112701
SHAUGHNESSEY NO.

7
REVIEW NO.

EEB BRANCH REVIEW

DATE: IN 4/23/81 OUT 5/18/81

FILE OR REG. NO.

PETITION OR EXP. PERMIT NO. 10182-EUP-12

DATE OF SUBMISSION 3/20/81

DATE RECEIVED BY HED 4/20/81

RD REQUESTED COMPLETION DATE 7/20/81

EEB ESTIMATED COMPLETION DATE

RD ACTION CODE/TYPE OF REVIEW 723/ Nonfood Use EUP

TYPE PRODUCT(S): I, D, H, F, N, R, S Rodenticide

DATA ACCESSION NO(S).

PRODUCT MANAGER NO. W. Miller (16)

PRODUCT NAME(S) Volak Rodenticide

COMPANY NAME ICI Americas, Inc.

SUBMISSION PURPOSE Submission of final report of data gathered under EUP

SHAUGHNESSEY NO.	CHEMICAL, & FORMULATION	% A.I.
112701	Brodifacoum - Talon® + Volak	50 ppm
	other Rodenticides were used	
	in this submission and copies of this	
	report will be placed in the respective files	

Brodifacoum

The data submitted under EPA's Accession Number 244802 covers final reports for the experimental use permit # 10182-EUP-12, the period from September 21, 1978 to September 21, 1980. These reports were submitted by ICI Americas, Inc., Registration & Regulatory Affairs Dept., Agricultural Chemicals Division, Wilmington, Delaware 19897. There are twelve studies in this package. Most of the reports are efficacy studies, and will only have a cursory review.

1) ICI Report Series TMUD 2557/B

VOLAK: Efficacy of Single-Hand Applications of 2 ounce Placepacks at 7.8 lb/A versus Broadcast at 11.3 lb/A Against Pine Voles in a Dormant Apple Orchard (Virginia), Reported: Dale Kaukeinen, Date: May 14, 1979.

Material: Volak - 50 ppm Brodifacoum pellets (JF 5072A: 3/16")

Test Location: Dormant apple orchard (Swing Orchard No. 2, Winchester, VA)

Period Covered: November 3 - December 8, 1978

Target Species: Pine vole (Microtus pinetorum)

Treatment Dates: November 9-10, 1978

Previous Control: Ramik broadcast previous season

Tree Spacing: Block 1 - 24 by 30 feet (60 trees/A)
Block 2 - 15 by 30 feet (97 trees/A)

No. Treatments: 2

Plots per treatment: 3

Total area Treated with PP581: 10.1A (4.1 ha) placepacks; 5.7A (2.3 ha) broadcast

Total Amt. PP581 Applied: 71.9 lb (8.2 kg) placepacks; 64.4 lb (29.3 kg) loose bait

Method of Bait Application: Hand Placement of one 2 ounce pack per active tree under concrete patio tiles or broadcast at 11.3 lb under-tree acreage with Lilly spreader.

Results:

Treatment	Av. %. Initial Act. 11/3	Av. % Fin. Act. 12/1	% Redn. Init.*	Adjusted % Redn.**	Final Trapped Voles/Plot	Final Trapped Voles/Active Site
Volak P-Packs	76	0	100	85	0.33	0.01
Volak B-cast	78	11	87	72	1.33	0.06
Control	83	70	15	---	21.00	0.92

* Reduction in activity ~~activity~~ after test expressed as percent of initial average activity level according to the formula:

% Reduction = 100% - (av. Final % Act. / Av. Int. % Act. x 100)

** Percent active reduction from treatment adjusted on the basis of apparent 15% natural decline in control plot population.

Points of Potential Interest for future reviews:

A) Place packs were considered to afford protection of the bait product from moisture.

B) covered with heavy concrete tiles, the bait is further protected and some hazards to non-targets is removed.

C) No nontarget poisonings were observed.

2) ICI Report Series TMUD475/B

VOLAK: Comparative Control of Pine Voles in Apple Orchards with a single 19 lb/A Mechanical Broadcast Application of 50 ppm Volak Pelletized Bait. Reporter: Dale Kaukeinen, Date: April 2, 1979

	Compound	formulation	Concentration	Rate
Material:	Brodifacoum (PP581)	Volak 3/16" JF 5072A pellets	50 ppm	18.92 lb/A (21.2) kg/ha
	Chlorophacinone	Rozol pellets	50 ppm	22.62 lb/A (25.4) kg/ha
	Bromadiolone	Maki Pellets	50 ppm	15.05 lb/A (16.9) kg/ha
	Diphacinone	Ramik Nuggets	50 ppm	20.27 lb/A (22.7) kg/ha

Test Type: Field Comparison of vole Rodenticides (ranked block design)

Test Location: Dormant apple orchard (Swing Orchard, Winchester, Va)

Period Covered: November 3 - December 8, 1978

Target Species: Pine voles (Microtus pinetorum)

Treatment Dates: Nov. 9, 1978

Previous Control: ROZOL broadcast previous season

Tree Spacing: 30 x 30 ft. (48 trees/A)

No. Treatments: 4 Plots Per Treatment: 3

Total area treated with PP581: 122,400 sq. ft. = 2.8A (1.1 ha)

Total Amount Applied: 35 lb (15.9 kg)

(Note: If Application Rate is 18.92 lb/A and you treat 2.8A then you should use 52.976 lb of material. No explanation for the discrepancy was given.)

Method of Application: Lilly modified spreader, Broadcast treatment

Results:

Treatment	Av.% Initial Act 11/3	Av. % Final Act. 12/1	% Reduction from Intial*	Adjusted % Reduction **	Voles/ Site	% Reduction Voles From Control
Volak	83	1	99	64	0.01	97
Rozol	81	5	94	60	0.02	95
Maki	80	10	87	53	0	100
Ramik	79	21	73	39	0.16	57
Control	79	56	34	---	0/37	---

* Reduced activity according to the formula:

$$\% \text{ Reduction} = 100 - \left(\frac{\text{avg. final \% activity}}{\text{Aug. initial \% activity}} \times 100\right)$$

** Percent activity reduciton adjusted on the basis of a 34% natural reduction in the control plots.

Points of Potential Interest for future reviews:

A) The table of results indicates that Maki is the most efficacious compound followed by Volak, Rozol and Ramik. The text summary states Volak is the most efficacious followed by Rozol, Maki, Ramik.

B) While they admit that they had trouble broadcasting the baits at the same rates, it is interesting that Maki was applied at nearly four pounds of bait per acre less than Volak and achieved nearly the same control level.

C) No evidence of primary or secondary poisoning to non-targets was reported or observed.

3) ICI Report Series TMUD 3354/B

VOLAK®: Effect of Bait Cover Type on Pine Vole Activity and on Volak Bait Pack Open in an Apple Orchard over One year (Virginia), Reporter: Dale Kaukeinen, December 19, 1980.

material: 50 ppm Volak in 2 oz. bait packs

Test Location: Dormant Apple Orchard (Winchester, VA)

Period Covered: April 3, 1978 - May 8, 1979

Target Species: Pine vole

Treatment Dates: Continuous (April, 1978 - May, 1979)

Previous control: yearly test evaluation - none in 1978 prior to study nor additional control until after May, 1979.

Tree Spacing: 25' centers

No. Treatments: 2

Plots Per Treatment: 3

Total Area Treated with PP581: 9.5 acres

Total Amount PP581 Applied: 42 lb (19.1 kg) Volak, or 0.95 mg brodifacoum

Method of Bait Application: Plastic 2 oz. packettes under covers. Covers equate to split rubber tires and concrete cinder blocks.

Comments:

a) No nontarget toxicity was observed.

4) ICI Report Series TMUD 3353/B

VOLAK®: Comparative control of Pine Voles in a Dormant Apple Orchard with 7 lb/A Hand Placement of 2 oz. Bait Packs (Virginia), Reporter: Dale Kaukeinen, Date: December 19, 1980.

Material: Volak 50 ppm pellet in 2 oz. bait pack

Test Location: Dormant Apple Orchard (Snapp-Graves Orchard), Winchester, VA

Period Covered: November 9-30, 1979

Target Species: Pine Vole

Treatment Dates: Nov. 14-16, 1979

Previous Control: yearly test evaluations (none in 1979 prior to this work)

Tree Spacing: Approximately 36 trees per acre (35' centers)

No. Treatments: 4

PLots per treatment: 11

Total area treated with PP581: 4.2 acres

Total amount PP581 applied: 29.4 lb (13.3 kg) Volak or 0.67 mg brodifacoum

Method of Bait Application: Hand bait beneath shingles

Compound	Formulation	Concentration	Rate (lb/A)
Volak	Pellets in 2 oz. Packs	50 ppm	7
Bell ZP	Pellets	2% Zinc phosphide	5
FMC ZP	Oats and Corn grain	2% Zinc phosphide	5
Ramik-brown	Vole - nuggets	50 ppm diphacinone	10

Results

Compound	% Control of Voles Average of 3 plots
Volak	97
Bell ZP	95
FMC ZP	65
Ramik Brown	66

Comments:

A) Volak and Bell ZP appear to give equivalent results even though less Bell ZP was used.

5) ICI Report Series TMUD 2609/B

Volak: Comparative Control of Meadow Voles in Apple Orchards Using Volak and Zinc Phosphide Rodenticides (New York), Reported: Mr. W.H. Palmer, Date: July 3, 1979

Material: Volak 0.005% 3/16 inch pellet and zinc phosphide crack corn 2%

Test Location: Dormant Apple Orchard, North Victory, New YOrk

Period Covered: 4/18 - 5/10/79

Target Species: Meadow Vole

Treatment Dates: 4/19/79

Previous Control: None in previous two years.

Tree spacing: 30 feet by 40 feet (36 tree/acre)

No. treatments: 3 (2 baits plus control)

Plots per treatment: 1

Total Area Treated with PP581: 1.57 A/plot

Total Area Treated with Zinc Phosphide: 1.65 A/plot

Total Amt. PP581 applied: 7.85 lb/plot 5 lb/Acre

Total Amt. Zinc Phosphide Applied: 16.50 lb/plot, 10 lb/Acre.

Method of Bait Application: Hand placement

Results:

Activity decreased 81.4% in the VOLAK plot and 82.1% in the zinc phosphide plot three weeks after treatment.

Comments

A) At the end of the study, it was noted that VOLAK had begun to mold and dissipate whereas the zinc phosphide treated corn, because of its paraffinized formulation, remained basically intact. "It would be reasonable to assume that if baits were not consumed by target rodents, there could be a greater chance of accidental poisoning with zinc phosphide than with Volak Rodenticide.

B) Based on ICI Report # TMUD 3353/B the zinc phosphide could of been applied at a lower rate than 10 lbs/A. In our judgement, comparing a non-paraffinized pellet to a paraffinized grain bait is a poor comparison. If the comparison was to prove broadifacoum more efficacious than zinc phosphide, then the carriers should be similar and the rate of application equivalent.

Compares products NOT the technical

C) No adverse effects to nontargets organisms were reported. They were not actively searched for

6) ICI Report series TMUD 3195/B

VOLAK™: Comparative control of Meadow Voles in a Dormant Apple Orchard with 50 ppm Pellets as Broadcast and Hand-bait Applications (Washington), Reporter: Dr. K.C. Volker, Date January 14, 1981.

material: VOLAK 50 ppm pellets

Test location: Dormant Apple Orchard (Zillah, Washington)

Period covered: December 4, 1979 - March 3, 1980

Target species: Meadow Vole

Treatment Dates: Dec. 11, 1979

Previous Control: 10-16 Ramik brown per acre in 1978

Tree spacing: 18 x 18 feet, 15-year-old trees

No. treatments: 4 (3 baits plus control)

Plot per treatment: 3

Total Area treated with PP581: 1.5 Acres

Total Amount PP581 applied: 15 lbs

Method of bait Application: Broadcast (Hand cyclone seeder)
hand placed bait packs under shingles

Results:

Compound	% Adjusted Reduction
Ramik	56%
Volak	48%
Volak packs	25%
control	0%

NO COMMENTS

7) ICI Report Series TMUD 2552/B

Volak: Comparative Control of Meadow Voles in an Apple Orchard with a 5 lb/A Handbait Application (Washington), Reporter: Dr. K.C. Volker
Date: May 14, 1979

Material: Volak 50 ppm 3/16 inch pellet
Rozol 50 ppm pellets

Test location: Dormant Apple Orchard (Horsley Orchard, Sawyer, WA)

Period covered: Dec. 10, 1978 - January 26, 1979

Target species: Meadow vole, Microtus pennsylvanicus

Treatment Dates: Dec. 21, 1978

Previous control: Zinc phosphide broadcast in 1977, fall 1978 application of zinc phosphide with trail builder for gophers.

Tree spacing: 20 by 20 feet (108 tree/A)

No. treatment: 3 (2 baits plus control)

Plot per treatment: 1

Total Area treated with PP581: 0.4A (0.2 ha)
Total Area treated with Rozol: .4 A/plot

Total Amount PP581 Applied: 2 lb (0.9 kg)
Total Amount Rozol Applied: 4 lb/plot

Method of bait Application: Volak - Hand place
Rozol - broadcast

Results:

Treatment	Adjusted % Reduction
Control	--
Rozol	55
Volak	48

Comments:

A) Since application procedures were different, this test cannot be readily compared. If Volak and Rozol had been applied the same way and at the same rate, then a comparison would be valid.

B) No secondary or non target mortality reported (degree of standoff NOT KNOWN

8) ICI Report Series TMUD 3364/B

Volak™: Comparative Control of Meadow Mice in a Dormant Apple Orchard with 10 lb/A Broadcast Baiting of 50 ppm fellets and 10 lb/A Ramik® Brown Pellets (Oregon), Reporter: Dr. K.C. Volker, Date: January 12, 1981.

Material: Volak 50 ppm Pellets

Test location: Dormant Apple Orchard (Crippen Family Orchards, Hood River, Oregon

Period covered: December 1-27, 1978

Target species: Meadow voles (Microtus sp.), M. canicaudus, (Gray-tailed), M. oregon: (Oregon), M. longicaudus (Long-tailed)

Treatment Dates: Dec. 2, 1978

Previous Control: No prior control for 2 years.

Tree spacing: Varience 16 to 24 feet b/n rows; 30 to 34 feet with trees planted on a diagonal or diamond design.

No. treatments: 3 (two baits plus control)

Plot per treatment: 3

Total Area treated with PP581: 4.6 Acres

Total Area treated with Ramik pellets: (?)

Total amount applied of PP581: 46 lbs

Total amount applied of Ramik: (?) 10 lbs/Acre

Method of bait Application: Hand crank cyclone seeder to broadcast pellets as uniformly by hand as possible.

Results

Treatment	Adjusted % Reduction
Ramik	62
Volak	60
Control	0

Comments:

A) No non-target toxicity was observed. ? the degree of search effort

B) Comparison seem equitable and showed a related value with Ramik a slight edge on efficacy.

9) ICI Report Series 2466/B

VOLAK: Comparative control of Prairie Voles and House Mice in Peach Orchards with a single 20 lb/A Broadcast Application of 50 ppm Volak Pelletized Bait. (Illinois) Reporter: Dale Kaukeinen, Date: March 23, 1979.

Material: 50 ppm Volak pellets
Zinc phosphide-2% on cracked corn

Test location: Dormant Peach Orchard (Alto Pass, IL)

Period Covered: Nov. 9 - Dec. 12, 1978

Target species: Prairie Vole, House mouse

Treatment Date: Nov. 21 1978

Previous Control: Seasonal Broadcast Applications of zinc phosphide at 10-20 lb/A

Tree spacing: 24 by 24 feet (75 tree/acre)

No. Treatments: 2 plus control

Plot per treatment: 2

Total area treated with PP581: 1.3 acres
Total area treated with zinc phosphide: Assumed 1.3 acres
total amount applied of PP581: 26 lbs.
total amount applied of zinc phosphide: assumed 26 lbs.
Method of Bait Application: Hand broadcast throughout plots
Coverage 1 pellet/square foot

\\

Comments

A) No evidence of poisoning to animals other than Rodents in the test plot was noted.

what was looked for? small plot size for hazard

10) ICI Report Series TMUD 2476/B

Volak: Comparative Control of Prairie Voles in Apple orchards with a single 5 lb per a hand application of 50 ppm Volak Pelletized Bait (Illinois), Reporter: Dale Kaukeinen, Date: April 2, 1979

Material: Volak-PP581 3/16 in. JF 5027 50 ppm
Zinc Phosphide - 2% on Cracked Corn 20,000 ppm

Test location: Rendleman Apple Orchard, Alto Pass, Illinois

Period Covered: Nov. 9 - Dec. 12, 1978

Target species: Prairie Voles (M. ochrogaster)
House mouse (Mus musculus)

Treatment Date: Nov. 21, 1978

Previous Control: Seasonal broadcast applications of zinc phosphide at 10-20 lb/A

Tree spacing: 24 x 24 feet (75 tree/acre)

No. Treatments: 2 + control

Plot per treatment: 2

Total area treated with PP581: 1.3 acres (0.5 ha)
Total area treated with zinc phosphide: Assumed 1.3 acres

Total amount of PP581 applied: 2 lb (0.9 kg)
Total amount of zinc phosphide applied: assumed 2 lb (0.9 kg)

Method of Application: Hand bait (1/3 oz. = 10 grams) under shingles. one site per treatment.

Comments:

A) No evidence of poisoning to animals other than rodents in the test plot was noted.

B) This study was billeted as a 5 lb/A application. If as the report indicates each tree had one treatment site, if a 1/3 of an ounce was used at each site and 75 tree per acre only 1.546 lbs/A were applied.

C) Under the table heading "Rate" 5 lb/A does not equal 0.9 kg/ha.

D) Since any or all values could be incorrect-due to either typographical errors or transcription errors, no further consideration should be given to this test until the Registrant can provide accurate information.

II) ICI Report series TMUD 3344/B

VOLAK™: Efficacy To Meadow Voles and Wildlife Hazard from Braodcast Application of 50 ppm Pellets at 9.4 and 41 lb/A in a dormant Apple Orchard (Virginia), Reporter: Mr. D.E. Kaukeinen, Date: December 11, 1980.

Material: Volak 50 ppm Pellet (GFU056)

Test Location: Front Royal, Virginia (Harmony Hollow)

Period Covered: November 6 - December 31, 1979

Target Species: Meadow vole

Treatment Dates: See "A" below

Previous Control: Chlorophacione, Zinc Phosphide

Tree Spacing: unknown

No. Treatments: unknown

Plots per treatment: unknown

Total Area treated with PP581: uncertain

Total amount PP581 applied: uncertain

Method of Bait Application: many reported for same areas with different rodenticides

Results: questionable

Comments:

A) Treatment Dates

	Date	Product or Chem. Name	Amount Reported	Size of Area
1)	11/30/79	Volak (50 ppm)	45.9 kg/ha (41 lb/A)	7.4 ha (18.3A)
2)	11/28/79	Volak (50 ppm)	10.5 kg/ha (9.4 lb/A)	8 ha (20A)
3)	11/8/79	Rozol	? (broadcast)	*
4)	11/16/79	Rozol	? (broadcast)	*

5)	11/15/79	Rozol	? (handplacement)	**
6)	12/5/79	Volak	? (handplacement)	**
7)	last wk. Dec.- 1st week of Jan.	Zinc phosphide (corn)	? (hand. & broad.)	***

* Apple and peach orchard in the northern most section of plot
** East of packing house and extreme southern section of plot
*** broadcast in southern most section of plot; hand bait east of packing house.

B) Population density formula is given several ways with the same factors, which one is correct?

C) Under scheduled - Nov. 15,-17 - 50 lb/A does not equal 2625 total pounds as is indicated.

D) Nontarget mortality
1) 4-Eastern cottontail rabbits: Residue 0.27-1.51 ppm, 6 to 31 day posttreatement

2) 1 white foot mouse: Residue - unknown posttreatment time-unknown

3) 3 Juncos: Residue: 0.31-1.05 ppm post treatment time-11-13 days

4) Influence of the use of brodifacoum is uncertain as far as Raptorial Birds are concerned. Raptors known in area-screech owls, barred owls, great horned owls, red-tailed hawks. Response to tape recorded calls indicated that the screech owl population may have decreased. No explanation for the decrease was given.

5) Unconfirmed report of a cat poisoned with a rodenticide

E) Of interest - If the assumption is made that milligrams of active per kilogram of body weight is equitable to ppm then the junco and rabbits had sufficient residue levels to kill most dogs. The fact that a cat was killed, even though the cause of death was not determined, could lead one to believe that extremely high residues occurred from one or both anticoagulants that were used.

F) No radio telemetry data was submitted, therefore it was assumed that none was used.

G) When discussing mammals in the orchard, deer were noticeably lacking? Hunting occurs in the area, and deer range through the orchard. This could pose a residue chemistry and human effects problem.

H) While this study's proposed guidelines have a few problems, we notice that the actual field research cannot be achieved by merely following the "guidelines". The major problems seem to be lack of control over

the area, lack of manpower, and a general disinterest in proving or disproving a secondary hazard. While the individuals conducting the research appear qualified for the job they have to accomplish, the report primarily considers efficacy.

12) ICI Report series TMU0520/B

Brodifacoum Residues in Voles and other wildlife from a 50 ppm VOLAK™ Treated Orchard-Trailed 24VA79-015
Reporter: Mr. J.P. Ussary Date: August 21, 1980

Site of Application: Front Royal, VA (Harmony Hollow)

See Report # 11 of this document for other pertinent Data, and residue analysis

A. Treatment	Residue in Voles (trapped)	$\bar{X}$ (days after application)
a. 10-lbs/A	not detectable to 5.34 ppm	2.05 ppm (1) 2.59 ppm (6) 0.33 (13)
b. 40-lbs/A	<0.12 to 9.47 ppm	4.29 (3) 5.64 (19)

B. Treatment	Residue in Voles (dead or moribund)	$\bar{X}$ (days after Application)
a. 10-lbs/A	0.34 to 5.86 ppm	$\bar{X}$(?) (7-9 days)
b. 40-lbs/A	0.70 to 7.64 ppm	2.56-4.05 (6 days)

Summary of All Studies

1) These tests seemed primarily concerned with efficacy of Brodifacoum.

2) No secondary poisoning was recorded. Test No. TMUD 3344/B (this report # 11) was supposed to be designed to answer some of the questions on poisoning potential. Mendenhall and Pank's (1980) study indicating secondary hazard to barn owl cannot be disregarded, as Test No. TMUD 3344/B does not contain data that would reverse their findings.

3) Pank, and H. Rata (1976) indicated by their data that a mongoose was affected (terminally) by a dose level equivalent to 4.61 ppm. Since residues in trapped voles (TMU 0520/B) on the 10 lb/A (50 ppm) reached 5.34 ppm, there could be a potential hazard to mammals. Further, Table I in TMUD 3344/B depicts the LD_{50} for dogs to be between 0.25-1.0 mg/kg. Trapped vole residues for day 1, 6, 13 in the 10 lb/A

(50 ppm) plots had means of 2.05 ppm, 2.59 ppm and 0.33 ppm, respectively. Thus, canines in the area appear in danger of dying if foraging takes place in the orchard, upto two weeks after application.

4) What effects were seen upon the local deer herds in the area?

What was the population level of rabbits pre- and post-treatment?

What happended to the raptor research?

How much effort, man hours or some other unit, was expended to to determine that no primary or secondary mortality had occurred?

Bibliography

Mendenhall V.M. & Pank, L.F. (1980) Secondary poisoning of owls by Anticoaqulent Rodenticides. Wildlife Society Bulletin, Vol. 8, No. 4 pp 311-315.

Pank, L.F. & Hirata, D.N. (1976) Primary and Secondary Toxicity of Anticoagulent Rodenticides. U.S. Fish and Wildlife Service, DWRC, Wildife Damage Research Station, Hilo, Hawaii, Job Completion Report, Work Unit DF-103.7.

Russel T. Farringer, III
Wildlife Biologist
Ecological Effects Branch/HED

5/27/81

Raymond Matheny FB. for RWM
Head, Review Section I
Ecological Effects Branch/HED

Clayton Bushong
Branch Chief
Ecological Effects Branch/HED

5/27/81

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE: 12/16/80

SUBJECT: Trip Report - Front Royal VA.

FROM: John Tice and Russ Farringer

TO: Ecological Effects Branch

THRU: Clayton Bushong, Branch Chief

Trip Report

On December 1, 1980. John Tice and Russel Farringer visited Front Royal and Winchester, Virginia. Front Royal was the study site of a recently approved experimental use permit for Volak (Brodifacom #112701). Because the bait was broadcast in a dormant orchard, interest in this study centered around the efforts to assess secondary hazard to raptors. The raptors indentified in the area and subsequently fitted with radio transmitters were 3 screech owls, a barn owl and a kestral. The monitoring of their movements, their food habits as well as the general design of the experiment were the major topics of conversation.

We were met on December 1 by Messrs. Jim Wagner and Dale Kaukeinen of ICI and Dr. Ross Byers of the Winchester Fruit Research Laboratory (WFRL). (WFRL is a research facility of Virginia Polytechnic Institute and State University.) During our afternoon meeting in Winchester, Dr. Byers explained various aspects of the experiment as well as the need for an efficacious rodenticide to protect orchards from damage caused by pine and meadow voles. Also discussed were various cultural practices and the latest techniques used for controlling vole populations. After our discussions we adjourned to the study site.

The study site is located in an isolated valley south of Front Royal, VA. On location, Dr. Byers' research assistants, Mark Merson and Lenny Leta joined us and showed us around the 175 acre site. As we were being guided through the area the reality and complexity of a natural ecosystem, as opposed to one described on paper, was eye opening. Mark pointed out many trees that had sustainted vole damage and explained the census techniques being used. Our attention was then directed to the birds. The radio direction finding equipment was demonstrated. Two birds (the kestral and barn owl) were located and visually sighted. The tour of the orchard was concluded at sundown.

On December 2, Dale and Lenny presented a slide show at the laboratory covering various aspects of ICI's past and present efforts to determine the extent of secondary hazards to birds as a result of using Volak and Talon. At the conclusion of the slide presentation, discussion was was directed to the current experiment and ICI's aspiration for Volak. Around noon, no new or important information was being exchanged so our meeting was concluded and all concerned returned to their respective duties.

For those interested in a more detailed discussion of the protocol, our findings and the discussion of the protocol will be placed in the brodifacoum folder.