITS =  69.04436 AND  115.7058


       LC10 =     36.12639
       95 PERCENT CONFIDENCE LIMITS = 21.61119 AND  48.30736
       **********************************************************************
```

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

MCLANE   rOOUNDUP 360   NEWLY EMERGED FROGS 48 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
180	18	18	100	3.814697E-04
90	18	15	83.3333	.3768921
45	18	6	33.3333	11.89423
22.5	20	1	5	2.002716E-03
11.25	20	1	5	2.002716E-03

THE BINOMIAL TEST SHOWS THAT 22.5 AND 90 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 56.15447


```
    RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
    SPAN         G            LC50            95 PERCENT CONFIDENCE LIMITS
     4        7.029575E-02                52.40946       41.06064
 68.63534


    RESULTS CALCULATED USING THE PROBIT METHOD
    ITERATIONS                  G              H
GOODNESS OF FIT PROBABILITY
    4                       .1092167        1
  .1195951


    SLOPE    =                  3.634041
    95 PERCENT CONFIDENCE LIMITS = 2.433065    AND    4.835017


    LC50 =     51.61713
    95 PERCENT CONFIDENCE LIMITS =  40.78895 AND  65.87588


    LC10 =     23.08451
    95 PERCENT CONFIDENCE LIMITS = 14.46924 AND  30.49163
    **********************************************************************
```

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

MCLANE   rOOUNDUP 360   NEWLY EMERGED FROGS 72 HOUR LC50
****
CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
180	16	16	100	1.525879E-03
90	16	16	100	1.525879E-03
45	16	9	56.25	40.18097
22.5	20	2	10	2.012253E-02
11.25	20	3	15	.1288414

THE BINOMIAL TEST SHOWS THAT 22.5 AND 90 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 41.41958

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
4	.1027428	33.85614	23.8361	45.42646

RESULTS CALCULATED USING THE PROBIT METHOD
ITERATIONS   G   H
GOODNESS OF FIT PROBABILITY
        5   .9332212   3.037544
.0278303

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

SLOPE   =   3.360031
95 PERCENT CONFIDENCE LIMITS = .1141276   AND   6.605933

LC50 =   35.00115
95 PERCENT CONFIDENCE LIMITS = 3.848137 AND 837.4293

LC10 =   14.65917
95 PERCENT CONFIDENCE LIMITS = 5.241533E-10 AND 29.41597
****

MCLANE   ROUNDUP 360 FROG 24 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
90	5	4	80	18.75
67.6	5	5	100	3.125
45	5	1	20	18.75
22.3	5	0	0	3.125
11.1	5	0	0	3.125

THE BINOMIAL TEST SHOWS THAT 0 AND +INFINITY 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 51.20384

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
4	.5976201	44.42308	20.07521	86.09863

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H

GOODNESS OF FIT PROBABILITY

6	.6470405	1

.3455239

SLOPE   =   6.741876
95 PERCENT CONFIDENCE LIMITS = 1.31879   AND   12.16496

LC50 =   54.23584
95 PERCENT CONFIDENCE LIMITS = 29.41832 AND 73.9661

LC10 =   35.1489
95 PERCENT CONFIDENCE LIMITS = 3.914442 AND 47.59696
****

MCLANE   ROUNDUP 360 FROGS 48 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
90	5	5	100	3.125
67.6	5	5	100	3.125
45	5	1	20	18.75
22.3	5	0	0	3.125
11.1	5	0	0	3.125

THE BINOMIAL TEST SHOWS THAT 0 AND +INFINITY 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 51.20384

WHEN THERE ARE LESS THAN TWO CONCENTRATIONS AT WHICH THE
PERCENT DEAD IS BETWEEN 0 AND 100, NEITHER THE MOVING AVERAGE
NOR THE PROBIT METHOD CAN GIVE ANY STATISTICALLY SOUND RESULTS.

****

NOTE: THERE WAS CONTROL MORTALITY, BUT AT LEAST ONE
 OF THE LOWER CONCENTRATIONS HAD ZERO MORTALITY.
 THEREFORE, ABBOTT'S CORRECTION IS NOT APPLICABLE.

MCLANE   ROUNDUP 360   FROGS 72 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
90	5	5	100	3.125
67.6	5	5	100	3.125
45	5	2	40	50
22.3	5	0	0	3.125
11.1	5	0	0	3.125

THE BINOMIAL TEST SHOWS THAT 0 AND +INFINITY 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 47.41979

WHEN THERE ARE LESS THAN TWO CONCENTRATIONS AT WHICH THE
PERCENT DEAD IS BETWEEN 0 AND 100, NEITHER THE MOVING AVERAGE
NOR THE PROBIT METHOD CAN GIVE ANY STATISTICALLY SOUND RESULTS.

****

NOTE: THERE WAS CONTROL MORTALITY, BUT AT LEAST ONE
 OF THE LOWER CONCENTRATIONS HAD ZERO MORTALITY.
 THEREFORE, ABBOTT'S CORRECTION IS NOT APPLICABLE.

MCLANE   ROUNDUP 360   FROGS 96 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
90	5	5	100	3.125
67.6	5	5	100	3.125
45	5	3	60.00001	50
22.3	5	0	0	3.125
11.1	5	0	0	3.125

THE BINOMIAL TEST SHOWS THAT 0 AND +INFINITY 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 41.11195

WHEN THERE ARE LESS THAN TWO CONCENTRATIONS AT WHICH THE
PERCENT DEAD IS BETWEEN 0 AND 100, NEITHER THE MOVING AVERAGE
NOR THE PROBIT METHOD CAN GIVE ANY STATISTICALLY SOUND RESULTS.

****

NOTE: THERE WAS CONTROL MORTALITY, BUT AT LEAST ONE
  OF THE LOWER CONCENTRATIONS HAD ZERO MORTALITY.
  THEREFORE, ABBOTT'S CORRECTION IS NOT APPLICABLE.

MCLANE GLYPHOSATE FROGS 24 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
135	5	5	100	3.125
90	5	2	40	50
67.6	5	1	20	18.75
45	5	0	0	3.125
22.3	5	0	0	3.125

THE BINOMIAL TEST SHOWS THAT 0 AND +INFINITY 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 94.82151

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
3	.2872567	87.93612	70.43003	120.9225

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H

GOODNESS OF FIT PROBABILITY

23	.6129955	1

.8559464

SLOPE =   9.744269
95 PERCENT CONFIDENCE LIMITS = 2.115089   AND   17.37345

LC50 =   88.34733
95 PERCENT CONFIDENCE LIMITS = 67.82111 AND 124.6519

LC10 =   65.44259
95 PERCENT CONFIDENCE LIMITS = 22.50734 AND 79.65102
****

NOTE: THERE WAS CONTROL MORTALITY, BUT AT LEAST ONE
  OF THE LOWER CONCENTRATIONS HAD ZERO MORTALITY.
  THEREFORE, ABBOTT'S CORRECTION IS NOT APPLICABLE.

MCLANE GLYPHOSATE FROGS 48 HOUR LC50
****

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)

135	5	5	100	3.125
90	5	2	40	50
67.6	5	2	40	50
45	5	0	0	3.125
22.3	5	0	0	3.125

THE BINOMIAL TEST SHOWS THAT 0 AND +INFINITY 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 94.82151

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
3	.2717878	82.50613	65.71425	108.014

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H

GOODNESS OF FIT PROBABILITY

6	.5468783	1

.5871211

SLOPE   =   7.790444
95 PERCENT CONFIDENCE LIMITS = 2.029316   AND   13.55157

LC50 =   83.14075
95 PERCENT CONFIDENCE LIMITS = 61.71223 AND 116.1075

LC10 =   57.12072
95 PERCENT CONFIDENCE LIMITS = 18.96722 AND 72.05848
****

NOTE: THERE WAS CONTROL MORTALITY, BUT AT LEAST ONE
 OF THE LOWER CONCENTRATIONS HAD ZERO MORTALITY.
 THEREFORE, ABBOTT'S CORRECTION IS NOT APPLICABLE.

MCLANE GLYPHOSATE FROG 72 HOUR LC50
****
CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
135	5	5	100	3.125
90	5	3	60.00001	50
67.6	5	2	40	50
45	5	0	0	3.125
22.3	5	0	0	3.125

THE BINOMIAL TEST SHOWS THAT 0 AND +INFINITY 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 77.99998

```
RESULTS CALCULATED USING THE MOVING AVERAGE METHOD
SPAN          G          LC50          95 PERCENT CONFIDENCE LIMITS
  3        .2863572      77.98539         60.46964      100.5498


RESULTS CALCULATED USING THE PROBIT METHOD
ITERATIONS                    G                H
GOODNESS OF FIT PROBABILITY
     9                     .5813513          1
.8645456

SLOPE    =               8.745548
95 PERCENT CONFIDENCE LIMITS = 2.077383    AND    15.41371

LC50 =    77.99186
95 PERCENT CONFIDENCE LIMITS =  57.4704 AND  105.7446

LC10 =    55.8255
95 PERCENT CONFIDENCE LIMITS =  17.74106 AND  69.33968
*********************************************************************
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