Appendix H

ECOTOX Open Literature Reviews

Chemical Name: Chlorophacinone

CAS Number: 3691-35-8

PC Code: 067707

Citations:

Teeters, W.R. (1981) Chlorophacinone technical: Toxicity to Laboratory Rat: Test No. 66. (U.S. Environmental Protection Agency, Pesticides Regulation Div., Agricultural Research Center, Animal Biology Laboratory, unpublished report.)

Teeters, W.R. (1981) Chlorophacinone technical: Toxicity to Laboratory Rat: Test No. 74. (U.S. Environmental Protection Agency, Pesticides Regulation Div., Agricultural Research Center, Animal Biology Laboratory, unpublished report.)

Teeters, W.R. (1981) Chlorophacinone technical: Toxicity to Laboratory Rat: Test No. 117. (U.S. Environmental Protection Agency, Pesticides Regulation Div., Agricultural Research Center, Animal Biology Laboratory, unpublished report.)

Teeters, W.R. (1981) Chlorophacinone technical: Toxicity to Laboratory Rat: Test No. 120. (U.S. Environmental Protection Agency, Pesticides Regulation Div., Agricultural Research Center, Animal Biology Laboratory, unpublished report.)

Purpose of Review: Litigation/Endangered Species

Date of Data Review: 5/15/11

Brief Summary of Study Findings:

Methods

All four studies were conducted in the same lab using very similar methodology. An outline of the available methodology information for each study is provided in **Table 1**.

Table 1. Study methods for the Albino rat feeding studies with chlorophacinone conducted at Beltsville Lab.

	Test 66	**Test 74**	**Test 117**	**Test 120**
Date started	4/28/80	6/20/80	5/1/81	5/22/81
active ingredient	100%			

Table 1. Study methods for the Albino rat feeding studies with chlorophacinone conducted at Beltsville Lab.				
	Test 66	**Test 74**	**Test 117**	**Test 120**
Mixing in feed	Chlorophacinone mixed with 40 g corn oil, added to mash to make 2000 g of diet	Chlorophacinone mixed with 40 g corn oil, added to mash to make 2000 g of diet	Chlorophacinone dissolved in acetone for measurement; acetone allowed to evaporate then residue mixed with 40 g corn oil, added to mash to make 2000 g of diet	Chlorophacinone dissolved in acetone for measurement; acetone allowed to evaporate then residue mixed with 40 g corn oil, added to mash to make 2000 g of diet
Species tested	Albino rats			
Test animal weight range	90-114 g	87-116 g	60-72 g	58-74 g
Number of animals per concentration	5 male and 5 female			
Number of control animals	5 male and 5 female			
Test concentrations	0.45 0.58 0.75 0.97 1.26 mg a.i./kg-diet	0.58 0.75 0.97 1.26 1.64 mg a.i./kg-diet	0.58 0.75 0.97 1.26 1.64 mg a.i./kg-diet	0.59 0.75 0.97 1.26 1.64 mg a.i./kg-diet
Length of test	5 days pre-test 5 days treated feed 9 days post-trt			
Environmental conditions	Individually caged, no other laboratory conditions reported			
Variables recorded	Date of death Weight start of pre-treatment Weight start of treatment Weight start of post- treatment Final weight (end of test or at death) Food consumption during each of the three observation intervals			

Results

ToxAnal2009 was used to determine the LC_{50} and slope (if possible) for each of the studies; statistical output at end of data review. These results are reported in Table 2. All four studies resulted in very similar LC_{50} values (1.14 – 1.26 mg a.i./kg-diet).

Table 2. Summary of test results f or the Albino rat feeding studies conducted at Beltsville Lab.

Test Number	LC_{50} (95% CI)	Probit slope (95% CI)
66	1.14 (1.02-1.36) mg a.i./kg-diet	13.2 (4.5, 21.9)
74	1.26 (0.97-1.64) mg a.i./kg-diet	NA, binomial method
117	1.14 (0.98-1.35) mg a.i./kg-diet	7.2 (3.8, 10.6)
120	1.26 (1.11-1.47) mg a.i./kg-diet	9.9 (4.9, 14.9)

Although all tests had very similar endpoints, the reviewer selected Test Number 117 as the most sensitive at it had a lower LC_{50} and a shallower slope.

No control animals died during the study. Animals were followed for 14 days after the starting the treated diet (5 days treated diet, followed by 9 days clean diet). All mortalities occurred between days 4 and 12 after the feeding of treated diet started. The majority of mortalities were between days 4 and 8. Although the study reports included data on body weight and food consumption, statistical analysis was not conducted for these parameters because of the high rate of mortality.

Description of Use in Document: All four studies are classified as Supplemental. Data can be used quantitatively in risk assessments, but do not meet any OSCPP 850 series guideline protocols.

Rationale for Use: These are the only available short-term feeding studies for mammals.

Limitations of Study: Details regarding laboratory conditions are not provided. Occurrence of sub-lethal signs of toxicity not reported. Necropsy results not reported.

Reviewer: Christine Hartless, OPP/EFED/ERB2

Secondary Review: Kristina Garber, OPP/EFED/ERB2

TNM66
christine chlorophacinone rat feeding

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CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
1.26	10	7	70	17.1875
.97	10	2	20	5.46875
.75	10	0	0	9.765625E-02
.58	10	0	0	9.765625E-02
.45	10	0	0	9.765625E-02

THE BINOMIAL TEST SHOWS THAT .75 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 1.137289

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
1	.8025485	1.137289	.9516522	1.710998

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
6	.4341997	1	.9875364

SLOPE = 13.18468
95 PERCENT CONFIDENCE LIMITS = 4.496789 AND 21.87258

INTERCEPT=-.760149

LC50 = 1.141968
95 PERCENT CONFIDENCE LIMITS = 1.018747 AND 1.364915

LC25 = 1.01507
95 PERCENT CONFIDENCE LIMITS = .8128303 AND 1.128076

LC10 = .9129568
95 PERCENT CONFIDENCE LIMITS = .6165315 AND 1.022396

LC05 = .8568318
95 PERCENT CONFIDENCE LIMITS = .516703 AND .9748389

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TNM74
christine chlorophacinone MAMMAL DIET 74

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CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
1.64	10	10	100	9.765625E-02
1.26	10	5	50	62.30469
.97	10	0	0	9.765625E-02
.75	10	0	0	9.765625E-02
.58	10	0	0	9.765625E-02

THE BINOMIAL TEST SHOWS THAT .97 AND 1.64 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 1.26

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.

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christine chlorophacinone MAMMAL DIET

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
1.64	10	9	90	1.074219
1.26	10	7	70	17.1875
.97	10	2	20	5.46875
.75	10	0	0	9.765625E-02
.58	10	1	10	1.074219

THE BINOMIAL TEST SHOWS THAT .75 AND 1.64 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 1.137289

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
3	.167186	1.16741	1.03287	1.348641

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
5	.2231471	1	.1231517

SLOPE   = 7.187266
95 PERCENT CONFIDENCE LIMITS = 3.792113 AND 10.58242

INTERCEPT=-.3985689

LC50 = 1.1362
95 PERCENT CONFIDENCE LIMITS = .9811681 AND 1.353543

LC25 = .9153946
95 PERCENT CONFIDENCE LIMITS = .7231876 AND 1.052828

LC10 = .7535976
95 PERCENT CONFIDENCE LIMITS = .5182536 AND .8904346

LC05 = .670798
95 PERCENT CONFIDENCE LIMITS = .4201442 AND .8139756

TNM120

christine chlorophacinone MAMMAL DIET

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CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(PERCENT)
1.64	10	9	90	1.074219
1.26	10	4	40	37.69531
.97	10	2	20	5.46875
.75	10	0	0	9.765625E-02
.59	10	0	0	9.765625E-02

THE BINOMIAL TEST SHOWS THAT .75 AND 1.64 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 1.322002

RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
3	.1679367	1.251496	1.110498	1.482791

RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
4	.2603391	1	.7928323

SLOPE = 9.856651
95 PERCENT CONFIDENCE LIMITS = 4.82745 AND 14.88585

INTERCEPT=-.9974919

LC50 = 1.262409
95 PERCENT CONFIDENCE LIMITS = 1.112478 AND 1.467248

LC25 = 1.078373
95 PERCENT CONFIDENCE LIMITS = .8790806 AND 1.212643

LC10 = .9357848
95 PERCENT CONFIDENCE LIMITS = .6783618 AND 1.070919

LC05 = .859642
95 PERCENT CONFIDENCE LIMITS = .5758107 AND 1.002941

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Chemical Name: Chlorophacinone

CAS Number: 3691-35-8

PC Code: 067707

Citation:

Ashton, A.D., W.B. Jackson and H. Peters. 1986. Comparative evaluation of LD_{50} values for various anticoagulant rodenticides in Control of Mammal Pests (eds. C.G.J. Richards and T.Y. Ku) Tropical Pest Management 32 (supplement) 1: 187-197.

Purpose of Review: Litigation/Endangered Species

Date of Assessment: 2/14/2011

Brief Summary of Study Findings:

Study provided a review of acute oral toxicity to the Norway rat (*Rattus norvegicus*) and house mouse (*Mus musculus*) and summarized results from studies conducted by the author (5-day gavage exposure) to several rodenticides (Technical warfarin, pival, chlorophacinone, diphacinone, difenacoum, and bromadiolone). Methods and results will only be presented in this review for chlorophacinone.

Methods

Technical chlorophacinone was suspended in a carrier (propylene glycol) to form a stock solution. Chlorophacinone was pulverized with a mortar and pestle to a fine powder before weighing. Stock solutions were diluted to the correct volume of dose. Dose levels were determined arbitrarily based on the available toxicological information concerning the chemical as known by the authors.

Intubations took place at approximately the same time each day for five consecutive days. The anticoagulant (in its carrier) was administered to rats by a 3" (75 mm) stomach gavage needle at the rate of 1 ml/kg body weight. For mice, dose levels were converted from mg/kg to mg/100 g body weight and administered with a 1" (38 mm) stomach gavage needle at a dose of 1 ml/100 g.

Ten rats (Hsd: Sprague Dawley (SD)BR) ,five males (M) and, five females (F) ,were used at each of four dose levels. Ten wild rats (five M and five F), obtained from the colony maintained on the premises were used at each dose level. Rats' were caged singly throughout the tests in wire-bottomed suspended cages. Mice (Hsd: (ICR)BR) weighing at least 18 g were caged in groups of five by sex in 11 x 7 x 5" (28 x 18 x 13cm) plastic boxes; ten mice (five, M and five F) were used at each dose level. Median lethal doses (LD_{50}) were determined using the method of Weil[1].

[1] Weil, C.S. (1952). Tables for convenient calculation of median effective dose (LD50 or ED50) and instructions in their use. Biometrics 8: 249-263.

Results

Laboratory results are tabulated below. Raw data and dose levels tested were not provided in the paper. The tabular results can be interpreted as: for Sprague-Dawley rats when sexes are combined, an estimated 50% of the tested individuals will die when given a daily dose of 0.19 mg a.i./kg-bwt for 5 days for a cumulative exposure of 0.95 mg a.i./kg-bwt.

LD50 (daily dose), mg a.i./kg-bwt			
Species	**Male**	**Female**	**Sexes Combined**
Sprague-Dawley	0.18 (0.18-0.18)	0.20(0.15-0.27)	0.19 (0.16-0.22)
Wild	0.13(0.10-0.19)	0.23(0.14:-0.36)	0.16(0.12-0.22)
House mouse	0.38(0.16-0.91)	3.48(1.76-6.87)	1.19(0.52-2.70)

Description of Use in Document: Qualitative

Rationale for Use: LD_{50} estimates can be use in the risk characterization section to suggest that daily exposure (gavage) over a 5-day interval may result in a lower LD_{50} than a single gavage exposure. This is the only study for chlorophacinone in which multiple known daily doses are given.

Limitations of Study: Results are limited to qualitative discussion because it is unclear if control animals were used and the length of observation time after study initiation was not reported (i.e., it is not reported if animals were observed for 5 days after start of test, or if they were observed for a longer time period.)

Reviewer: Christine Hartless, OPP/EFED/ERB2

Chemical Name: Chlorophacinone

CAS Number: 3691-35-8

PC Code: 067707

ECOTOX Record Number and Citation: Primus 0165

Primus, Thomas M., J.D. Eisemann, G.H., Mataschek, C. Ramey, and J.J. Johnston. 2001. Chlorophacinone Residues in Rangeland Rodents: An Assessment of the Potential Risks of Secondary Toxicity to Scavengers. In: John J. Johnston (Ed.). Pesticides and Wildlife. ACS Symposium Series 771. American Chemical Society, Washington, DC. Study conducted by APHIS/WS/National Wildlife Research Center, U.S. Department of Agriculture, 4101 LaPorte Avenue, Fort Collins, CO 80521-2154.

Matschke, G. 1999. Chlorophacinone in bait stations for Beldings Ground Squirrel. (completed project report). National Wildlife Research Center. 2pp. (http://www.vpcrac.org/research/documents/COMPLETED%20PROJECT%20REPORTmatschkebeldings.pdf)

Ramey, C., G. Matschke, and R. Engeman. 2007. Chlorophacinone baiting for Belding's ground squirrels. Proceedings of the 12th Wildlife Damage Management Conference (D.L. Nolte, W.M. Arjo, D.H. Stalman, Eds).

Stewart, W.B., G.H. Matschke, G.R. McCann, J.B. Bourassa, and C.A. Ramey. 2000. Hand baiting efficacy of chlorophacinone and diphacinone grain baits to control valley pocket gophers. Proc. Vertebr. Pest Conf. 19:393-397.

Purpose of Review: Litigation/Endangered Species

Date of Assessment: 2/14/2011

Brief Summary of Study Findings:

The primary article in this review (Primus et al., 2001) is supplemented by three additional papers that provide further clarification as to the bait concentrations and application methods for the carcass residues.

The objective of this study was to assess the residue concentrations of chlorophacinone in rangeland rodent carcasses and livers, and to assess their potential hazards to mammalian and avian scavengers, especially raptors. Primus et al. (2001) also included calculated risk quotients; these will not be included or reviewed in this summary. Only information on chlorophacinone residues will be discussed; diphacinone residues will be evaluated separately.

During field studies conducted in California to assess the efficacy of chlorophacinone-treated steam-rolled oats for controlling rangeland rodents, Belding's ground squirrels, valley pocket gophers and *Microtus* spp. carcasses were collected and analyzed for chlorophacinone residues.

The LOD for liver and carcass tissue samples averaged 0.036 µg/g and 0.034 µg/g, respectively. Belding's ground squirrel liver and carcass tissue residues ranged from <LOD to 0.82 µg/g and <LOD to 0.55 µg/g, respectively. Residues in valley pocket gopher ranged from <LOD to 0.42 µg/g and from <LOD to 1.21 µg/g in liver and carcass tissues, respectively. In *Microtus* sp., chlorophacinone residues in whole body tissues ranged from 0.26 to 4.1 µg/g.

Methods

Sample Collection

Carcasses of Belding's ground squirrels were collected above ground during field efficacy trials using chlorophacinone treated steam-rolled oat baits, applied by spot baiting and with bait stations. Studies were conducted in Siskiyou County, California from May to June 1996. Several *Microtus* sp. carcasses were found and collected during the field portion of the bait station study above. These samples were handled, stored, processed, and analyzed using the same methods as for the Belding's ground squirrels.

In addition, field efficacy studies with chlorophacinone and diphacinone treated steam-rolled oat bait used by spot baiting in burrow systems, valley pocket gophers were located and collected underground from October to November 1997. Whole rodent carcasses were collected and placed in individual plastic bags, sealed, labeled, and frozen (-5°C). Samples were then shipped to the laboratory and stored in freezers at -20°C until analysis.

Sample Preparation

Whole animal carcasses were weighed. The pelt, head, and appendages were removed, and the remaining carcass was weighed a second time. A third weight was recorded after finally removing the liver, and the liver was also weighed separately. Individual livers and carcasses (minus head, pelt, and appendages) were frozen and homogenized with a cryogenic mill. Homogenization was completed by freezing the tissue with liquid nitrogen in a stainless steel cylinder and crushing the sample with a stainless steel piston until the sample was a powder. Liver samples were then transferred to a 35 mL glass sample bottle and the carcass samples were transferred to a 500 mL polyethylene bottle. Samples were stored frozen (-20°C) and assayed within two weeks.

Sample Extraction

Homogenized tissue samples were weighed (1.0-1.1 g) into a mortar and 10.0 g of anhydrous sodium sulfate (to remove water from sample) was added. The mixture was ground together with a pestle for five minutes. The solid mixture was then transferred to a 50-mL tube with a powder funnel. The mortar was rinsed three times with 5 mL aliquots of extraction solution and transferred to the 50 mL tube; extraction solution consisted of a 1% formic acid in 1:1 acetone:chloroform. Tubes were vortexed and shaken horizontally on a mechanical shaker at high speed for 20 minutes. Samples were then centrifuged at ~2500 rpm for 5 minutes.

The extract was transferred to a 50 mL glass tube, and the extraction was repeated an additional two times following two subsequent 10 mL additions of extraction solution. Extract solvent was removed by placing the tubes in a warm water bath (≤ 60°C) and allowing nitrogen gas to flow over the surface of the extract until no solvent remained. The residue was reconstituted with 5.0 mL of hexane, gently vortexed and sonicated for 10 minutes.

Analyte Concentration
Each silica SPE (2 g) column was conditioned with approximately 5 mL of hexane. The packing material was not allowed to dry. The reconstituted sample extract was added to the SPE column with a Pasteur pipet. The entire solution was passed through the column (1 to 2 mL/min; typically without vacuum). The eluate was collected in a 25-mL glass tube. Each column was then rinsed with hexane by adding 5 x 2.5 mL aliquots to the 50 mL tube and transferring the solution to the SPE columns. This eluate was discarded. Each SPE column was rinsed with 20 mL (8 x 2.5 mL) of 1:1 ethyl ether:hexane and this eluate was also discarded.

Liver Sample Analyte Elution
A clean 15-mL screw top centrifuge tube was placed under each SPE column. The analyte was eluted by adding 15 mL of 12% (v/v) methanol in ethyl ether. After the last 2.5 mL aliquot of eluant passed through the SPE column, vacuum was used to collect eluant that remained in the SPE packing material.

Carcass Sample Analyte Elution
Carcass sample analytes were eluted similar to the liver samples, except that 20 mL of 15% (v/v) methanol in ethyl ether was added to the SPE column.

Sample Reconstitution
The volume of eluate was reduced by placing centrifuge tubes in a warm water bath and blowing a stream of nitrogen over the solution until the solvent was removed. The remaining residue was redissolved with 1.0 mL of 75:25 methanol:water (with 5 mM tetrabutyammonium phosphate), vortex mixed, and sonicated for 5 minutes. The reconstituted samples were filtered through a 0.45 µm Teflon syringe filter into a vial and capped before HPLC analysis.

High Performance Liquid Chromatography
The HPLC system consisted of a Hewlett-Packard 1090 liquid chromatograph and a Hewlett-Packard 1050 variable wavelength detector. The mobile phase was prepared by mixing aqueous and methanolic solutions of 5 mM tetrabutylammonium dihydrogen phosphate (32:68 v/v) and adjusting the pH to 8.0 with 4 N phosphoric acid. The mobile phase was degassed by sparging with helium. At the end of each set of analyses, the column was washed with a mixture of 1:1 (v/v) methanol:water for 40 minutes. Each tissue sample was analyzed in duplicate.

Quality Control Samples and Control Fortification
Belding's ground squirrels and valley pocket gophers were trapped and euthanized at two study sites prior to any baiting efficacy tests. These animal carcasses and livers were processed and screened for chlorophacinone and diphacinone prior to combining control samples into a composite. Control samples were fortified at 0.10, 1.0, and 10 ppm chlorophacinone with aliquots of fortification standards. The QC samples were then assayed as described above.

Microtus Analysis
Several *Microtus* sp. carcasses were found and collected during the field portion of one of the studies. These samples were handled, stored, processed, and analyzed as described above.

Results

By combining descriptions presented in Primus (2001) and the secondary papers, characterization of the bait exposures and collection methods for each for the field studies was possible. This additional information is provided in the table below.

Carcass and Liver Residues
Residues from Belding's ground squirrels (n = 62) ranged from <LOD to 0.82 µg/g in liver samples and from <LOD to 0.55 µg/g in whole carcass samples. In valley pocket gophers (n = 8), chlorophacinone residues ranged from <LOD to 0.42 µg/g in liver samples and from <LOD to 1.21 µg/g in carcass samples. For samples containing <LOD, the LOD was used to calculate mean and total residue.

Microtus Residues
Chlorophacinone residues in 3 whole animal *Microtus* sp. were 0.26, 0.36, and 4.1 µg/g.

Chlorophacinone Residue Levels in Mammalian Primary Consumers

Exposure information	Carcass species	Sample size	mg ai/kg bait	Mean whole-carcass residue (mg a.i./kg-bw)	Reference
Field, spot bait. Daily carcass searches for 15 days after trt began	Belding's ground squirrel	38	100	6 carcasses <LOD=0.025 32 carcasses: 0.159+0.141(sd) Overall range (0.025 – 0.546)	Primus et al. 2001 (E0165) Ramey et al. 2007 (Quantitative)
Field, bait station. Daily carcass searches for 15 days after trt began	Belding's ground squirrel	16	50	0.122 range (<LOD, 0.265)	Primus et al. 2001 (E0165) Matschke, 1999 (Quantitative)
	Microtus sp. vole	3	50	1.58 range(0.26-4.1)	
Field, bait applied in burrow systems. Radio-collared animals followed for 13 days after application. Collared animals with no movement for 3 days were excavated.	Valley pocket gopher	8	50 and 100	0.357 range (<LOD, 1.21)	Primus et al. 2001 (E0165) Stewart et al 2000 Quantitative

Analytical Recoveries
Mean recoveries of chlorophacinone from liver (n = 24) and carcass (n = 28) QC samples were 80.4 ± 17.2% and 75.5 ± 10.0%, respectively. Two lots of the silica solid phase extraction columns were used to complete the analyses and no differences in recoveries were detected between the two lots.

Analytical recoveries of chlorophacinone in Belding's ground squirrel and valley pocket gopher tissues for QC samples (from Primus 2001).

Fortification Levels (ppm)	*Tissue*	*Range (%)*	*Mean (%)*	*Std. Dev. (%)*	*CV (%)*
Belding's Ground Squirrel					
0.010 - 10	Carcass (n = 17)	60 - 134	83	17	21
0.010 - 10	Liver (n = 17)	55 - 89	74	10	14
Valley Pocket Gopher					
0.010 - 1.0	Carcass (n = 7)	70 - 87	76	5.4	7.1
0.010 - 2.5	Liver (n = 11)	62 - 98	79	11	14

Description of Use in Document: Quantitative.

Rationale for Use: Carcass residue values can be used to estimate intake of chlorophacinone by secondary consumers feeding on contaminated individuals. These field studies cannot be used to estimate the availability of contaminated individuals (alive or dead) to predators and scavengers.

Limitations of Study:
- All potential exposure scenarios to scavengers cannot be estimated and quantified. It is not possible to accurately estimate food availability to scavengers by taking into account the population numbers of potential prey, as well as varying residue concentrations in tissues.
- No control plots were used in any of the field studies.
- The full range of body burdens may not be realized in these data as some carcasses may not have been collected (retrieved by predators/scavengers prior to field collections, death occurred underground, death occurred off the study sites, or carcass not found).
- Data presented on diphacinone residues and the risk assessment (RQ calculations) were not evaluated in this review.

Primary Reviewer: John Marton, Cambridge Environmental, Inc.

Secondary Reviewer: Christine Hartless, OPP/EFED/ERB2