A PILOT CONTROL PROJECT TO EVALUATE OPERATIONAL USE OF BT AGAINST THE WESTERN SPRUCE BUDWORM IN MONTANA

1981

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INTRODUCTION

As part of a national effort and in cooperation with the Intermountain and Pacific Northwest Regions, the Northern Region will conduct a pilot project using Bacillus thuringiensis Berliner (Bt) against the western spruce budworm in central Montana. A sister project will be conducted in the Southwestern Region. The purpose is to evaluate efficacy of two registered formulations of Bt against the western spruce budworm under operational conditions across the range of this insect. Project results will be presented in a manner which will permit comparisons between the two projects.

This project is part of a Forest Service commitment and effort to make additional materials and particularly biologicals available for budworm control. Since the ban on the use of DDT, forest managers have been evaluating other agents to manage forest defoliators. Bt, bacilovirus, and insect growth regulators (IGR) are candidate materials which are more environmentally exceptable than conventional chemical insecticides. Because Bt is a biological insecticide, it would be an important addition to a resource manager's pest management options. Bt would find many uses in sensitive areas where conventional insecticides may be hazardous. Some of these areas might include: Along waterways, near lakes, domestic watersheds, special wildlife and inhabited areas.

This plan describes the objectives, project location, project design and sampling procedures, administration and organization, budget, etc. Project design and sampling procedures for this project are similar to those of recent Forest Service projects in the West. Minor variations to the basic pilot project design were made based on Bt's mode of action. A few other changes to the traditional design were made to incorporate recommendations from Research and the Bt task force.

OBJECTIVES

The objective of this project is to obtain data on the performance of two registered formulations of Bt (Thuricide 16B and Dipel 4L) on western spruce budworm.

Specific tasks include:

1. Identify and attempt to resolve problems associated with mixing and application of the two commercial formulations.

2. Determine unit cost for use of Bt against western spruce budworm.

3. Measure effect of Bt on target pest population reduction and foliage protection during the year of treatment and for 2 more years following treatment, when contiguous areas are left untreated.

4. Compare efficacy in two widely separated portions of the target pest's range (Northern Rockies vs Southwest).

5. Obtain aerial photography and compare differences between treated and untreated areas.

PROJECT LOCATION

This project will be located in western spruce budworm infested Douglas-fir stands on portions of the Deerlodge and Beaverhead National Forests in Montana (figures 1a and 1b). The overall project area extends from Jerry Creek area, Wise River Ranger District, on the southwest to Whitetail Creek, Jefferson Ranger District, on the northeast. Budworm outbreaks have occurred often in these areas. Data collected from an intensive egg mass survey conducted in 1980 indicate moderate to heavy defoliation over much of the area in 1981. The actual spray blocks and boundaries will be selected and adjusted using information from a field check of larval density in early May 1981. This area consists primarily of Douglas-fir stands along the forest fringe between 5,400 and 6,900 feet elevation MLS.

Forest activities on this land include, but are not limited to, timber harvesting, grazing allotments, summer homesites, summer and winter recreation, small and big game hunting, mining, and watershed.

INSECTICIDES

Thuricide 16B and Dipel 4L are formulations of spores and crystalline bodies produced by the bacterium Bacillus thuringiensis Berliner. To be effective the larvae must ingest Bt. When ingested, the crystalline inclusion soon dissolve releasing a toxin that paralyzes and disrupts the gut wall. Feeding may stop within 30 minutes to 2 hours. Death generally follows in 3 to 5 days. Effect of sublethal doses on larval activity is unknown. Unlike chemical pesticides, Bt formulations are very selective. It is only toxic to the larval stage of Lepidoptera (butterflies and moths). Examples include spruce budworm, gypsy moth, tent caterpillars, spring and fall cankerworm, cabbage looper, etc. To the best of our knowledge other forms of life are not affected. Neither product has shown phytotoxicity when applied at the recommended rate. Bt is exempt from residue tolerance requirements on food crops. No toxic or adverse effects are known for humans, wildlife, fish, earthworms, honeybees, etc. Both Thuricide and Dipel are registered for many insects including western spruce budworm on a wide variety of crops and forest trees.

PROJECT DESIGN

This project will entail one aerial application of Thuricide 16B and Dipel 4L each at 8 BIU/gal/acre against mid-instar larvae. Each treatment will be replicated three times on blocks of 2,000 to 4,000 acres. Three other 2,000- to 4,000-acre blocks will serve as controls and will not be treated. Blocks will be located to avoid drift between blocks.

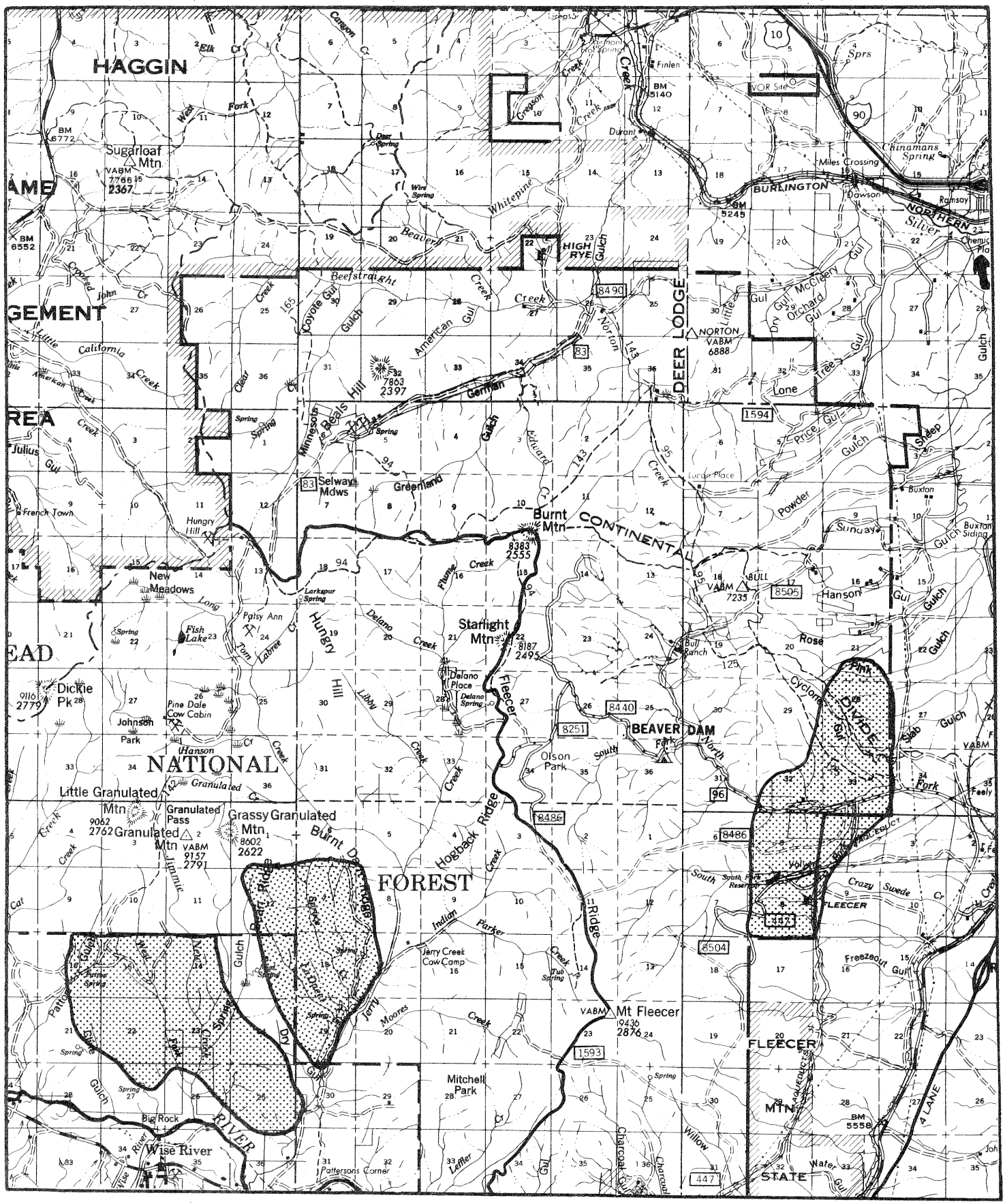


Figure 1a. Approximate block locations for Bt project, 1981.

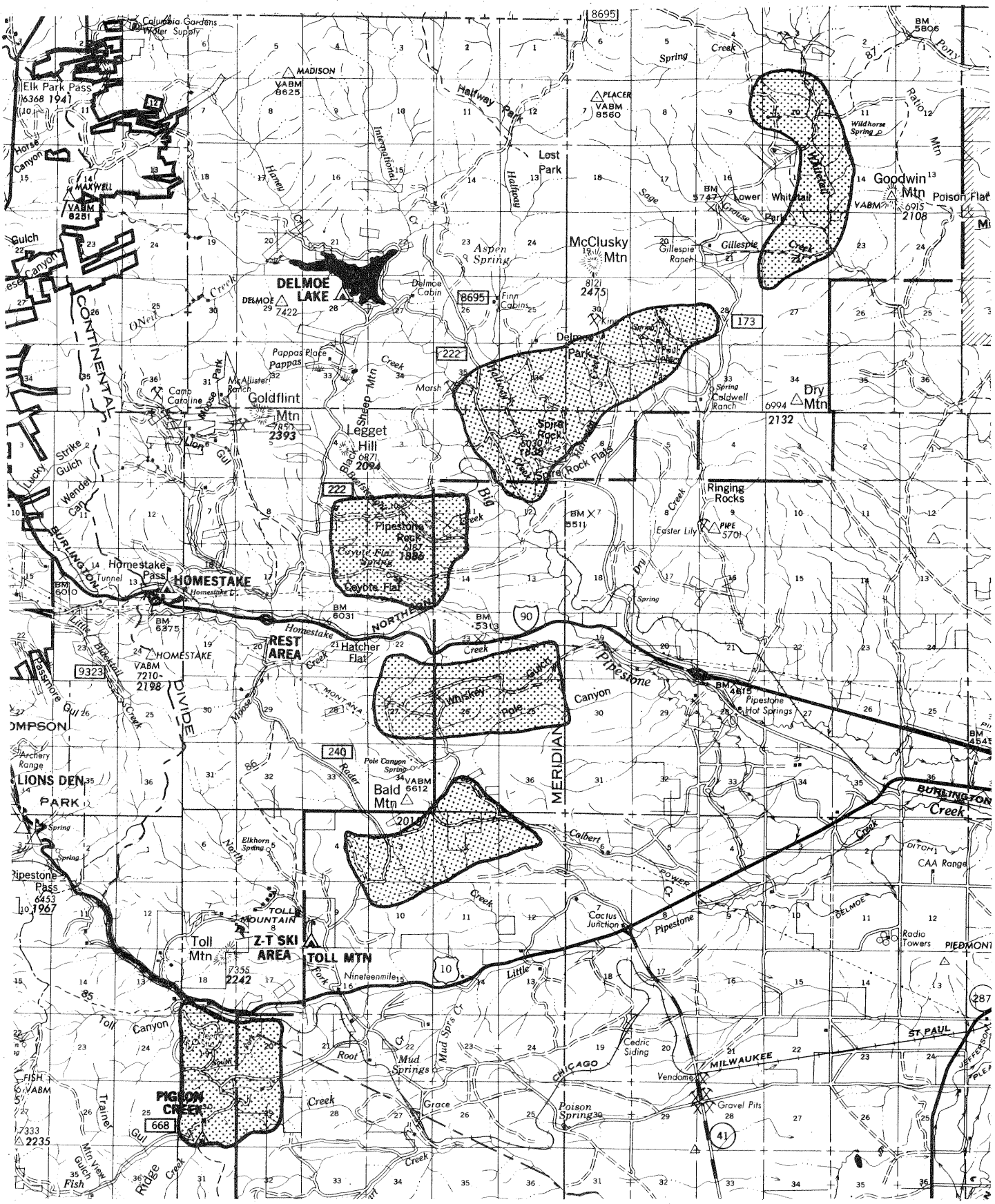


Figure 1b. Approximate block locations for Bt project, 1981.

Block Selection

Each treatment and check block will be selected on the basis of (1) budworm population density (> 15 and < 45 larvae per 100 shoots), (2) host type (> 40 percent Douglas-fir), (3) topography (gentle to moderate), and (4) access (good to excellent). Where possible, block boundaries will follow prominent topographic features for ease of identification and location by spray pilot and aerial observer. Breaks in type or clearings will also be used as boundaries.

Sample Clusters

Cluster plots of three trees each will be established within each block and used as the basic sampling unit. Twenty-five 3-tree clusters will be selected in each block. Budworm population density will be based on the mean number of larvae per 100 shoots. These clusters will be carefully selected and distributed throughout each block in order to best represent stand conditions within each block, and will be located at least 2 chains from the boundary and/or roads.

Sample Trees

Trees selected for sample cluster trees will be open grown Douglas-fir, 35-60 feet tall, with full crowns. Previous defoliation should be less than 25 percent. All trees in a cluster will be located within a 1-acre area (radius of 118 feet).

Sampling Periods

Sampling of various life stages will be made at six different times during the project as follows:

1. Development sample to measure larval development by instar in order to calculate percent in each instar, and to determine stage of bud development.

2. Prespray sample to determine prespray larval population density in each block.

3. Postspray sample to measure postspray population density 7 days after spraying.

4. Postspray sample to measure postspray population density 14 days following treatment.

5. Postspray sample to measure postspray population density 21 days following treatment.

6. Postspray sample to measure postspray egg density and percent defoliation.

SAMPLING PROCEDURES

Development Sampling. An accurate determination of larval development and development of new foliage is essential for the proper timing of the insecticide application. Ten single-tree plots, which will be independent of the cluster plots, will be established well in advance of the projected treatment date. These plots will be distributed throughout the elevational range within each block. Development sampling will begin when the vegetative buds begin to break. Two branches 45 cm in length will be cut from opposite sides of the midcrown of each tree and placed individually in paper bags. Sampling frequency will increase to daily when the number of third instar larvae approaches 75 percent.

Prespray Sampling. The prespray population sample will be taken within 24 to 48 hours of spraying when it is determined by the development sample that 50 percent of the larvae are in the fourth instar and that sufficient new foliage is exposed. The prespray sample will be retaken if the block is not treated within 48 hours after the prespray sample was taken. Four 45-cm branches will be removed from the midcrown quandrants (north, east, south, west) from each of the 75 cluster trees in each block. Extreme care must be exercised in order to avoid knocking larvae off the sample branch as it is being cut. Careless knocking of branches will result in an understimate of the population.

Each branch and all contents of the catch bag will be placed in separate paper bags. All the bags from each cluster will be fastened together and transported to the laboratory. During handling and transfer, care will be taken to keep samples cool and out of direct sunlight.

Postspray Sampling. All postspray samples will be taken from the same cluster trees that were used for the prespray sample. Three postspray population density samples will be collected; one at 7, 14, and 21 days following treatment. Prespray sampling procedures will be used. Again, care should be taken not to dislodge larvae from sample branches or other branches on the tree. Individually bagged branch samples will be taken to the laboratory for larval counting.

When egg hatch is complete, egg density and defoliation data will be collected. Four 70-cm branch tips will be cut from midcrown of each sample tree. Using a six-class defoliation rating system, 25 shoots from each branch will be rated as follows:

Percent defoliation	Rating
0	0
> 0-25	1
>25-50	2
>50-75	3
>75-99	4
100	5

Two of these branches will be bagged and returned to the laboratory for egg mass examination.

Laboratory Procedures. The basic function of the field laboratory will be to count and tabulate all larval data from branches collected during the different sampling periods. Branch samples delivered to the laboratory will be placed in cold storage (4° C.). Samples arriving each day will be processed no later than the end of the next day. Specific procedures are described as follows for each sampling period:

1. Development. Each branch will be thoroughly examined for budworm larvae. All larvae will be collected and placed in 70 percent ethyl alcohol. Larvae will be separated by instar by a trained technician on the basis of physical characteristics and head capsule size. Blocks will be released for treatment when the 25-plot mean shows that 50 percent of the larvae are fourth instar or more and sufficient new foliage is exposed.

2. Prespray. Data required from the prespray samples are number of vegetative buds (shoots), length and width (inches), number of budworm larvae, and number of other defoliating larvae. Population data will be expressed in terms of the number of budworm per 100 shoots.

3. Postspray. Laboratory procedures will be the same as described under prespray except all live larvae and pupae collected from the 21-day sample will be placed in rearing cups. Final count will be the number surviving to the adult stage.

Aerial Photography. Aerial photographs will be taken of each block during peak defoliation. Partial coverage with both vertical and oblique photographs will be taken from light aircraft. One or two flight lines per block will be used to take vertical stereo triplets in each block. A 70-mm camera will be used to produce print scales of 1:6000 and 1:12000. Stereo obliques will be taken along a single flight line that will best show stand conditions.

PROJECT COORDINATION

The success of any spray project is dependent upon coordination. In this view, daily briefings will be conducted each evening with key personnel. Weather briefings, insect development, air operations, personnel needs, deposit sampling, and spray scheduling will be discussed at these meetings.

The manner in which the spray block is sprayed may determine wether or not project objectives are met. Therefore, the pilot will be thoroughly oriented as to project needs and will be briefed daily. The pilot is an essential team member. Abbott (Dipel 4L) and Sandoz (Thuricide 16B) will have a representative on site during mixing and application to answer any technical questions.

TIMING

The release of each block for treatment will be made when 50 percent of the larvae are in the fourth instar and when sufficient new foliage is exposed. At the time a block is released, the prespray sample will be taken. If a block is not sprayed within 48 hours of the prespray sample, another prespray sample will be needed prior to treatment.

MIXING

Mixing will be done as part of the aerial application contract under direct supervision of a project officer. A company representative will be available for on-site technical assistance. The specific mixing procedures for each product will be specified by Abbot and Sandoz.

The following 2,000-gallon tank mixes will be used:

Dipel 4L		Thuricide 16B	
Dipel	500 gallons	Thuricide	1,000 gallons
Water	1,469 gallons	Water	989 gallons
Rhodamine	10 pounds	Rhodamine	10 pounds
Acrylocoat	30 gallons	Acrylocoat	10 gallons

APPLICATION

The spray mixture will be applied by an agricultural spray aircraft of the type generally used for defoliator control in a forested environment. Spray aircraft will be calibrated to insure the desired application rate of 1 gallon per acre. The aircraft will be characterized for atomization by spraying a small amount of each tank mix over an open area. Approximately 50 gallons of each tank mix will be required for characterization. To minimize variation in the application, only 1 day will be allowed to spray any given block.

As part of the aircraft contract, the contractor will furnish the equipment necessary for mixing and handling the spray mixture. The contractor will provide a 2,000- to 4,000-gallon mixing tank with mechanical agitation and a metered pump to measure loading. All insecticide mixes for a day's operation can be prepared with equipment of this type. Under no circumstances will a tank mix be used that is more than 24 hours old.

AIR OPERATIONS

Air operations will be based out of the Butte airport, Butte, Montana. All spray operations, loading and mixing will be done by contract. A project officer will be present to check for compliance with control specifications and safety procedures. Spraying will be done by one or more aircrafts

capable of treating 2,000 to 3,000 acres in 3 to 4 hours. Spraying will commence at daybreak and continue until one block is complete or weather conditions deteriorate. A helicopter will serve as an observation ship during spraying. An aerial observer will ride in the observation ship and map progress.

SPRAY DEPOSIT ASSESSMENT

Spray deposit assessment will be evaluated on the amount of spray material deposited on Kromkote® cards in holders (together referenced as samplers) placed in the spray block. The cards will be placed in position during the predawn hours before spraying. Twelve samplers will be located at each cluster in the block, four per sample tree. A marking agent, Rhodamine dye, will be added to the water base spray at the rate of 1 pound per 100 gallons of tank mix.

Four spray deposit cards will be put in cardholders and placed on wooden stakes at the drip line of each tree in each cluster. These cards will be placed at the four cardinal directions of each sample tree (300 cards per block).

Cards will be analyzed on the Quantimet® at Los Alamos Scientific Laboratory to determine the number of drops deposited per cm^2 and gallons of tank mix per acre. This analysis will be coordinated by specialists from Forest Pest Management, Methods Application Group, Davis, California.

METEOROLOGY

Local weather forecasts and weather observations during the application phase will be provided by a meteorologist from National Oceanic and Atmospheric Administration (NOAA). Forecasts on local weather will be presented to the Project Director each evening at the project team briefing.

A weather observer will be stationed in the spray block during the application to monitor windspeed, relative humidity, and temperature at the 2-meter level. Spraying will terminate when either the temperature exceeds 18° C. or windspeeds are over 8 mph. Rain gages will be placed in each unit 10 days before the projected spray date to measure precipitation prior to spraying and 5 days after spraying.

DATA ANALYSIS

No single factor will be used to evaluate the overall effectiveness of this project. The final evaluation will be based on a composite analysis of population reduction, foliage protection, egg mass densities, and visual defoliation. Specific analyses will be made as follows:

Table of means and standard errors

Estimates of larval population density by cluster will be computed for each block (treatment and controls) and for each sampling period (prespray, 7, 14, and 21 days). These data will be expressed as the number of larvae per 100 shoots. For each block and sampling period the block mean and standard error will be displayed in tabular form.

Block mean formula:

$$Yij = \left(\sum_{k=1}^{Mij} Yijk \right) \Big/ Mij$$

Block standard error formula:

$$S.E.\,yij = \sqrt{\frac{\sum Yijk^2 - (Yijk)^2}{Mij\,(Mij - 1)}}$$

Cluster level values for larvae per 100 shoots will be computed as follows:

$$Yijk = \left[\sum_{e=1}^{\text{No. trees}} \left(\frac{\sum_{m=1}^{\text{No. branches}} \frac{(\text{budworm larvae})\ em}{(\text{buds})\ em}}{(\text{No. of branches})_e} \right) \right] \Big/ (\text{No. of trees})$$

Yijk represents the number of budworm larvae per 100 shoots for the kth cluster in the jth block of the ith treatment.

Estimates of egg density per square meter will be computed as follows:

$$Yijk = \left(\sum_{m=1}^{\text{branches}} \left(\frac{\text{No. of Egg mass}}{\text{area}} \right) \right) \Big/ (\text{No. of branches})$$

Defoliation estimates based on a 6-class rating system will be computed as follows:

$$Yijk = \left(\sum_{m=1}^{\text{branches}} (\text{Defoliation Index})\ m \right) \Big/ (\text{No. of branches})$$

Analysis of Variance Model

$Yijk = M + Ti + Lij + Nijk$

Where Nijk is the sampling error due to subsampling within each block

Lij is the experimental error between blocks

Ti is the effect due to treatments

Yijk is the observation (budworm/100 buds in the kth tree from the jth replication in the ith treatment)

i = 1, 2 treatment (Thuricide, Dipel, control)

j = 1, 2, 3 replicates

k = 1, . . ., 25 clusters within each block.

Spray Deposit Data

For each spray block the ASCAS computer program will be used to compute drops per cm^2, VMD, mean number of drops, and recovery rate (gallons per acre).

Aerial Photographs

Visual defoliation will be rated as light, moderate, or heavy on stereo vertical and oblique photographs. A qualitative analysis will be made from between block differences.

PESTICIDE STORAGE AND DISPOSAL

Pesticides will be stored near the project headquarters as stated in the guidelines (FSM 2157.2). These guides include the following:

1. Store in a locked dry storage shed where unauthorized personnel cannot come in contact with them.

2. Plainly label each entrance to the pesticide storage area with prominent waterproof signs bearing the words "Pesticide Storage."

3. Store pesticides in the original, labeled container, making sure each label is both visible and legible.

4. Store empty pesticide containers as though they were full until proper disposal can be arranged.

5. Never store pesticides near food or animal feeds.

The local fire department will be notified of the storage area, its contents, and any special hazards should there be a fire.

Disposal of unused pesticides and pesticide containers will follow the procedures and guidelines found in FSM 2157.3.

POSTTREATMENT YEAR EVALUATION

Posttreatment (1982 and 1983) surveys are planned to evaluate carryover and possible long-range effects of these treatments. This evaluation will consist of egg mass density and defoliation data from each cluster tree for up to 2 years following treatment.

ADMINISTRATION AND ORGANIZATION

Personnel from Forest Pest Management (FPM), State and Private Forestry, Region 1, in cooperation with the Deerlodge National Forest, will conduct and administer this project. Coordination and supervision of the project will be with the Forest Supervisor with assistance from FPM. Project organization is illustrated in figure 2. The responsibilities and duties of each position are described below:

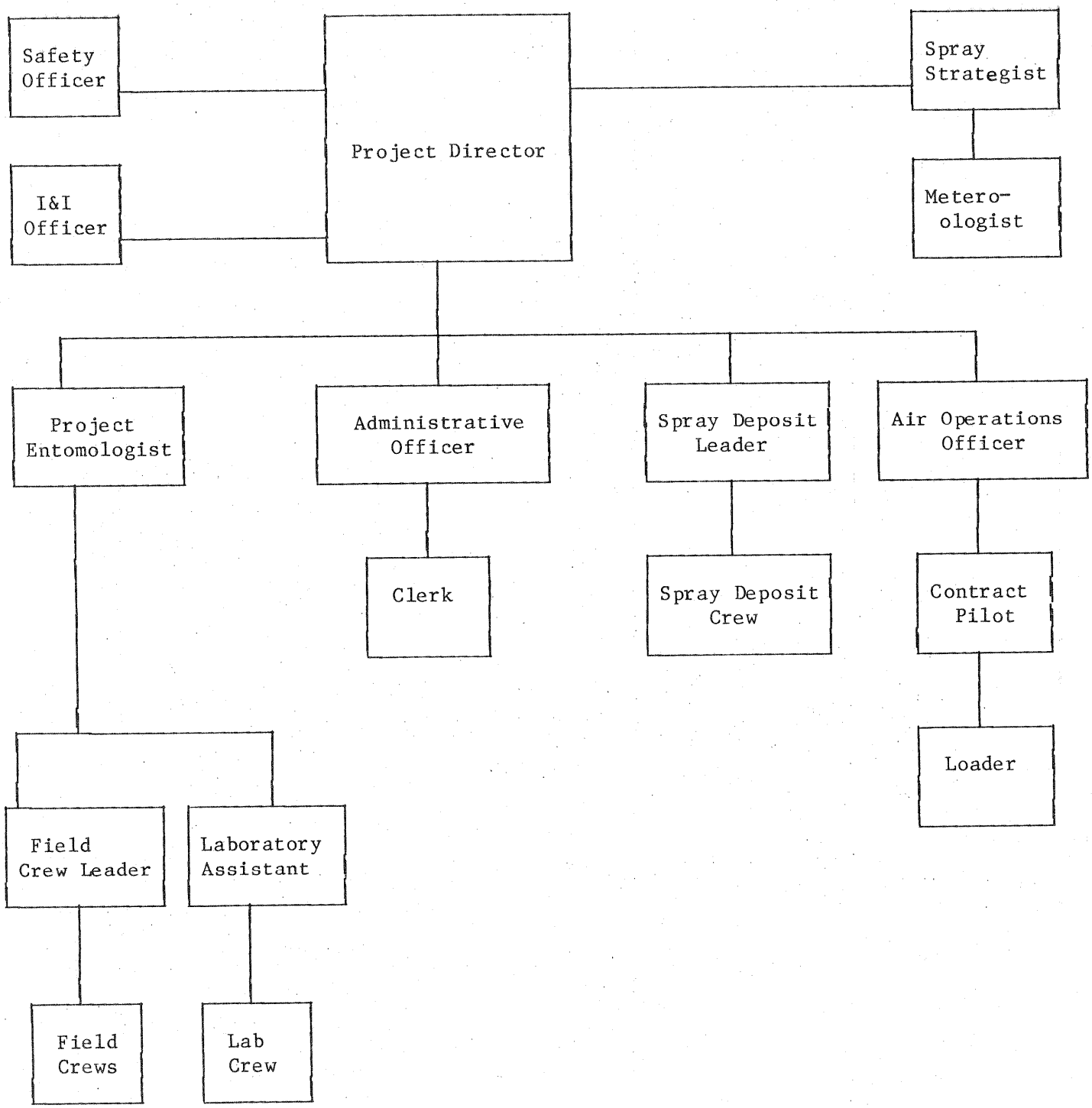
1. Project Director. Overall responsibility for the entire conduct of the project including the coordination of all key project personnel. Will also provide contact with all outside agencies and prepare the final reports.

2. Administrative Officer. Will report directly to the Project Director and be responsible for timekeeping, contract administration, purchasing, recordkeeping, and clerical duties.

3. Inform and Involve Officer. Will prepare and distribute timely news releases through the appropriate media. Will also serve as spokesperson to the public and attend and/or conduct public meetings as required.

4. Safety Officer. Will insure that all phases of the project are conducted in the safest manner possible. Will review all safety plans for sound principles and make recommendations for the correction of any unsafe practices or conditions.

Figure 2.--Organizational Chart



5. Project Entomologist. Will be responsible for the entomological phase of the project. Specific duties will include training field and laboratory personnel, maintaining proper records, maintaining data summaries on insect development and population, and releasing blocks for treatment.

6. Field Crew Leader. Train and supervise field crews with emphasis on quality of work and safety in establishing sample plots, marking boundaries, and collecting samples.

7. Laboratory Crew Leader. Train and supervise laboratory crews in instar determinations, foliage examination, and recordkeeping.

8. Spray Strategist. Advise Project Director on all aspects of spray operations and meteorology.

9. Meteorologist. Will be responsible for all forecasts and assist with weather monitoring during the project.

10. Air Operations Officer. Will be responsible for developing and execution of the air operations work plan, coordination of air safety, and act as aerial observer. Will also maintain detailed data on each spray mission--aircraft, gallons, area sprayed, etc.

11. Spray Pilot (Contract). Will brief the Spray Strategist on proposed spray swath distribution prior to spraying each block. Will make final decisions regarding the proper and safe use of the spray aircraft.

12. Loader (Contract). Will be responsible for loading and keeping load records by aircraft load and spray block.

13. Clerk. Principal duties include telephone, payroll (T&A's), vouchers, records, and report keeping.

INFORM AND INVOLVE

The I&I function for this project will be to insure that key individuals and the general public are informed about this project, especially the significance and safety of Bt in integrated pest management (IPM). A separate I&I plan will be prepared (see appendix D). The I&I Officer will be responsible for the following:

1. To meet individually with key contacts.

2. Timely news releases.

3. Public meetings.

4. Open house for news media.

5. Prepare videotape coverage on all project phases.

6. Describe problem and proposal through pictorial displays.

7. Prepare public service announcements.

SAFETY

The Forest Service Health and Safety Code will provide the basic guidelines for all phases of this project. Particular attention will be given in the areas of vehicle use, pesticide storage and handling, and air operations. The Project Safety Plan will outline specific directions (appendix A).

Financial Summary

	Funding		Subtotals
	R-1	Special	
Aircraft			
Spray and mixing		80,000	
Helicopter (admin. & recon. and chase)		18,000	98,000
Pesticides			
Thuricide 16B		47,925	
Dipel 4L		40,387	
Rhodamine Dye		3,680	95,367
Acrylocoat		3,375	
Vehicles			
Rental		9,300	
Gasoline and oil		3,000	
Service and repair		500	12,800
Equipment			
Lab		3,000	
Field		4,000	7,000
Administration			
Salaries	22,000	47,000	
Per diem		15,000	
Overtime		19,700	81,700
Services			
Spray deposit analysis		9,500	
Meteorology		1,000	
Telephone		500	
Lab rental		1,200	
Maps and photos		300	
Data analysis		200	
Cold storage		1,200	
Defoliation and egg mass survey		11,000	24,900
Reports and Information			
Final Report		1,400	
Videotape		5,000	
News releases		N/C	
Displays		800	
Public Service Announcement		1,700	
Public meetings		N/C	
Environmental Analysis		3,000	11,900
Overhead			
Forest @ 30% on 71,400		21,000	21,000
Total by Source	22,000	352,667	
Grand Total			374,667

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APPENDIX A

BT PILOT CONTROL PROJECT
SAFETY PLAN 1981
PREFACE

A pilot control project to test the effectiveness of an aerial application of Bt (Bacillus thuringiensis Berliner) against the western spruce budworm (Choristoneura occidentalis Freeman) will be conducted in 1981. The project will be carried out in mixed conifer stands on the Deerlodge NF, Montana; the objective is foliage protection with resulting lowered amounts of tree mortality and annual growth loss. Success of the insecticidal applications will be determined by resultant larval mortality in treated blocks when compared to natural larval mortality in untreated check blocks. Aerial applications will be made using fixed-wing aircraft with a helicopter used as an observation craft. Ground and laboratory crews will support the aerial portion of the project. The Project Work Plan details procedure, policy, objectives, and personal responsibilities attendant to the project. This document, as a supplement to the work plan, further outlines each individual's responsibility for the safe conduct of the project.

GOALS

The safety goals of this project are the prevention of accidents and the protection of each person involved. To meet these goals, the following objectives must be met:

1. Each person involved in the project, regardless of the nature of that involvement, must strictly adhere to safety practices outlined here and in other supporting documents.

2. No fatalities and no lost-time injuries.

3. Prevention of accidents, both on and off the job.

4. Management must accept responsibility for the safe operation of the project. Further, each employee must accept responsibility for his own safe conduct.

RESPONSIBILITIES

The Project Director is directly responsible for the project's safety program which includes the directives outlined in this plan as well as governing articles found in FSM 6700, FSH 6709.11 (Health and Safety Code Handbook) and FPM Unit Safety Plan. In addition, he will insure that all personnel are provided nonhazardous working conditions; proper training to do their job safely; safe, defective-free equipment; adequate first aid training and supplies; and adequate time to do their job safely. The Project Director will also be responsible for supervising the use of all pesticides, including their transportation, mixing, storage, and disposal.

The Project Safety Officer is responsible for the implementation of the Project Safety Plan. He will assure that policy and practices of safety are adhered to by every individual engaged in any facet of the project. He will be under the immediate supervision of the Project Director.

GENERAL SAFETY PLAN

Prevention

The following preventive measures will be followed during the project to reduce the probability of an accident or lessen its severity should one occur:

1. The general public will be kept out of the spray area during application.

2. No spectators will be allowed in the loading area.

3. No smoking will be permitted within 50 feet of any fueling or loading operations.

4. All field and laboratory crew members will be provided safety and first aid training prior to the project. This training will include specific hazards recognition and instruction concerning safeguards necessary while working around spray material, equipment, and vehicles.

5. Loading and fueling area for fixed-wing aircraft and helicopters will have a vehicle equipped with a two-way radio, first aid kit, fire extinguisher, stretcher, and fire tools. This vehicle will also serve as an ambulance should the need arise.

6. The nearest hospital will be notified concerning the nature of the project and the type of pesticide being used.

7. Emergency telephone numbers will be posted in all work areas.

8. Preventive measures identified in other parts of the plan will also be adhered to.

Ground Vehicles

The operator of any vehicle has primary responsibility for the safe maintenance and operation of that vehicle. All vehicle operators must have a valid Government operator's license and be familiar with FSH 7109.18 (Driver-Operator Handbook). They will observe all State, local, and Forest Service driving regulations.

The operator and all passengers will travel with safety belts fastened at all times. No vehicle will carry more passengers than the number of safety belts provided for them.

Both the Driver-Operator Handbook and the Health and Safety Code Handbook provide suggestions for safe vehicle operation. Each driver must, however, recognize his responsibility to:

1. Consider the differences between highway driving conditions and those existing on most forest roads. Roads are often narrow, winding, unpaved, and steep. Sight distances are lessened by curves, dust, etc., and the driver's ability to see and be seen is often greatly reduced.

2. Drive defensively. The best defense against vehicle accidents is learning to recognize hazards and ways to avoid them. On forest roads, defensive driving is particularly important. Drive with headlights on, drive more slowly, keep to the right, and expect another vehicle at each blind curve. Anticipate that all other vehicle operators will do something wrong.

At the beginning of each day, the vehicle operator should check for proper functioning of the mechanical systems of his vehicle; check condition of tires and wheels; maintain adequate fuel, oil, and fluid levels. Report needed repairs or equipment to the Field Crew Leader.

Air Operations

This pilot control project will entail the use of both fixed-wing aircraft and helicopters. Most phases of the project having to do with aircraft and air operations will be conducted by personnel under Government contract; however, Government employees will become involved with these operations on occasion. All personnel so involved must be aware of particular hazards and be prepared to exercise necessary caution.

Though these operations must be viewed as hazardous by their very nature, most accidents involving aircraft are the result of human error. Most such accidents are preventable. By practicing safety, serious accidents will be avoided. Personnel working in and around aircraft will comply with the following:

1. Stay away from aircraft when engines are in operation unless authorized by the pilot.

2. When nearer than 50 feet to the aircraft, approach or leave from an angle so that the pilot can always see you.

3. Unless wearing safety goggles or glasses, do not watch landings, takeoffs, or hovering closer than 100 feet to helicopter.

4. When aboard aircraft wear seat belts, hard hats (or crash helmet), and flame resistant (Nomex) clothing.

5. When a passenger, do not approach nor leave aircraft until instructed to do so by the pilot.

6. When approaching or leaving aircraft, be especially mindful of rotors or propellers. Special care must be exercised around helicopters because of the danger of the tail rotor.

7. The pilot has final say concerning the safe operation of his aircraft. Marginally safe altitudes, flight speeds, or landing areas will be avoided at his discretion.

Mixing, Loading, and Spills

The insecticide being used in this project, Bacillus thuringiensis, is a host specific microbial agent which has never exhibited adverse effects on nonhost organisms. Therefore, the hazards normally existing when chemical insecticides are used or handled do not exist in this case. Still, precautions should be taken to avoid unnecessary spillage of insecticide mixtures. Likewise, caution should be exercised during mixing and loading of insecticide and chemical dyes and in the fueling of aircraft.

Though innocuous to humans, caution is advised in handling the pesticide. Contact with skin, eyes, or clothing should be avoided. The liquid carrier could cause skin irritations in sensitive individuals. Handling, storage, and disposal instructions appearing on product label will be strictly adhered to.

TECHNICAL DATA

Insecticide	Dipel® 4L Thuricide® 16B
EPA registration number	275-36 and 11273-11
Active ingredient	Bacillus thuringiensis Berliner (a common, soil inhabiting, rod-shaped bacterium).
Manufacturers	Abbott Laboratories, Chemical and Agricultural Products Division (Dipel); Sandoz, Inc. Crop Protection (Thuricide).
Formulation	Emulsifiable suspension formulated to a potency of 8 BIU/qt. (Billion International Units/quart) and 4 BIU/qt (Dipel and Thuricide, respectively).

Cautions	Keep out of reach of children. Avoid contact with skin, eyes, or clothing.
Antidote	Not applicable

EMERGENCY ASSISTANCE

(Butte Emergency Telephone No. 911)

Poison Control Center: Butte, Montana	1-800-525-5042
Nearest hospital: St. James Community Hospital, Butte, Montana	406-792-8361
County Sheriff, Silver Bow County, Butte, Montana	406-723-8262
Local Police Department, Butte, Montana	406-723-8262
Ambulance	406-723-3132
Designated Physician, Dr. Miller, St. James Community Hospital Emergency Service	406-792-8361
Butte Ranger District, Deerlodge NF (Mark Petroni, EMT)	406-494-2147

ACCIDENT REPORTING

All accidents and serious injuries will be reported to Project Safety Officer. Accidents involving aircraft will be reported immediately to Project Air Officer who will notify Regional Air Officer. Where required, necessary accident and injury reports will be made in accordance with FSH 6709.11, FSH 7109.18, and FSM 6730. Questions concerning use or information on reporting forms should be directed to Project Clerk or Personnel Management in the Forest Supervisor's Office.

APPENDIX B

CODE EXPLANATIONS

Survey Code:

888 = project survey code

Form:

1 = Larvae

2 = Egg Mass

3 = Defoliation

4 = Spray Card Deposit

5 = Foliage Deposit

Year:

81

Region:

01

Treatment:

1 = Treatment 1 - Thuricide

2 = Treatment 2 - Dipel

3 = Treatment 3 - Check

Sample:

1 = Pre-spray

2 = Spray Day

3 = 1st Post-spray - 7 days

4 = 2nd Post-spray - 14 days

5 = 3rd Post-spray - 21 days

6 = Egg Mass and Defoliation

Block:

1 to 9

Cluster:

1 to 25

DEVELOPMENT SAMPLE (45cm Branch)

Block Name_____ Block No._____

Cluster No._____ Tree No._____

Branch: N1 E2 S3 W4

Day_____ Month_____ Year_____

Collectors_____

DEVELOPMENT SAMPLE (45cm Branch)

Block Name_____ Block No._____

Cluster No._____ Tree No._____

Branch: N1 E2 S3 W4

Day_____ Month_____ Year_____

Collectors_____

DEVELOPMENT SAMPLE (45cm Branch)

Block Name_____ Block No._____

Cluster No._____ Tree No._____

Branch: N1 E2 S3 W4

Day_____ Month_____ Year_____

Collectors_____

BUDWORM DEVELOPMENT DATA

Block Name _____ Cluster No. _____

Tree	Branch	Budworm Stage					
		3rd	4th	5th	6th	Pupae	Total
1	1						
	2						
2	1						
	2						
Total							
Percent							

BUDWORM POPULATION SAMPLE (45cm Branch)

Field

Block Name_____ Block No._____

Cluster No._____ Tree No._____

Branch: N1 E2 S3 W4

Day_____ Month_____ Year_____

Collectors_____

Laboratory

Length_____cm Width_____cm

Shoot Development: No. Non-expanded_____

No. Partially expanded_____

No. Fully expanded_____

No. Budworm Larvae_____ No. Budworm Pupae_____

No. Budworm Cases_____ No. Other Larvae_____

BUDWORM POPULATION SAMPLE (45cm Branch)

Field

Block Name_____ Block No._____

Cluster No._____ Tree No._____

Branch: N1 E2 S3 W4

Day_____ Month_____ Year_____

Collectors_____

Laboratory

Length_____cm Width_____cm

Shoot Development: No. Non-expanded_____

No. Partially expanded_____

No. Fully expanded_____

No. Budworm Larvae_____ No. Budworm Pupae_____

No. Budworm Cases_____ No. Other Larvae_____

LARVAE DATA FORM

Survey Code (1-3)	Form (4)	Year (5-6)	Region (7-8)	Treatment (9)	Sample (10)	Block (11-12)	Cluster (13-15)
888	1	81	01				

TREE	BRANCH	Budworm				No. Shoots	Other Larvae	Length	Width
		Larvae	Pupae	Cases	Total				
(16)	N (17) 1	(18-20)	(21-23)	(24-26)	(27-29)	(30-32)			
	E (33) 2	(34-36)	(37-39)	(40-42)	(43-45)	(46-48)			
1	S (49) 3	(50-52)	(53-55)	(56-58)	(59-61)	(62-64)			
	W (65) 4	(66-68)	(69-71)	(72-74)	(75-77)	(78-80)			
(16)	N (17) 1	(18-20)	(21-23)	(24-26)	(27-29)	(30-32)			
	E (33) 2	(34-36)	(37-39)	(40-42)	(43-45)	(46-48)			
2	S (49) 3	(50-52)	(53-55)	(56-58)	(59-61)	(62-64)			
	W (65) 4	(66-68)	(69-71)	(72-74)	(75-77)	(78-80)			
(16)	N (17) 1	(18-20)	(21-23)	(24-26)	(27-29)	(30-32)			
	E (33) 2	(34-36)	(37-39)	(40-42)	(43-45)	(46-48)			
3	S (49) 3	(50-52)	(53-55)	(56-58)	(59-61)	(62-64)			
	W (65) 4	(66-68)	(69-71)	(72-74)	(75-77)	(78-80)			

DEFOLIATION DATA FORM
Six Class System

Survey Code (1-3)	Form (4)	Year (5-6)	Region (7-8)	Treatment (9)	Sample (10)	Block (11-12)	Cluster (13-15)
888	3	81	01				

TREE	BRANCH	4 Class Index[1]	Six Class System Percent Defoliation					
			0	1-25	26-50	51-75	76-99	100
			0	1	2	3	4	5
(16)	N (17) 1	(18-20)	(21-22)	(23-24)	(25-26)	(27-28)	(29-30)	(31-32)
	E (33) 2	(34-36)	(37-38)	(39-40)	(41-42)	(43-44)	(45-46)	(47-48)
1	S (49) 3	(50-52)	(53-54)	(55-56)	(57-58)	(59-60)	(61-62)	(63-64)
	W (65) 4	(66-68)	(69-70)	(71-72)	(73-74)	(75-76)	(77-78)	(79-80)
(16)	N (17) 1	(18-20)	(21-22)	(23-24)	(25-26)	(27-28)	(29-30)	(31-32)
	E (33) 2	(34-36)	(37-38)	(39-40)	(41-42)	(43-44)	(45-46)	(47-48)
2	S (49) 3	(50-52)	(53-54)	(55-56)	(57-58)	(59-60)	(61-62)	(63-64)
	W (65) 4	(66-68)	(69-70)	(71-72)	(73-74)	(75-76)	(77-78)	(79-80)
(16)	N (17) 1	(18-20)	(21-22)	(23-24)	(25-26)	(27-28)	(29-30)	(31-32)
	E (33) 2	(34-36)	(37-38)	(39-40)	(41-42)	(43-44)	(45-46)	(47-48)
3	S (49) 3	(50-52)	(53-54)	(55-56)	(57-58)	(59-60)	(61-62)	(63-64)
	W (65) 4	(66-68)	(69-70)	(71-72)	(73-74)	(75-76)	(77-78)	(79-80)

1 Optional

EGG MASS DATA FORM

Survey Code (1-3)	Form (4)	Year (5-6)	Region (7-8)	Treatment (9)	Sample (10)	Block (11-12)	Cluster (13-15)
888	2	81	01				

TREE	BRANCH	Length cm	Width cm	Egg Masses		
				New	Old	
(16)	N (17) 1	(18-20)	(21-23)	(24-26)	(27-29)	
1	S (49) 3	(50-52)	(53-55)	(56-58)	(59-61)	
(16)	N (17) 1	(18-20)	(21-23)	(24-26)	(27-29)	
2	S (49) 3	(50-52)	(53-55)	(56-58)	(59-61)	
(16)	N (17) 1	(18-20)	(21-23)	(24-26)	(27-29)	
3	S (49) 3	(50-52)	(53-55)	(56-58)	(59-61)	

APPENDIX C

EMULSIFIABLE SUSPENSION
BIOLOGICAL INSECTICIDE

Active Ingredient:

Bacillus thuringiensis, Berliner, 8,800 International Units of Potency per mg. (32 billion International Units per gallon).

KEEP OUT OF REACH OF CHILDREN

CAUTION

E.P.A. Registration No. 275-36
E.P.A. Est. No. 5905-AR-01

CAUTION

Avoid contact with skin, eyes or clothing. In case of contact immediately flush eye or skin with plenty of water. Get medical attention if irritation persists.

BENEFICIAL INSECTS

Honey bees foraging treated areas are not harmed by DIPEL 4L use.

DIPEL 4L does not interrupt the activities of beneficial and predacious arthropods in pest management programs.

SPECIMEN LABEL — NEW

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

STORAGE AND DISPOSAL

STORAGE: Reclose containers of unused DIPEL 4L. Store under cover at temperatures under 110°F (43°C).

DISPOSAL: Do not reuse 1 qt. or 2.5 gal. container. Perforate or crush and discard empty container according to local trash disposal regulations.

Thoroughly clean and rinse empty drum with water and remove labeling. Unused pesticide or dilute spray and rinsate should be disposed of by burial.

Days to harvest: There are no restrictions on applying DIPEL 4L up to the time of harvest.

Sites: DIPEL 4L may be used for any labeled pest in both field and greenhouse uses.

dipel® 4L
WORM KILLER

Bacillus thuringiensis is exempt from the requirement of a tolerance on all raw agricultural commodities when applied to growing crops or after harvest in accordance with good agricultural practices.

For Smaller Spray Volumes: If Rate is	Use This Amount Per Gallon
½ pt./acre or 100 gals.	½ tsp.
1 pt./acre or 100 gals.	1 tsp.
1 qt./acre or 100 gals.	2 tsps.
2 qts./acre or 100 gals.	4 tsps.

DIRECTIONS FOR USE

DIPEL 4L is a highly selective insecticide for use against listed caterpillars (larvae) of lepidopterous insects. Close scouting and early attention to infestations is highly recommended. Larvae must eat deposits of DIPEL 4L to be affected. Always follow these directions:

- Treat when larvae are young (early instars) before the crop is extensively damaged.
- Larvae must be actively feeding on treated, exposed plant parts.
- Thorough spray coverage is needed to provide a uniform deposit of DIPEL 4L at the site of larval feeding. For some crops directed drop nozzles by ground machine are required.
- Under heavy pest population pressure, use the higher label rates, shorten the spray interval, and/or raise gallonage to improve spray coverage.
- Repeat applications at an interval sufficient to maintain control, usually 3 to 14 days depending on plant growth rate, moth activity, rainfall after treating, and other factors. If attempting to control a pest with a single spray, make the treatment when egg hatch is essentially complete, but before extensive crop damage occurs.
- A spreader-sticker which has been approved for use on growing and harvested crops should be added for hard-to-wet crops such as cole crops, or to improve weather-fastness of the spray deposits.

After eating a lethal dose of DIPEL 4L, larvae stop feeding within the hour, and will die within several days. Dying larvae move slowly, discolor, then shrivel, blacken and die.

DIPEL 4L may be applied in conventional ground or aerial equipment with quantities of water sufficient to provide thorough coverage of infested plant parts. The amount of water needed per acre will depend on crop size, weather, spray equipment, and local experience. Unless otherwise indicated, use at least 2 gallons of water by air; except in the far west, 5 to 10 gallons is the usual minimum. Add water to the spray or mixing tank at the level that provides maximum agitation. With the agitator running, add the DIPEL 4L. Continue agitation. Then add other spray materials (if any). Add the balance of the water. Maintain the suspension while loading and spraying. Do not mix more DIPEL 4L than can be used in a 12-hour period.

CAUTION

DIPEL 4L compatibility with chemical insecticides, fungicides and other spray materials is unknown. Tank mixes should be avoided except where specific recommendations are made in the label.

APPLICATION RATE

Crop	Pest	Pints/Acre
Cole Crops	Loopers	1 to 2
	Hornworms	½ to 1
	Imported Cabbageworm	½ to 1
	Diamondback Moth	⅔ to 1⅓
	Green Cloverworm	½ to 1
	Webworm	1 to 2
	Armyworms*	2 to 4

*DIPEL 4L may be used to suppress small armyworms (1st and 2nd instar) when populations are light and full coverage ground sprays are applied.

Soybeans	Loopers	1 to 2
	Green Cloverworm	½ to 1
	Velvetbean Caterpillar	⅔ to 1⅓
	Podworm*	1 to 2

*DIPEL 4L suppresses podworms under pest management conditions

Alfalfa, Pastures, Hay, Small Grains and Forage Crops	Loopers	1 to 2
	Alfalfa Caterpillar	¼ to ½
	European Skipper (Essex Skipper)	½ to 1

Rangeland	Range Caterpillar	¼

Use in 1 to 2 qts. water per acre against 1st through 4th instar larvae

Cotton	Tobacco Budworm*	½ to 2
	Cotton Bollworm*	½ to 2
	Loopers**	1 to 2

*Use to suppress light to moderate populations of newly hatched worms in pest management conditions. Use under close scouting when beneficial insects are active or building. Repeat treatments at 4 to 5-day intervals as long as necessary and results are acceptable. If 15% or more terminals have eggs, add[1] ⅛ lb. AI chlordimeform (Galecron® or Fundal®) per acre to ½ pt. DIPEL 4L. Increase chlordimeform to ¼ lb. AI if needed.

Once beneficial insects are no longer a factor, DIPEL 4L (at ½ to 1½ pts./acre) may be tank mixed with methomyl (Lannate® or Nudrin®) at .225 to .675 lbs. AI per acre to control light to moderate infestations of early instar larvae. Observe any rate, frequency, or boll load label restrictions for methomyl in your area. Methomyl will likely cause reddening of cotton foliage. Discontinue this tank mix if reddening becomes excessive.

Before using any tank mix, read the product labels for all environmental and usage cautions. Chlordimeform is restricted to aerial application and to states where registered.

**Full plant coverage needed.

[1]The mixture of **B.t.** with chlordimeform for inhibiting the growth of lepidopterous larvae on plants is covered by Abbott U.S. patent 3,937,813.

DIPEL 4L for Trees

Crop	Pest	Pints/100 Gallons* (Ground Equipment)	Pints/Acre (Aerial** Application)
Forest, Shade, Sugar Maple Trees	Gypsy Moth	1 to 2	2
	Bagworm	1 to 2	1 to 2
	Red-Humped Caterpillar	½ to 1	½ to 1
	Spring & Fall Cankerworm	½ to 1	½ to 1
	Fall Webworm	1	1
	Elm Spanworm	1 to 2	1 to 2
	Tent Caterpillars	½ to 1	1
	California Oak Moth	½ to 1	½ to 1
	Pine Butterfly	2	2
	Spruce Budworms[1]	2	2
	Saddle Prominent Caterpillar	1 to 2	—
	Douglas Fir Tussock Moth	2	2
	Western Tussock Moth	1 to 2	—
	Fruit Tree Leafroller	1 to 2	—
	Blackheaded Budworm	2	—
	Mimosa Webworm	1 to 2	—
	Jack Pine Budworm	1 to 2	1½ to 2
	Saddleback Caterpillar	1 to 2	—

*Rate for hydraulic sprayer. For mist blowers, mix the applicable amount (pts.) in 10 gallons of water.

**For aerial application, use in one to ten gallons of water depending on type and density of trees. For best results, spray systems which deliver droplet size of 200 microns should be used.

[1]Use against populations below 35 larvae per 18-inch branch tip. Use a minimum of ½ gallon/acre of the total mixture by air.

®Fundal, Galecron, Lannate, Nudrin, are trademarks of companies other than Abbott Laboratories.

Chemical and Agricultural Products Division
Abbott Laboratories
North Chicago, Illinois 60064

List 5138 Printed in U.S.A.

thuricide®-16B

AQUEOUS CONCENTRATE FOR AERIAL OR GROUND APPLICATION

ACTIVE INGREDIENTS: Bacillus thuringiensis Berliner, potency of 3,430 International Units (at least 5 million viable spores) per milligram*	0.69%
Xylene	3.00%
INERT INGREDIENTS:	96.31%
	100.00%

*Equivalent to 4.0 billion International Units per quart.

STORE IN A COOL PLACE.

KEEP OUT OF REACH OF CHILDREN

CAUTION

AVOID INHALATION OR CONTACT WITH EYES OR OPEN WOUNDS.
APPLY THIS PRODUCT ONLY AS SPECIFIED ON THIS LABEL.

DIRECTIONS FOR USE

Suspension must be shaken or stirred before use. Pour the recommended amount of THURICIDE 16B into the required volume of water in the spray tank. Maintain agitation. Do not allow diluted sprays to remain in the tank for more than 24 hours. THURICIDE 16B is formulated to provide desirable coverage and stickability on leaf surfaces. Additional adjuvants, spreaders, or stickers may be added but are not essential.

Ground Application:

Use adequate water to obtain good foliar coverage. Wet foliage but do not allow excessive run-off. Apply the recommended per acre rates of THURICIDE 16B with the following suggested amounts of water:

100 gallons with high gallonage hydraulic sprayers.

10 gallons with mist blower.

Aerial Application:

Use a minimum of 20% water in the spray mix per acre. Use not less than one half gallon of spray mix per acre. Best results are obtained when THURICIDE 16B is applied to dry foliage with a calibrated aircraft capable of obtaining droplet sizes below 300 microns and preferably in the range of 50-150 microns.

CONTAINER DISPOSAL: Do not reuse empty container. Destroy or discard in safe place.

NOTICE: Sandoz, Inc. makes no warranty, express or implied, including the warranties of merchantability and/or fitness for any particular purpose, concerning this material except those which are contained on Sandoz, Inc.'s label.

NET_____U.S. GALLONS

SANDOZ

Sandoz, Inc.
Crop Protection
480 Camino Del Rio So.
San Diego, California 92108

EPA Reg. No. 11273-11

1.5N280C

RECOMMENDATIONS: Thorough coverage is essential when using THURICIDE 16B. Use the higher rates against very heavy worm infestations.

FOR SHADE TREES, ORNAMENTALS & FOREST

Pest	Qts. per Acre	DIRECTIONS FOR USE
Spring and Fall cankerworm Elm spanworm Forest tent caterpillar Gypsy moth	1-2 1-2 2 2	Apply when leaf expansion reaches 40%-50% as infestation warrants. If eggs hatch over a long period of time or if reinfestation occurs, spray about 14 days after first application.
Eastern spruce budworm	1½-2	Apply during 3rd-4th instar. Also consider the opening of the bud cap to ensure foliage exposure.
Douglas fir tussock moth	1-2	Apply 2nd-3rd instar.
Jack pine budworm	1-2	Apply no later than 5th-6th instar when insect is feeding on exposed foliage.

APPENDIX D

APPENDIX D

INFORM AND INVOLVE PLAN
Bt Pilot Control Project

1981

ISSUE

Use of Bacillus thuringiensis (Bt) against the western spruce budworm on the Deerlodge National Forest.

BACKGROUND

On July 20, 1977, the Northern Region filed a Final Environmental Impact Statement (FEIS) on their Western Spruce Budworm Management Plan.

The selected alternative called for managing western spruce budworm by long-term special silvicultural treatments on 934,019 acres out of a total infestation of 3,151,985 acres. The option of chemical management with Sevin-4-Oil was retained for future use in infested stands on or adjacent to high value sites. These areas include seed production areas and developed recreation sites, both existing and planned. Chemical application depends on cyclic budworm infestations and expected rates of reinfestation.

Alternatives to the proposed action included pesticide treatment of all infested areas except those in designated wildernesses, primitive areas, and new study areas. Special silvicultural treatments will occur on all areas except designated wildernesses, primitive areas, new study areas, and roadless areas with no action other than normal forest management activities. Within the pesticide treatment alternatives, three options were considered:

Biological pesticides
Chemical pesticides, registered
Chemical pesticides, promising

The following paragraph regarding Biological Pesticides was extracted from the FEIS:

3. Pesticides:

a. Kinds of pesticides:

(1) Biologicals.--Biological pesticides fall into several categories: Viral, fungal, microsporidial, and bacterial. The only one of these that has shown promise against the western spruce budworm is a bacterial agent, Bacillus thuringiensis Berliner, usually referred to as Bt. Bt is an aerobic sporeformer infective to numerous lepidopterous larvae. It is registered against such forest pests as tent caterpillars, fall webworm, gypsy moth, and

elm spanworm. It is not currently registered for use against the western spruce budworm, but has been pilot tested. McGregor, et al. 1976, attained up to 74 percent population reduction, and recommended further testing before registration. Once Bt is registered, it can be considered a viable alternative for reducing budworm populations and protecting foliage in high use sensitive areas in the future. The most action of Bacillus thuringiensis on eastern spruce budworm larvae has been under investigation in Canada for several years; initial field tests were made up in 1959 (Angus, et al. 1961: Smirnoff, 1963). Denton (1960) found in laboratory and field tests that Bacillus thuringiensis, when ingested in significant amounts, was toxic to larvae of the western spruce budworm.

Aerial applications of Bacillus thuringiensis have demonstrated that it can cause considerable mortality of the budworm, but not at levels as high as those obtained with chemicals (Mott, et al. 1961; Klein and Lewis, 1966). Larval mortality caused by Bacillus thuringiensis is due to an initiation of septicemia after ingestion of the bacterial spores. Septicemia does not begin until the bacteria have penetrated the gut wall and entered the hemolymph (Smirnoff, 1971). Addition of the enzyme chitinase (which hydrolizes chitin) to Bacillus thuringiensis preparations administered to budworm larvae increased the mortality rate attributable to the bacterium (Smirnoff, 1971). Recent aerial application of Bacillus thuringiensis - chitinase formulation showed a larval mortality rate high enough to suggest the possibility of using such a formulation for budworm control (Smirnoff, et al. 1973).

The central point is, ..."McGregor, et al. 1976, attained up to 74 percent population reduction, and recommended further testing of Bt before registration. Once Bt is registered, it can be considered a viable alternative for reducing budworm populations and protecting foliage in high use sensitive areas in the future..." This pilot project proposal deals with the further testing necessary to achieve registration.

GOALS

1. To provide information concerning potential environmental effects of Bt.

2. To achieve public understanding on the intent of the project.

3. To achieve public acceptance of the need of the project.

CONCERNED PUBLICS

To identify the concerned publics, we first reviewed Section V of the FEIS. We then added local publics who we felt would be interested. The "local publics" are identified by an asterisk (*).

1. Federal Level

- U.S. Department of Agriculture
  * Soil Conservation Service
  * Headwaters RC&D Project

- U.S. Department of the Interior
  * Bureau of Land Management

- U.S. House of Representatives
  * Representative Pat Williams

- U.S. Senate
  * Senator Max Baucus
  * Senator John Melcher

2. State Level

- Montana State Clearing House

- Montana Department of Fish, Wildlife, and Parks
  * Regional Director - Region 2
  * Regional Director - Region 3

- Montana State University
  * Integrated Pest Management Group

- State Congressional Delegation
  * Senate Districts
  * House Districts

3. Local Level

  * County Commissioners (affected counties)

4. Organizations, Groups, and Individuals

- Inland Forest Resource Council
- Champion Timberlands
- Burlington Northern
- Montana Wilderness Association
- Northern Plains Resource Council
- Sierra Club (Northwest Rep.)
- Friends of the Earth
- Trout Unlimited
- Wildlife Management Assoc.
  * Skyline Sportsmen
  * Identified individuals
- Ducks Unlimited
- Montana Association of Conservation Districts
- Environmental Quality Council
- Western Scientists for Public Enlightenment
- Montana Stockgrowers Association
- Western Montana Stockmen's Assoc.
- Montana Cattlemen's Association
  * Local service clubs
- Montana Wildlife Federation
  * Summer Homeowners

5. Media

The Missoulian
The Bozeman Chronicle
High Country News
Associated Press
Western News
Great Falls Tribune
Dillon Tribune - Examiner
Montana Standard
Ravalli Republic
The Boulder Monitor
The Madisonian
Anaconda Leader
Silver State Post
* KXLF - TV
* KECI - TV
* KBOW
* KOPR
* KANA
* KGNA
* KMSM-FM

6. U.S. Department of Agriculture - Forest Service Distribution

a. Regional Offices and Experiment Stations

Regional Foresters, Regions 2, 3, 4, 5, and 6
Intermountain Forest and Range Experiment Station
Rocky Mountain Forest and Range Experiment Station
Pacific Southwestern Forest and Range Experiment Station

b. Northern Region

Regional Forester
Deputy Regional Forester - S&PF
R-1 Office of Information
Beaverhead National Forest
Bitterroot National Forest
Deerlodge National Forest (Employees)
Gallatin National Forest
Helena National Forest
Lewis and Clark National Forest
Lolo National Forest
Missoula Equipment Development Center

TECHNIQUES

A. The following techniques will aid in accomplishing the identified goals:

* News releases
* Feature newspaper articles
* Fact sheets (Q & A Format)
* TV programs
* Group meetings
* Open houses
* Decision notice
* One-to-one contacts

B. The following matrix shows how identified techniques will be used to accomplish the established goals with the concerned publics.

TECHNIQUES	PUBLICS	Other Federal Agencies	Congressional Delegation	State Agencies	State Congressional Delegation	Organization and Groups	Individual	USDA Agencies	Media	General Public	Deerlodge National Forest Employees
News Release									X	X	
News Articles							X			X	
Fact Sheet (Q & A)			X		X		X			X	X
TV Programs (Focus)										X	
1:1 Contacts		X	X		X		X	X			
Personal Letters			X		X						
Group Meetings						X					X
Open House										X	
Decision Notice		X	X	X	X	X	X	X	X		

ANALYSIS METHODS

Our analysis scheme is structured to answer two questions. The first is the level of concern about the testing and potential registration of Bt. The second question is how well we meet our three established goals. Depending on the answers to the above, we may modify the attached Action Plan.

To test the level of concern we intend to make personal or phone contacts to a cross section of concerned publics. This will be done after announcing the EA process and distributing the Fact Sheets. In addition, we will ask, in a cover letter accompanying the Fact Sheet, the public to comment regarding the level and the areas of their concern. This information will be used in the scoping process for the Environmental Analysis (EA).

If the decision on the EA is to proceed with the test project, we will monitor, through interviews, our success in accomplishing the identified goals.

FEEDBACK TO PUBLIC

Much of our effort will be toward disseminating information. We will, however, be asking for a response from the public as part of the scoping process. For those who respond, we will acknowledge their comments and tell them how their comment(s) were used in the scoping process. Finally, if their comments became part of the identified issue, they will be contacted.

ACTION PLAN

ACTION	PURPOSE	RESPONSIBILITY	DATE	
			PROPOSED	ACCOMPLISHED
Phase I				
1- 1:1	Personal or phone contact with community leaders to let them know about upcoming study and to help identify questions for the Fact Sheet and Scope of Concern.	Rangers/Staff	3/20	
2-News Release	Announce start of study and time schedule.	PIO	4/3	

ACTION PLAN

ACTION	PURPOSE	RESPONSIBILITY	DATE PROPOSED	DATE ACCOMPLISHED
3-Family Meeting	To inform our own employees of the project.	Durland	4/2	
4- 1:1 Contacts	To explain projects to local adjacent landowners and the congressional delegation.	FS/DR	4/3-20	
5-Personal Letters	To explain project (include Fact Sheet).	PIO	4/2	
6-Prepare and Mail Fact Sheet	To place answers of the most often asked questions into the hands of the public (Effects of Bt).	PIO	4/8	
7-Feature Article	To explain magnitude of budworm, problem, solutions and the test project.	PIO	4/15	
8-Radio and News Bulletin	Announcement of Open House Mt. Stand. Radio.	PIO	4/15-20	
9-Open House	To allow interested individuals to stop in to learn more about project and provide their concerns.	DR's	4/20	

ACTION PLAN

ACTION	PURPOSE	RESPONSIBILITY	DATE PROPOSED	DATE ACCOMPLISHED
10-EA and Record of Decision	To disclose effects of alternatives and document decision of Forest Supervisor.	Staff	5/1	
11-News Release (ROD)	To announce the Forest Supervisor's decision on the project and announce availability of EA.	PIO	5/1	
Phase II				
12-News Release	To announce start of project (location, number of people, space needs, etc.)	PIO	6/15	
13- 1:1 Contacts	To show the project (via a tour) to interested individually. Include some Forest employees.	Project Director	6/24	
14-TV Appearance (possibly a Focus Program)	To show project and discuss project.	Project Director	6/21	
15-News Release	To announce completion of project and when results will be available.	PIO	6/30	

APPENDIX E

WORK PLAN

EVALUATION OF DOUGLAS-FIR NEEDLES AS
A MEDIUM FOR SPRAY DEPOSIT ASSESSMENT

OBJECTIVES

1. Evaluate intended target site of an aerial spray as a medium for assessing spray deposits.

2. Investigate relationship of insect mortality to deposit on Douglas-fir needles.

3. Compare deposit on Douglas-fir needles to standard Kromekote card samplers.

TEST SITE

Region 1, Deerlodge NF, Montana. Evaluation to be conducted in conjunction with a pilot control project of two commercial preparations of Bacillus thuringiensis against western spruce budworm.

TEST DESIGN

Existing test design will be used to every extent possible. All six spray blocks and all sample tree clusters within the blocks will be included in the evaluation.

The following changes in the existing test design are necessary:

A. Following each days spraying, 4 branch tips, one from each cardinal direction, will be removed from each sample tree. These will be placed individually in paper bags, labeled, and returned to the laboratory. Each branch will be identified by Block No., Cluster No., Tree No., and Quadrant (NSEW).

B. In the laboratory, randomly select 5 new shoots of growth from each branch sample. Remove 4 needles from mid-point of each shoot. Measure needle length in cm and count number of droplets on top and bottom surfaces of needle. Record on data sheet (Exhibit 1).

C. Pre- and post-spray insect sampling is to be revised as follows:

1. Increase pre-spray sample to four branches per tree in lieu of two.

2. Collect branch samples from each quadrant of the sample tree (NESW).

3. Store branch samples separately and record insects separately by branch.

INVESTIGATORS, STAFFING AND FUNDING

Principle investigator is Bill Ciesla, FPM/MAG, Davis, CA. Two additional seasonal employees and one additional lease vehicle will be required to accommodate this evaluation. MAG will also provide an additional one or two technicians. A total of $10,000 will be provided to R-1 from FPM/MAG funds to support this effort.

EQUIPMENT NEEDED

Sectional pole pruners--3 pair	(R-1)
Binocular microscope	(MAG)
Data sheets	(MAG)
Collecting bags	(R-1)

DATA ANALYSIS

A. Deposit will be expressed as droplets per cm of needle length.

B. Regression analysis techniques will be used to compare:

1. Insect mortality with deposit on needles by tree quadrant, tree cluster and block.

2. Needle deposits with deposits on Kromekote cards.

DATA SHEET

Douglas-fir Needle Analysis

Block _____ Cluster _____

Needle Number	Tree 1								Tree 2								Tree 3							
	N		E		S		W		N		E		S		W		N		E		S		W	
1	#	L	#	L	#	L	#	L	#	L	#	L	#	L	#	L	#	L	#	L	#	L	#	L
1																								
2																								
3																								
4																								
5																								
6																								
7																								
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10																								
11																								
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14																								
15																								
16																								
17																								
18																								
19																								
20																								

Sum

Mean

SD

SE

1 # = Number of droplets L = Needle length (cm)

APPENDIX F

Sampling to Determine Optimum Spray Timing for *B. t.* Application

by

John Neisess, D. Twardus, and J. Wong

Objective

The objective of this aspect of the project is to evaluate larval and bud development in relation to *B.t.*-caused mortality of budworm. The project will be done as part of the *B.t.* pilot control test of Region 1.

Justification

The justification of the project lies in some of the poor results obtained in field application of *B.t.* (Harper, 1974). Since *B.t.* loses 75 percent of its insecticidal activity within 5 days after application (Thompson et al. 1977), it must be applied when the target insect is exposed and actively feeding on the foliage to be most effective. In the past, *B.t.* applications have been timed to coincide with larval development ranging from the late third to late fifth larval instar (Harper, 1974).

For some plots or treatment blocks, treatment may not coincide well with host tree phenology. This often occurs if the spring has been wet and cool, or if the weather becomes cold after a warming trend has initiated larval and bud development. In such cases, the *B.t.* is timed only against larval development, and the larvae may still be webbed inside buds.

For the present project, timing of the single application will be based upon 50 percent of larvae being in the fourth instar. The relatively early treatment may provide problems with considerable numbers of larvae still webbed within buds and not exposed to *B.t.* for several days. This optimum timing study will reveal those situations where poor mortality can be attributed to larval or bud development.

Methods

The pilot project will use 25, 3-tree clusters within each block for prespray and post-spray sampling. For the timing study, the prespray branch samples from 12 of the clusters will be used. Using the same branches will alleviate problems associated with sampling error. The 12 clusters per block will be selected from the project's 25 to provide sufficient geographical variation.

When the prespray branches are brought to the laboratory, the timing-study crew will separate the branches for the selected plots. Buds on each branch will be classified: 1 = not expanded, needles held by sheath; 2 = partially expanded, sheath is holding needles at acute angle to axis; or 3 = fully expanded, needles approaching 90 degree angle to axis.

After bud development is classified, the branches will be returned to the pilot test crew for larval counts. All larvae from the selected plots will be deposited in alcohol-filled vials, labeled, and set aside. These larvae will be classified by instar at a later date. Head capsule widths will be used to determine larval instar. To determine instar development, head capsule widths measured in millimeters will be plotted as a histogram.

Three instar categories will be considered, instars II and III as one category, instar IV, and instars V and VI as the third category.

Data Analysis

The objective of data analysis will be to determine the optimum (in terms of highest percent larval mortality) time of application as determined by a pre-spray classification of larval instar and bud development.

Larval development and bud development will be averaged for each plot within each block. Mortality from the individual plots as obtained by the pilot test at 7, 14, and 21 day intervals will be compared to larval and bud development for those plots at the time of treatment.

Since three blocks are used per treatment, analysis of variance will be used to test if differences among spray blocks within treatments exists. If no difference is observed, plot results will be pooled and regression analysis used to illustrate the effect of larval development and bud development upon mortality.

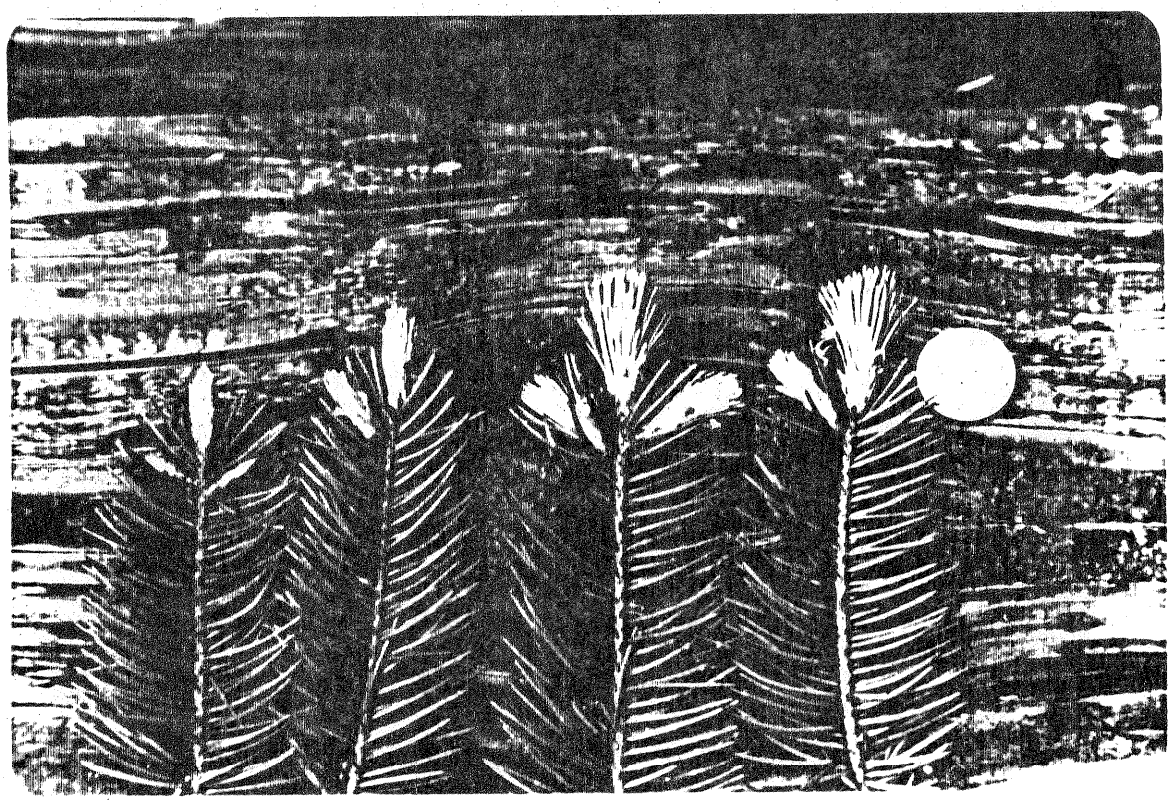

Figure 1.

Douglas-fir bud development

Category 1.

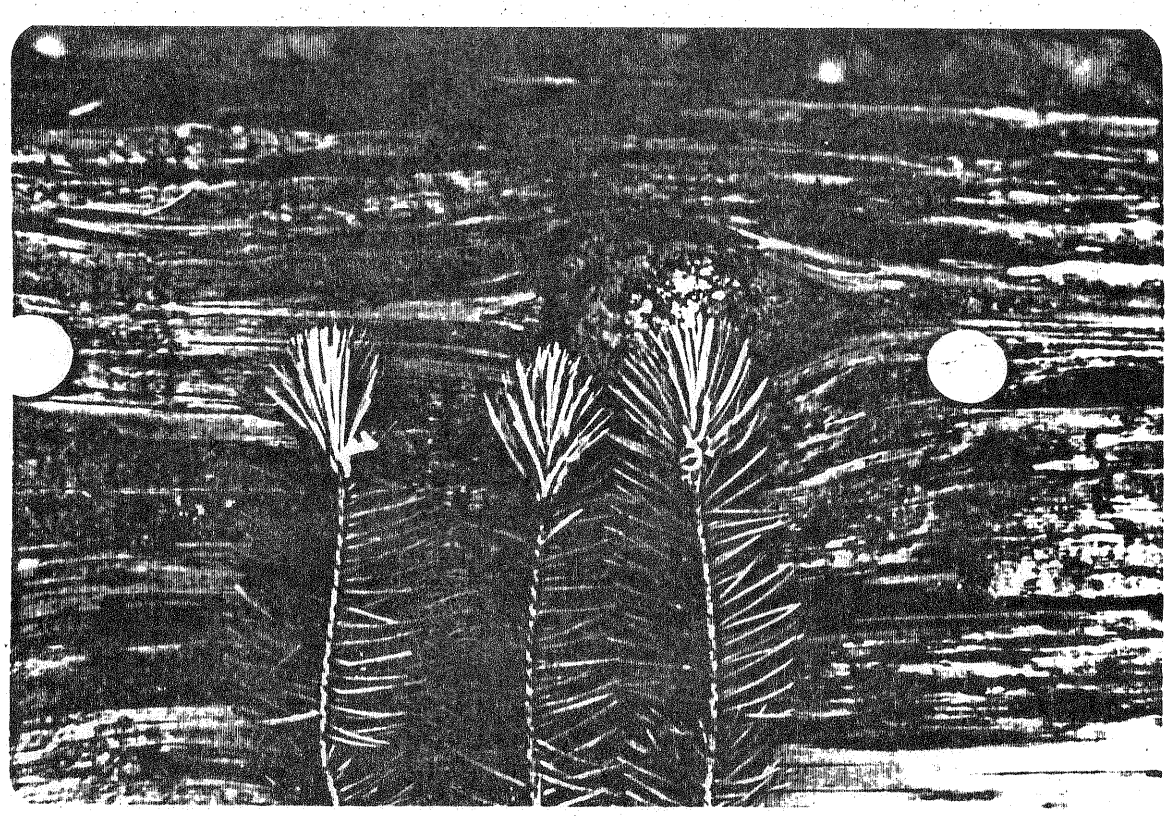

Figure 2.

Douglas-fir bud development

Category 3.

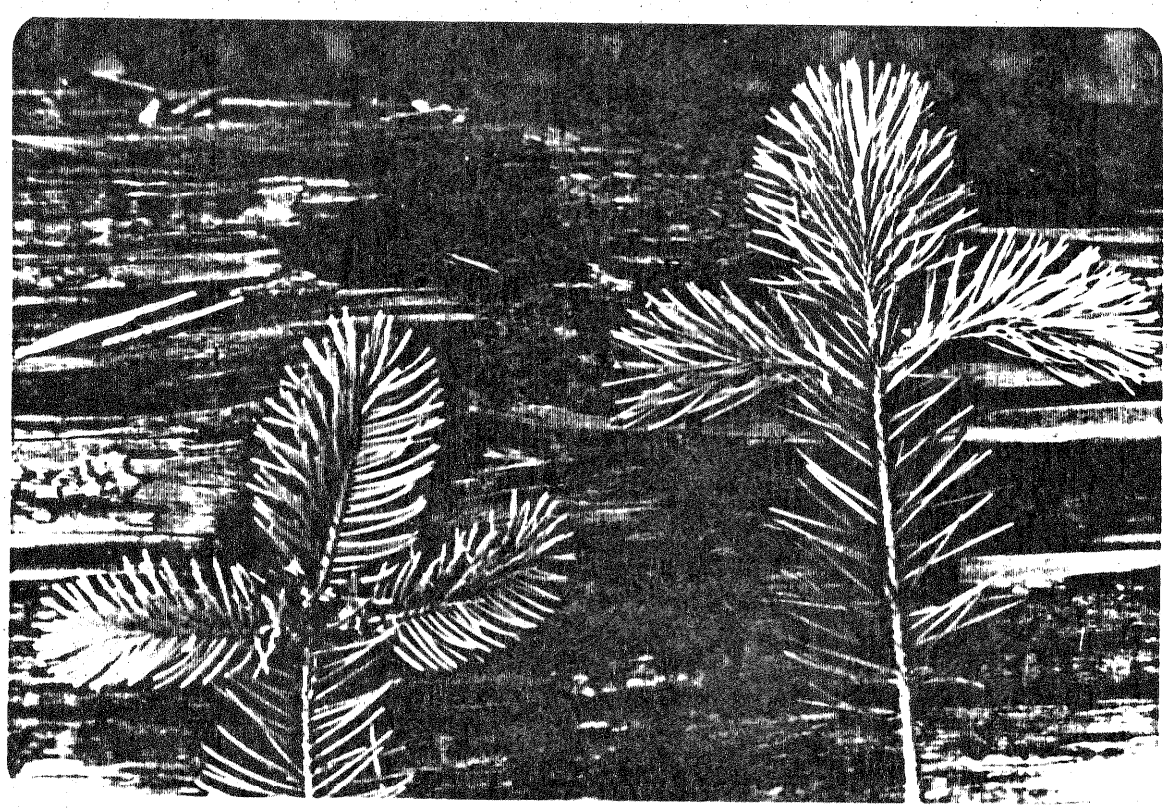

Figure 3.

Douglas-fir bud development

Category 3.

Project Costs

	Travel & Per Diem	Other
Two people to Montana - 15 days	$2,800.00	
(Twardus, GS-12 salary from CANUSA)		
(McConnell, GS-7 salary from FPM)		
Vehicle (rental, 13 days)	500.00	
Misc. equipment		50.00
Total cost	$3,350.00	

References

Harper, J. D.
1974. Forest Insect Control with *Bacillus thuringiensis*. Auburn University, December, 1974.

Thompson, C. G., J. Neisses, and H. Batzer
1977. Field Tests of *Bacillus thuringiensis* and Aerial Application Strategies on Western Mountainous Terrain. USDA For. Serv. Res. Pap. PNW-230. 12 p.

APPENDIX G

AIRCRAFT OPERATIONS - AERIAL APPLICATION OF CHEMICALS

The following safety rules and procedures have been extracted from FSH 6109.13 "U.S. Department of Agriculture, Forest Service Health and Safety Code," FSM 2140 "Forest Insect and Disease Suppression," FSH 5700 "Air Operations," and other sources.

This plan incorporates general guidelines for developing, equipping, and manning airports for supporting aircraft operations.

This Plan does not itemize all the safety rules which are applicable to aircraft operations. Project personnel should be constantly alert to detect any unsafe practices and correct them immediately.

All project personnel should be familiar with this Plan and, a copy of this Safety Plan should be in the possession of each person who is a COR, Inspector, Base Station Operator, or Project Officer on a project on which aircraft are used.

Doctors and ambulance services, which will be available in case of emergency, and an Accident Reporting Chart are listed in Section XI.

Section:

I Guidelines for Developing Base Airports for Spraying

II Personnel Working on any Aircraft Project

III Personnel Working on Aircraft Spray Projects

IV Visitors to the Aircraft Project

V Aircraft

VI Pilot Safety

VII First Aid and Accident/Incident Reporting

VIII Search and Rescue Before Crash is Located

IX When Crash is Located

X When Crash Site is Reached

XI Where to Obtain Medical Treatment

Section I

Guidelines for Developing Base Airports for Spray Projects

A. Physical Considerations

1. The airport should be situated so that the approach and departure routes are into the prevailing wind.

2. The airport should be dustproofed with either dust abatement chemicals or water, as needed.

3. Approach and departure routes should not exceed 8:1 slope and the side clearances should not exceed 2:1 slope.

4. A wind sock will be erected in an open area away from the flight routes.

B. Personnel Considerations

Technical (Maintenance) Inspector and Forest Service Pilot Inspector (may be one person, if qualified) will be used on all projects. The Technical Inspector and Forest Service Pilot may be needed only at the start of the project.

Air/Spray Operations Officer - overall supervision and safety of aircraft operation marshaller: radio and traffic routing.

Loader and Assistant - Proper loading and manifesting of chemicals, manifesting and loading.

C. Equipment Considerations

1. Forest net, air net, or VHF radio.
2. Wind sock and pole.
3. One 120 lb. fire extinguisher per two aircrafts.
4. Dust abatement materials (if necessary).
5. Personal protection equipment for each person working around aircraft.
    a. Goggles.
    b. Hard hat with chin strap.
    c. Flame resistant clothing.
    d. High visibility vest for marshallers.
    e. First aid kit.
    f. Hazard maps.

Section II

The designated COR Inspector, Project Officer, or Air Service Manager will enforce the safety rules outlined in Sections II through X.

Personnel Working on Spray Project Shall:

A. Become familiar with and comply with FSH 6109.13, Forest Service Health and Safety Code.

B. Wear nonskid-soled footwear with snag resistant shirts and trousers.

C. Stay away from aircraft when propeller blades are in motion. This means stay at least 50 feet away from fixed-wing aircraft.

D. When closer than 50 feet to aircraft, approach or leave from front of aircraft, where pilot can always see you.

E. Never approach or leave aircraft from any side where ground is higher than ground where aircraft is standing.

F. Unless equipped with safety goggles or glasses, do not watch landings, takeoffs, or hovering, closer than 100 feet from aircraft.

G. When aboard aircraft, wear seat belts, hard hats, or crash helmets with chin strap under chin, shoulder harness, and flame resistant clothing. Keep safety belt fastened until instructed by pilot after landing to leave the aircraft.

H. Stay away from propeller at all times and see that others do likewise.

I. When working in the vicinity of aircraft, wear headgear that will not blow off and foul helicopter or other equipment.

J. Keep landing area clear of debris and equipment which may be dislodged by the wind created by the propeller blade.

K. Report overdue aircraft, malfunctioning equipment or aircraft to the COR or Project Officer immediately.

L. When a passenger, do not approach or leave the aircraft until authorized by the pilot.

M. Keep the base station informed as to the location of the aircraft.

N. Observe no smoking as follows:

1. Smoking in or around aircraft is prohibited.

2. Passengers and crew will not carry "strike anywhere" matches on aircraft flights.

Section III

Personnel Working on Spray Project Shall

A. Persons working with spray material should wear clean work clothing daily.

B. Keep children and irresponsible adults, pets, and livestock out of loading or storage sites and areas in which application is in process.

C. Wash hands with soap and water immediately after contact with dye and fuel oil, and before smoking or handling food. Do not eat, drink, or smoke while near dye and/or fuel oil.

D. Select sites for loading and cleaning of equipment and storage to avoid contaminating streams, ponds, cisterns, food stocks, or crops adjacent to work area.

E. Pick up and safely dispose of empty chemical containers immediately after use. (FSH 6109.13, Sec. 8.37)

F. Never use milk or beverage bottles, or other types of food containers, for storage of chemicals.

G. Clean up spilled chemicals at once.

H. Label all containers which are used for chemical storage.

I. Do not allow leaks in the spray distribution system or in the chemical mixing equipment.

J. Arrange spraying schedules so that poor visibility before and shortly after sunrise and sunset will not affect the safety of the pilot.

K. Allow spraying from a higher altitude where steep canyonheads, snags, or standing timber in the spray area make it too hazardous to spray at the specified contract heights.

L. Allow sufficient elevation to be gained by the pilot at the lower open end of drainages after a spraying run to eliminate the need to climb in returning for another spray run.

M. Pilot will cease spraying, when in his own judgment, conditions are too hazardous.

N. Handle full barrels of chemicals or diesel oil with care to avoid personal injury. Use barrel rolls when applicable.

O. Maintain maximum flight height over vegetative cover and obstacles which permits acceptable results, as specified in contract being administered--usually 50 feet above canopy.

P. Pilot will conduct reconnaissance flights prior to spray day.

Section IV

Visitors

A. Will be kept in safe areas by all project personnel.

B. Will be told to leave the project area if they refuse to comply with applicable safety rules as outlined in Section II of this Safety Plan.

Section V

Aircraft

A. . Monitor pre-flight inspections to be performed by pilot each day, including oil and gas check. Visual check without disassembly of aircraft for items such as oil leaks, loose nuts or bolts, worn hinges, and bad tires or skids.

B. Check reserve fuel supply.

C. COR will issue Suspend Work Order for aircraft which is considered unsafe or otherwise unsatisfactory for performance of ferry, reconnaissance, or application flights.

D. Do not permit the aircraft to be refueled while the engine is running or propeller blades turning.

E. Insure that a suitable electrical ground is provided when aircraft is being refueled with metal container.

Section VI

Pilot Safety

A. Flight plans will be filed for all flights.

B. Ridges are to be approached at not more than a 45 degree angle.

C. Caution pilots to recognize dangers, such as lone snags and trees and probable locations of downdrafts. Review District hazard map with each pilot, to include areas to be sprayed, and approaches to and from those areas. Pilots will conduct an aerial reconnaissance of the area to be sprayed and the approach to identify any other hazards.

D. Caution pilots as to the location of known telephone or power lines near any airport which will be used and in vicinity of spray area.

E. Pilots will wear flight helmets and flame resistant clothing as specified in the contract.

F. Pilots will not fly in fog, heavy rain, or before daylight or after dark.

G. Pilots will not exceed the flight and duty time limitations as outlined below:

1. Flight time will not exceed a total of 7 hours per day.

2. Pilots accumulating 30 or more hours of flying in any 6 consecutive days will be off duty the following full calendar day.

3. Pilots must have a minimum of 10 consecutive hours off duty within 24 hours after the beginning of any duty.

4. Duty includes flight time, ground duty of any kind, and standby or alert status at any location.

5. During any 14 consecutive days, pilots will be off duty for 2 full calendar days. Days off duty need not be consecutive.

6. A duty day is any day a flight is made or 4 hours or more of other duty is performed.

NOTE: Regional Aviation Officers, or their equivalent, may waive the "consecutive" part of Item 3 so that pilots flying such missions as aerial application may have two shorter off duty periods provided they aggregate 10 hours or more.

H. The sending District will notify the receiving District of the daily accumulated flying time for each pilot in any 6-day period when between District moves are made.

I. The pilot in command will be responsible for the safety of the aircraft, its occupants, and cargo. He has complete authority to postpone, change, or cancel any flight when he believes existing or impending conditions make it unsafe.

J. Always recognize and guard against the effects of pressure altitude as affected by temperature.

K. Do not dispatch aircraft for mountain flying when average wind velocity over a 5-minute period at exposed peak is 30 mph or more.

THE RESPONSIBILITY FOR IMPLEMENTING THE VARIOUS PHASES OF THE SAFETY PLAN OUTLINED IN SECTIONS VI THROUGH XI.

Section VII

First Aid and Accident/Incident Reporting

A. Definition of Accident and Incident

1. As used in this Safety Plan, ACCIDENT shall mean:

a. Destruction or substantial damage to the aircraft or service truck.

b. Damage to the aircraft components.

c. Minor, serious, or fatal injury to personnel.

2. As used in this Safety Plan, INCIDENT shall mean any air or ground mishap, malfunction, or situation involving aircraft or personnel which results in a deviation from standard procedures or has the potential of resulting in an accident, injury, or death.

B. The contractor's personnel shall be equipped and trained to take proper action in an emergency. This is the contractor's responsibility.

C. The Forest Service COR or Inspector on the project will be equipped to take proper action in an emergency. Equipment will include a radio, an adequate first aid kit, Stokes litter, and crash rescue kit.

D. The person manning the base station or the radio net will have telephone numbers of doctors, ambulance service, and hospital service, recorded in a convenient place for ready use. When a crash is reported, he will dispatch medical aid as soon as possible to the airport being used.

E. All injuries and/or accidents involving people will be reported immediately to the Base Station Operator on the radio net.

The operator at the base station will immediately notify the Project Director, District Ranger, or his Acting, who will notify the Forest Air Officer/Dispatcher.

F. Any accident or incident involving aircraft, regardless of severity, will be reported immediately to the Base Station Operator on the radio net. The Base Station Operator will immediately notify the District Ranger or his Acting. He will notify Forest Air Officer/Dispatcher who in turn will notify the Regional Air Officer. The Regional Air Officer will advise of further action and reporting requirements.

The initial verbal report will follow the format of Form 5700-14.

Additional accident reporting instructions are given in FSM 5714.18.

Section VIII

Search and Rescue Before Crash is Located

A. The Inspector on the project will notify Base Station Operator, and the Base Station Operator will notify the Project Director or District Ranger, who will notify the Forest Air Officer/Dispatcher of the general area of the search.

B. The Forest Air Officer/Dispatcher will have the Forest Service plane or other alerted aircraft scout the area, keeping in radio communication with the base station.

C. A radio equipped ground rescue squad should be started toward the general crash area from the base station immediately, keeping in communication with search aircraft or base station for directions.

D. The Base Station Operator will make arrangements for medical (doctor and hospital) and ambulance service.

E. If crash is not located within a reasonable period, the Forest Air Officer/Dispatcher will request other qualified aerial observers to join the search.

F. The Forest Air Officer/Dispatcher will notify the Regional Air Officer and notify the contractor's home office, if it is a contract aircraft.

G. The District Ranger, or his Acting, will notify the Sheriff of the County in which the emergency occurs.

Section IX

When Crash is Located

A. Prior to the time the Sheriff takes over the administration of the rescue operation:

1. The Base Station Operator will:

a. Immediately notify the District Ranger or Acting, who will decide whether to use airborne or ground rescue squads, and start whichever is decided upon.

b. Keep in constant communication with rescue squads and, start medical and ambulance service to the crash.

2. As soon as the rescue squad reaches the crash, they should report the condition of the pilot and any other persons involved in the crash to medical units and to the base station. The base station will relay the information to the Forest Air Officer/ Dispatcher who will notify the Regional Air Officer.

3. Whatever action is necessary to save the lives of the crash victim or victims will be taken by the medical unit and rescue squad. In case of fatality, the Forest Air Officer/Dispatcher will follow instructions in R-3 Supplement No. FSM 6179.15c.

4. The forest air officer/dispatcher will initiate request for investigation and report by NTSB representative and Regional Air and Safety Officers.

B. After the Sheriff takes over the administration of the rescue operation:

1. Forest Service personnel will assist the Sheriff as follows:

a. Furnish communications through the Forest Service communications system.

b. Furnish guide service to the scene of the emergency.

c. Help in arrangements for pack stock and other forms of transportation where necessary.

d. Furnish necessary maps, details of Forest organization, etc.

e. Aid in arrangements for ground personnel at the scene of the accident.

2. The Forest Air Officer/Dispatcher will keep the Regional Office informed of the developments in the rescue operation.

Section X

When the Contractor's Ground Crewman and/or Forest Service Representative Reach the Crash Site

A. If the aircraft is on fire:

1. Try to get the pilot out and move him to a safe area.

2. Put out the fire with extinguisher unless it is dangerous to do so.

3. If pilot is not seriously injured, arrange for delivery to hospital or doctor. If seriously injured or if extent of injuries is unknown, administer necessary first aid and request medical aid.

B. If the aircraft is not on fire:

1. If the pilot is not seriously injured, take him to hospital or doctor.

2. If the pilot is seriously injured or unconscious:

a. Do not move him from the aircraft.

b. Check to see if he is strangling or choking.

c. Check bleeding in accordance with the latest first aid procedures.

d. Treat for shock.

e. Obtain trained medical assistance.

Section XI

Where to obtain emergency treatment:

Medical Unit: St. James Community Hospital

Telephone Number: 406-792-8361

Doctor: Dr. Miller

Telephone Number: 406-792-8361

Telephone Numbers for Emergency Use:

Doctor: 406-792-8361

Hospital: 406-792-8361

Ambulance: 406-723-3132

Poison Control Center: 1-800-525-5042

Deerlodge Fire Dispatcher: 406-723-2437

Butte Ranger District: 406-494-2147

Whitehall Ranger District: 406-287-3223

Regional Air Officer: 406-329-3210

Silver Bow County Sheriff: 406-723-8262

APPENDIX H

CHASE HELICOPTER OPERATION

The following safety rules and procedures have been extracted from FSH 6109.13 "U. S. Department of Agriculture, Forest Service Health and Safety Code," FSM 5240 "Forest Insect and Disease Suppression", FSH 5714 "Air Operations", and other sources.

This plan incorporates general guidelines for developing, equipping and manning heliports and helispots used for supporting helicopter operations.

This Plan does not itemize all the safety rules which are applicable to helicopter operations. Project personnel should be constantly alert to detect any unsafe practices and correct them immediately.

A copy of this Safety Plan should be in the possession of each person who is a COR, Inspector, Base Station Operator or Project Officer on a project on which helicopters are used.

Doctors and ambulance services which will be available in case of emergency, and an Accident Reporting Chart are listed in Section XV and Appendix A of this Safety Plan.

Section

I Guidelines for Developing Base Heliports for Spraying and Seeding

II Personnel Working an any Helicopter Project

III. Visitors to the Helicopter Project

IV. Helicopter

V. Pilot Safety

VI. First Aid and Accident/Incident Reporting

VII. Search and Rescue Before Crash is Located

VIII. When Crash is Located

IX. When Crash Site is Reached

X. Where to Obtain Emergency Treatment

Section I

Guidelines for developing base heliports for spray and seeding projects.

A. Physical considerations

1. One landing pad will be provided for each helicopter in use at each base heliport.

2. Landing pad will be located in the center of a safety circle with the following minimum dimensions:

	Landing Pad	Safety Circle
Small helicopter	15 x 15	75'
Medium helicopter	20 x 20	90'
Large helicopter	30 x 30	110'

3. The heliport and helispots should be situated so that the approach and departure routes are into the prevailing wind.

4. The heliport and helispots should be dust proofed with either dust abatement chemicals or water as needed.

5. Appraoch and departure routes should not exceed 8:1 slope and the side clearances should not exceed 2:1 slope.

6. A wind sock will be erected in an open area away from the flight routes.

B. Personnel considerations

An Air Service Manager-Heliport I will be assigned to each base heliport if 3 or more helicopters will be operating from that heliport.

Air Service Manager-Heliport II if less than 3 helicopters.

A trained helicopter foreman will be at each helispot to manage the helicopter operations.

Helicopter Technical (Maintenance) Inspector and Forest Service Pilot Inspector (may be one person, if qualified) will be used on all projects. The Helicopter Technical Inspector and Forest Service Pilot may be needed only at the start of the project.

Basic Duties

ASM-H: overall supervision and safety of helicopter operation marshaller: Radio and traffic routing. (Base Station Operator.)

1. forest net, air net or VHF radio
2. wind sock and pole
3. helispot or landing pad markers
4. 1 20lb. fire extinguisher per 2 helicopters
5. dust abatement materials
6. personal protective equipment for each person working around helicopters
    a. goggles
    b. hard hat with chin strap
    c. flame resistant clothing
7. high visibility vest for marshaller
8. large first aid kit
9. antidote for chemicals used

10. hazard map

11. tent fly or other suitable operations area

Section II

The Designated COR Inspector, Project Officer or Air Service Manager Heliport will enforce the safety rules outlined in Sections II through X.

Personnel Working on any Helicopter Projects Shall:

A Become familiar with and comply with FSH 6109.13, Forest Service Health and Safety Code.

B. Wear logger-type shoes with nonskid soles and snag-resistant shirts and trousers.

C Carry first aid kits, compasses, pocketknives,and a snakebite kit in snake country.

D Stay away from helicopter when rotor blades are in motion, unless authorized by the pilot or other authority. This means stay at least 50 feet away from small helicopters and 100 feet away from large helicopters.

E When nearer than 50 feet to the helicopter, approach or leave from front or from side near front, where the pilot can always see you.

F Never approach or leave ship from any side where ground is higher than ground where ship is standing.

G Unless equipped with safety goggles or glasses, do not watch landings, takeoffs, or hovering, closer than 100 feet from helicopter.

H When aboard aircraft, wear seat belts, hard hats or crash helmets with chin strap under chin, shoulder harness, and flame resistant clothing. Keep safety belt fastened until instructed by pilot after landing to leave the aircraft.

I When leaving the ship, duck down and walk immediately away, to the front or side toward the front until you are at least 50 feet from the rotors.

J Stay away from tail rotor at all times and see that others do likewise. "THE TAIL ROTOR IS A KILLER."

K When working in the vicinity of the helicopter, wear headgear that will not blow off and foul helicopter or other equipment.

L Keep helispot clear of debris and equipment which may be dislodged by the wind created by the rotor blades.

M Report overdue aircraft, malfunctioning equipment or aircraft to the COR or Project Officer immediately.

N When a passenger, do not approach or leave the helicopter until authorized by the pilot.

O Place caution signs on approaches to active helispots located on or near a road.

P Keep the Base Station informed as to the location of the helicopter.

Q Inform the receiving District as to the expected time and place of arrival of the helicopter when between-District moves are made.

R Inform the sending District of the arrival time of the helicopter when a between-District move has been made.

S Shall observe no smoking rules as follows:

1 Smoking of cigars or pipes in or around aircraft is prohibited.

2 Cigarette smoking is prohibited under the following conditions:

(a) During ground operations.

(b) During and immediately after takeoff.

(c) Immediately before and during landing.

(d) During refueling.

(e) When aircraft is covered with other than fire-resistant fabric or upholstery.

(f) When carrying inflammable cargo.

(g) When suitable, permanently-installed ash containers are not available for safe disposal of cigarettes.

(h) When, in the pilot's opinion, other conditions make smoking undesireable or dangerous.

(i) When common courtesy requires abstinence for comfort of passengers subject to airsickness.

(j) While flying in an open cockpit helicopter.

T Passengers and crew will not carry "strike-anywhere" matches on aircraft flights.

Section III

Visitors to the Helicopter Project:

A Will be kept in a safe area by the Forest Service project supervisor.

B Will be asked to leave the project area if they refuse to comply with applicable safety rules asoutlined in Section II of this Safety Plan.

Section IV

Helicopter:

A Monitor pre-flight inspections to be performed by pilot each day. This will include oil and gas check. Visual check without disassembly of aircraft for items such as oil leaks, loose nuts or bolts, worn control hinges, and bad tires or skids.

B Check reserve fuel supply.

C COR will issue Suspend Work Order for aircraft which are considered unsafe or otherwise unsatisfactory for performance of ferry, reconnaissance, or applicating flights.

D Do not permit the aircraft to be refueled while the engine is running or blades turning.

E Check to see that a suitable electrical ground is provided when aircraft is being refueled with metal container.

Section V

Pilot Safety:

A Pilots should not be permitted to take exploratory side trips without filing a flight plan with the onsite Forest Service Officer in charge of the project.

B Ridges are to be approached at not less than a 45 degree angle.

C Caution pilots to recognize dangers such as lone snags and trees and probable locations of downdrafts. Review District Hazard Map with each pilot, paying particular attention to helispots, areas being sprayed, and approaches to and from those areas.

D Caution pilots as to the location of telephone lines near any helispot which will be used. Mark telephone line with plastic flagging or other highly visible material.

E Pilots will wear crash helmets and flame resistant clothing as specified in the Contract.

F Pilots will not fly in fog, heavy rain or before daylight, or after dark.

G Pilots will not exceed the flight and duty time limitations as outlined below:

1 Flight time will not exceed a total of 7 hours per day.

2 Pilots accumulating 30 or more hours of flying in any 6 consecutive days will be off duty the following full calendar day.

3 Pilots must have a minimum of 10 consecutive hours off duty within 24 hours after the beginning of any duty.

4 Duty includes flight time, ground duty of any kind, and standby or alert status at any location.

5 During any 14 consecutive days, pilots will be off duty for 2 full calendar days. Days off duty need not be consecutive.

6 A duty day is any day a flight is made or 4 hours or more of other duty is performed.

NOTE: Regional Aviation Officers, or their equivalents, may waive the "consecutive" part of Item 3 so that pilots flying such missions as aerial application may have two shorter off-duty periods provided they aggregate 10 hours or more.

H The sending District will notify the receiving District of the daily accumulated flying time for each pilot in any 6-day period when between-District moves are made.

I Place a wind indicator of plastic ribbon or similar material near each helispot or heliport being used.

J The pilot in command will be responsible for the safety of the aircraft, its occupants, and cargo. He has complete authority to postpone, change, or cancel any flight when he believes existing or impending conditions make it unsafe.

K Always recognize and guard against the effects of pressure altitude as affected by temperature.

L Do not dispatch helicopters for mountain flying when average wind velocity over a 5-minute period at exposed peak is 30 mph or more.

THE RESPONSIBILITY FOR IMPLEMENTING THE VARIOUS PHASES OF THE SAFETY PLAN OUTLINED IN SECTIONS V THROUGH XIV IS STATED IN EACH SECTION.

Section VI

First Aid and Accident/Incident Reporting:

A Definition of Accident and Incident

1 As used in this Safety Plan, ACCIDENT shall mean: 1) Destruction or substantial damage to the aircraft, or service truck; 2) damage to the aircraft components, and 3) minor, serious, or fatal injury to personnel.

2 As used in this Safety Plan, INCIDENT shall mean any air or ground mishap, malfunction or situation involving aircraft or personnel which results in a deviation from standard procedures or has the potential of resulting in an accident, injury, or death.

B The contractor's personnel shall be equipped and trained to take proper action in an emergency. This is the contractor's responsibility.

C The Forest Service COR or Inspector on the project will be equipped to take proper action in an emergency. Equipment will include a radio, an adequate first aid kit, and Stokes litter.

D The person manning the base station or the radio net will have telephone numbers of doctors, ambulance service and hospital service recorded in a convenient place for ready use. When a crash is reported he will start medical aid as soon as possible to the helispot being used.

E All injuries and/or accidents involving people will be reported immediately to the Base Station Operator on the radio net. The Operator at the Base Station will immediately notify the District Ranger or his Acting, who will notify the Forest Air Officer/Dispatcher.

F Any accident or incident involving aircraft, regardless of severity, will be reported immediately to the Base Station Operator on the radio net. The Base Station Operator will immediately notify the District Ranger or his Acting. He will notify the

Forest Air Officer/Dispatcher who in turn will notify the Regional Air Officer. The Regional Air Officer will advise of further action and reporting requirements.

The initial verbal report will follow the format of Form 5700-14.

Additional accident reporting instructions are given in FSM 5714.18.

Section VII

Search and Rescue Before Crash is Located:

A The Inspector on the project will notify the Base Station Operator and the Base Station Operator will notify the District Ranger, who will notify the Forest Air Officer/Dispatcher of the general area of the search.

B The Forest Air Officer/Dispatcher will have the Forest Service plane or other alerted aircraft scout the area, keeping in radio communications with the Base Station.

C A radio equipped ground rescue squad should be started toward the general crash area from the Base Station immediately, keeping in communication with search aircraft or Base Station for directions.

D The Base Station Operator will make arrangements for medical (doctor and hospital) and ambulance service.

E If crash is not located within a reasonable period, the Forest Air Officer/Dispatcher will request other qualified aerial observers to join the search.

F The Forest Air Officer/Dispatcher will notify the Regional Air Officer and notify the Contractor's home office if it is a Contract aircraft.

G The District Ranger or his Acting will notify the Sheriff of the County in which the emergency occurs.

Section VIII

When Crash is Located:

A Prior to the time the Sheriff takes over the administration of the rescue operation:

1 The Base Station Operator (BSO) will:

(a) Immediately notify the District Ranger, or Acting, who will decide whether to use airborne or ground rescue squads, and start whichever is decided upon.

(b) Keep in constant communication with rescue squads and start medical and ambulance service to the crash.

2 As soon as the rescue squad reaches the crash, they should report the condition of the pilot and any other persons involved in the crash to medical units and to the Base Station. The Base Station will relay the information to the Forest Air Officer/Dispatcher who will notify the Regional Air Officer.

3 Whatever action is necessary to save the lives of the crash victim or victims will be taken by the medical unit and rescue squad. In case of fatality, the Forest Air Officer/Dispatcher will follow instructions in R-3 Supplement No. FSM 6179.15c.

4 The Forest Air Officer/Dispatcher will initiate request for investigation and report by NTSB representative and Regional Air and Safety Officers.

B After the Sheriff takes over the administration of the rescue operation:

1 Forest Service personnel will assist the sheriff as follows:

(a) Furnish communications through the Forest Service communications system.

(b) Furnish guide service to the scene of the emergency.

(c) Help in arrangements for packstock and other forms of transportation where necessary.

(d) Furnish necessary maps, details of Forest organization, etc.

(e) Aid in arrangements for ground personnel at the scene of the accident.

2 The Forest Air Officer/Dispatcher will keep the Regional Office informed of the developments in the rescue operation.

Section IX

<u>When the Contractor's Ground Crewman and/or Forest Service Representative Reach the Crash Site:</u>

A If the helicopter is on fire:

1 Try to get the pilot out and move him to a safe distance.

2 Put out the fire with extinguisher unless it is dangerous to do so.

3 Check the pilot's clothing if he has been working on a chemical application project, to see if he has been splashed with chemicals. If so, and if he is not seriously injured, help him to the nearest water and wash several times with soap.

4 If pilot is not seriously injured, take him to hospital or doctor.

B If the helicopter is not on fire:

1 If the pilot is not seriously injured, take him to hospital or doctor.

2 If the pilot is seriously injured or unconscious:

(a) Do not move him from the helicopter.

(b) Check to see if he is strangling or choking.

(c) Check bleeding in accordance with the latest first aid procedures.

C When an injured pilot is taken to a hospital or doctor, make certain they know the pilot has been exposed to chemicals if he has been working on a chemical application project. Check with contractor's ground crewman to learn which chemicals the pilot has recently been exposed to. If a shot of morphine for pain is given the pilot, and he has phosphate poisoning, it can kill him.

Section X

Where to obtain emergency treatment:

Medical Unit: St. James Community Hospital

Telephone Number: 406-792-8361

Doctor: Dr. Miller

Telephone Number: 406-792-8361

Telephone Numbers for Emergency Use:

Doctor: 406-792-8361

Hospital: 406-792-8361

Ambulance: 406-723-3132

Poison Control Center: 1-800-525-5042

Deerlodge Fire Dispatcher: 406-723-2437

Butte Ranger District: 406-494-2147

Whitehall Ranger District: 406-287-3223

Regional Air Officer: 406-329-3210

Silver Bow County Sheriff: 406-723-8262