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ENVIRONMENTAL ASSESSMENT OF THE USE OF BAYTICOL (FLUMETHRIN) 1% POUR-ON ACARICIDE IN THE PILOT ERADICATION PROJECT PROPOSED FOR THE TROPICAL BONT TICK (AMBLYOMMA VARIEGATUM) ON ANTIGUA, WEST INDIES

Prepared for

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INTEGRATED PEST MANAGEMENT AND ENVIRONMENTAL PROTECTION PROJECT

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I. EXECUTIVE SUMMARY AND RECOMMENDATIONS

MAIN FINDING: Bayticol 1% pour-on should not be approved for use in the Antigua pilot bont tick eradication project at this time.

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USDA/APHIS has requested that U.S.A.I.D. approve the use of the acaricide Bayticol (flumethrin) 1% pour-on for use in a pilot tropical bont tick eradication project on Antigua. Because Bayticol is not registered ir the U.S., U.S.A.I.D. commissioned this update of the 1987 Environmental Assessment (EA) that was done for the previously proposed acaricides amitraz (Taktic) and permethrin (Atroban). The main objective of this EA is to determine to what extent Bayticol data is available to satisfy U.S. EPA registration requirements, and whether any data gaps found are critical with regard to the proposed use of Bayticol on Antigua.

APHIS was responsible for providing foreign registration data on Bayticol (flumethrin) for review by the EA team. One set of data, submitted in support of Bayticol registration in the Federal Republic of Germany, was procured from Bayer/Mobay Chemical by APHIS for the EA team's inspection on condition that none of the data be divulged.

The team conducted a literature search and contacted world-class specialists in pesticide toxicology in order to locate additional information on Bayticol. None of the information thus located satisfied data gaps found in the German registration submission with regard to U.S. registration requirements as stated in EPA regulation 40 CFR Part 158.

The EA team also made site visits on Antigua and St. Lucia in June 1989 and conferred extensively with people who are involved in tick control and/or have experience using Bayticol under local conditions. This input from the field was central to the team's conclusions and recommendations.

The EA concludes that Bayticol pour-on is very effective and that it offers important logistical, cost and safety advantages including portability, relative rainfastness, long residual action, and reduction of exposure of applicators and the environment. However, a review of the available data shows critical gaps in information that is required by EPA for U.S. registration and which is also pertinent to the proposed use of Bayticol on Antigua:

a. no chronic studies on reproduction effects on multiple generations;

b. no oncogenicity data;

c. a missing teratogenicity study;

d. no data on movement and metabolism in soil;

e. no studies on toxicity to fish and other aquatic animals; and

f. insufficient information on inert ingredients.

2. **USDA should ask Bayer/Mobay to reconsider registering Bayticol 1% pour-on in the U.S. and collaborate with them to develop the data required in support of registration.** p. 11

3. **As mandated in the 1987 EA, USDA should evaluate other acaricides that are EPA-registered or under development and which might be superior to amitraz and permethrin sprays for use in the project. This includes both acaricides formulated as pour-ons and those having other novel delivery systems.** p. 24

The bont tick eradication project on Antigua has the necessary research component and is a pilot program with potential for developing technology to be applied throughout the Caribbean. The use of Bayticol or some other effective pour-on acaricide would greatly improve the chances for successful eradication of the bont tick.

4. **More USDA staff should be assigned to the project to insure successful implementation, including the proper use of acaricides.** p. 30

An experienced officer is needed in the field full-time to do nothing but supervise treatment evaluation teams and be vigilant about data collection and the safety and effectiveness of field operations.

5. **Treatment teams should be given veterinary training so that the teams can also provide veterinary assistance and livestock management advice to animal owners.** p. 32

This training would have several important benefits:

a. increased motivation of farmers and treatment team staff to carry out their roles in the eradication program effectively;

b. the tick eradication program could contribute to an improved veterinary care program for the island that would be capable of assisting livestock owners and monitoring for reintroduction of ticks and tick-borne diseases after termination of the project;

c. motivated, interested individuals likely to do good work will be more attracted to, and more likely to stay with, treatment team jobs;

d. a cadre of quality animal handlers/veterinary assistants would be produced for Antigua and other Caribbean islands; and

e. the quality (and perhaps quantity) of animals on Antigua would improve.

6. The project staff epidemiologist and veterinarian should study the epidemiological status of ticks and tick-borne diseases on Antigua. p. 33

7. Before field activities begin, the project should secure a commitment from the Antiguan government for effective enactment and enforcement of supportive legislation and post-project continuation of the tick/disease monitoring and treatment program. p. 33

II. INTRODUCTION

A. Background and Purpose

The presence in the Caribbean of the tropical bont tick Amblyomma variegatum and the associated diseases heartwater and dermatophilosis represents an important threat to surrounding countries with significant livestock industries. If heartwater reached the U.S., the cost to the cattle industry would be tremendous. Therefore, the U.S. Agency for International Development (U.S.A.I.D.) and the U.S. Department of Agriculture (USDA) have cooperated in efforts to determine the feasibility of eradicating the tropical bont tick in the Caribbean.

In September 1987, U.S.A.I.D. and USDA entered into an agreement to pass U.S.A.I.D. funds (appropriated by Congress) to USDA to conduct research activities and administer a pilot tropical bont tick eradication project on Antigua. Implementation of the pilot eradication project would be the responsibility of the USDA Animal and Plant Health Inspection Service (APHIS). Under the auspices of USDA's Office of International Cooperation and Development (OICD), research on wildlife hosts of the tropical bont tick on Antigua has begun. Further research on the economic benefits of tick eradication has been outlined and contracted but not yet begun.

APHIS first planned to use the acaricides amitraz (sold as Taktic) and permethrin (sold as Atroban) in the pilot bont tick eradication project. An Environmental Assessment (EA) of the proposed use of these chemicals was completed in 1987 by the Consortium for International Crop Protection (CICP) and they were approved.

Subsequently, APHIS learned about the pour-on formulation of a synthetic pyrethroid acaricide called flumethrin (sold as Bayticol). It is registered and used in many foreign countries, but not in the U.S. Bayticol pour-on appears to offer many efficacy, safety and logistical advantages for the bont tick eradication project, so APHIS requested that U.S.A.I.D. authorize its use on cattle, sheep and goats on Antigua. Accordingly, U.S.A.I.D.'s Bureau of Latin America and the Caribbean requested that CICP prepare an updated EA for the project that covers the proposed use of Bayticol.

The EA team was to determine to what extent Bayticol data is available to satisfy EPA requirements for U.S. registration, and whether any data gaps found are critical with regard to the proposed applications of Bayticol on Antigua. Based on this analysis, the team was to make a recommendation to U.S.A.I.D. regarding approval of Bayticol for project use.

The team was also to comment and enlarge upon the original (1987) EA, evaluate the potential environmental impact of Bayticol and propose mitigative measures relating to the use of acaricides including Bayticol in the bont tick program.

B. Data examined

USDA/APHIS was responsible for providing foreign registration data on Bayticol for examination by the EA team (see Annexes 7 and 8). Only the data submitted in support of an application for registration in the Federal Republic of Germany (not granted to date) was obtained by APHIS (Bayer 1986d).

Bayer/Mobay Chemical permitted the EA team to examine the German registration data provided that it not be copied or divulged. Because of that restriction, this EA comments solely on the availability of data to address EPA requirements. No information on the quality, significance, implications, etc. of the data reviewed is included herein. Therefore, some data listed in Table 1 as available from Bayer might not be deemed acceptable by EPA in support of U.S. registration.

Another consequence of the confidentiality of the German registration data is that all the information on Bayticol given in this report had to be derived from Bayer product bulletins or from the scientific literature. There are many generalizations about pyrethroid pesticides as a group, which were included for clarification in the absence of more specific data for Bayticol. However, generalizations about the chemical class as a whole can not be considered adequate to support the use of Bayticol by U.S.A.I.D.. There is a large number of synthetic pyrethroids and their characteristics vary significantly, including their toxicity to different organisms and their behavior in the environment. Each chemical must be evaluated individually. It is for this reason that EPA requires specific data for each pyrethroid pesticide that is proposed for registration.

If data was available to address every relevant EPA requirement, it would become necessary to scrutinize the quality and significance of that data in order to determine whether Bayticol would meet EPA safety standards for registration. Under its current commitment to guard the confidentiality of Bayer's proprietary information, this EA team could not report such findings. Therefore, detailed scrutiny of Bayticol data might have to be accomplished by submitting the data directly to EPA for review.

Bayticol pour-on is registered in 12 countries, some of which may have registration requirements closer to those in the U.S. than the West German requirements are. However, APHIS was not able to obtain those sets of foreign registration data for the EA team's inspection.

The EA team conducted an extensive computer literature search in an attempt to find further pertinent information (Annex 1). Eminent specialists on synthetic pyrethroids (such as Bayticol) were contacted in order to explore all avenues for locating the Bayticol data required for a U.S. registration. None of these sources yielded information that filled data gaps found in the German registration submission.

In preparing this EA the environment and conditions on Antigua, the project design, and the projected use patterns for Bayticol on the island were all taken into consideration. The entire EA team made site visits to

Antigua (June 25-29, 1989) and St. Lucia (June 30, 1989) to make observations first hand and consult people who would be connected with the project and/or the proposed use of Bayticol. The comments and suggestions of these contacts in the Caribbean were central to the team's deliberations and conclusions.

C. Relation to the 1987 project EA

This EA is a sequel to, and complementary to, the original project EA that was submitted to U.S.A.I.D. by CICP on July 30, 1987 (CICP 1987). The findings and recommendations of the original EA are still valid. We have cited, commented on, and enlarged upon them.

Information on some key EA-related topics has been published since the 1987 EA was written. Heartwater is still a threat to the U S. mainland through movement of the tick vector and/or infected livestock (Walker and Olwage 1987, Barré et. al. 1987, Camus and Barré 1987, Alderink and McCauley 1988, SCWDS 1988). White-tailed deer may become a heartwater reservoir on the mainland (Oberem and Bezuidenhaut 1987). Morrow et. al. (1989) have produced a current review of the tropical bont tick and dermatophilosis on Antigua.

III. PESTICIDE PROCEDURES

A. The EPA registration status of the requested pesticide

1. U.S. Registration

No application has ever been made to the U.S. EPA for the registration of Bayticol (flumethrin) in the U.S. (Mr. A. Hayward, EPA, personal communication).

Puerto Rican Agriculture Officials considered applying for an experimental use permit (EUP) for Bayticol for the USDA tick eradication project in Puerto Rico. However, Mobay Chemicals (Bayer's U.S. representative) did not want to develop the additional data necessary for an EUP because of the cost involved in relation to the small U.S. market. Therefore the application was never made (Dr. Lonnie King, USDA, personal communication). EPA data requirements for obtaining an EUP for Bayticol are listed in Tables 1 and 2.

Bayticol would not be eligible under U.S. EPA regulation 40 CFR Part 166.2-3 for application on an emergency use basis against the tropical bont tick (Amblyomma variegatum) on Antigua. In that regulation, "emergency condition" is defined as an "urgent, non-routine situation." The bont tick was first reported from the Caribbean (Guadeloupe) in 1828 and has been spreading slowly since. It reached Antigua in 1895 and Puerto Rico in 1974 (Alderink and McCauley 1988). Based on its history of spread, its appearance on the North or South American mainland is not thought to be imminent.

2. Foreign registrations

An application was made to register Bayticol 1% pour-on in the Federal Republic of Germany. As of 8/89, registration had not been granted (Dr. D. Cox, Mobay Chemical, personal communication).

Bayticol 1% pour-on is currently registered for beef and lactating and non-lactating dairy cattle in 12 countries: Algeria, Argentina, Australia, Barbados, Brazil, Japan, Mali, New Zealand, Peru, Turkey, the United Kingdom and Uruguay. It is also registered in England for controlling ectoparasites (not including ticks) on sheep. Seven countries have registered Bayticol 6% E.C. for spray and dip.

3. Availability of Bayticol data to meet U.S. registration requirements as published in EPA regulation 40 CFR Part 158

The Bayticol data available for review by the EA team does not meet EPA requirements for U.S. registration of either the manufactured product or the 1% pour-on commercial end-use product. (In this regard it is pertinent to note that since only data submitted in application for a German registration was available for review, the EA team could not be certain that any of the data examined has been found acceptable in support of Bayticol registration in any country with authoritative standards.)

Table 1 lists the EPA-required data that were found to be available. The format and methodology of some studies differ from that required by EPA and might be adjudged unacceptable.

Table 2 lists data which are required for U.S. registration but not available from any source investigated by the EA team. Missing data fell into the broad categories of product chemistry (about half missing), toxicology (about half missing), environmental fate (almost completely missing), and wildlife and aquatic organisms (completely missing). Some of the data gaps are very significant in view of the projected use pattern of Bayticol 1% pour-on on Antigua.

It is clear that applicators and treated livestock would carry Bayticol to almost every corner of the wider environment of Antigua. Treated animals become coated with Bayticol over their entire body surface. Even ectoparasites between the cloven hoofs of ruminants are eliminated. There is an acaricidal "rub-off effect" on untreated livestock that is herded together with treated animals. Therefore Bayticol can also be expected to rub off of animals onto the ground, trees and brush that they contact, and might wash off to some degree.

Bayticol is toxic to fish and reptiles and contamination of water should be avoided (Bayer 1986a, Neuhauser 1982). One of the main reasons that USDA/APHIS wishes to use Bayticol pour-on is that the formulation is relatively portable. Treatment teams could go where the animals are rather than be forced to collect animals at some easily accessible central spraying site, which is more likely to be a livestock owner's domestic premises. Sixty to 65% of the island's livestock is the property of landless owners

TABLE 1. Data Available From Bayer (Submitted for German Registration)

Use Pattern: Indoor/Domestic Outdoor
(*Data not required for an Experimental Use Permit)

CFR 158.120 Product Chemistry Data Requirements Data required	Supporting data[1]
Product identity and composition:	
Product identity and disclosure of ingredients	MP, EP
Description of beginning materials and manufacturing process	TGAI, MP, EP
Analysis and certification of product ingredients:	
Preliminary analysis	TGAI
Physical and chemical characteristics:	
Color	MP, EP, TGAI
Physical state	MP, EP, TGAI
Density	EP
Stability	TGAI
Miscibilty	TGAI
Storage stability	MP, EP

CFR 158.125 Residue Chemistry Data Requirements Data required	Available
Chemical identity	TGAI
Directions for use	Label
Nature of residue	
Livestock	PAIRA
Residue analytical method	TGAI
Magnitude of residues	
Meat/milk	TGAI
Proposed tolerance	Residue of TGAI

CFR 158.130 Environmental Fate Data Requirements Data required	Available
Hydrolysis	TGAI

CFR 158.135 Toxicology Data Requirements Data required	Available
Acute testing	
Acute oral toxicity - rat	EP, TGAI
Primary eye irritation - rabbit	EP
Primary dermal irritation	EP
Teratogenicity - rat only	TGAI
Special testing	
General metabolism	PAIRA
Domestic animal safety	EP
Mutagenicity testing	
Gene mutation	TGAI*
Structural chromosomal aberration	TGAI*
Other genotoxic effects	TGAI*

[1]EP - end use product; MP - manufactured product; TGAI - technical grade active ingredient; PAIRA - pure active ingredient, radio labeled.

TABLE 2. Data Required For Registration But Not Available (From Bayer German Registration Data Unless Footnoted Otherwise)

Use Pattern: Indoor/Domestic Outdoor
(*Data Not Required For an Experimental Use Permit)

CFR 158.120 Product Chemistry Data Requirements Data required	Not Completed[1]
Product identity and composition:	
Discussion of formation of impurities	MP, TGAI, EP
Analysis and certification of product ingredients:	
Preliminary analysis	EP, MP
Certification of limits	EP, MP
Analytical methods to verify certified limits	MP[2], EP[2]
Physical and chemical characteristics:	
Odor	MP, TGAI, EP
Boiling point	TGAI
Density, bulk density, or specific gravity	MP, TGAI
Solubility	TGAI
Vapor pressure	TGAI
Dissociation constant	TGAI
Octanol/water partition coefficient	PAI
Corrosion characteristics	MP, EP

CFR 158.130 Environmental Fate Data Requirements Data Required	Not Completed
Metabolism studies	
Aerobic soil	TGAI or PAIRA*
Leaching and adsorption/desorption	TGAI or PAIRA*
Dissipation studies - field	
Soil	TEP*

CFR 158.135 Toxicology Data Requirements Data Required	Not Completed
Acute testing	
Acute oral toxicity - rat	MP
Dermal sensitization	MP, EP
Subchronic testing	
21-day dermal	TGAI, EP*
Chronic testing	
Oncogenicity study - 2 spp. - rat and mouse preferred	TGAI*
Reproduction - 2 generations	TGAI*
Teratogenicity - 1 sp. (not rat)	TGAI*

[1]EP - end use product; MP - manufactured product; TGAI - technical grade active ingredient; PAI - pure active ingredient PAIRA - pure active ingredient, radio labeled; TEP - typical end use product.

[2]Method is not the multi-residue method required in EPA guideline 62-3, "Hazard Evaluation Division Pesticide Assessment Guidelines Residue Chemistry," which will detect flumethrin.

TABLE 2. (CONT.)

CFR 158.145 Wildlife and Aquatic Organisms Data Requirements

Data Required	Not Completed[1]
Avian and mammalian testing	
Avian oral LD_{50}	TGAI[2]
Avian dietary LC_{50}	TGAI
Aquatic organism testing	
Freshwater fish LC_{50}	TGAI[3]
Acute LC_{50} freshwater invertebrates	TGAI

[1]TGAI - technical grade active ingredient

[2]An LD_{50} figure is available for hens (Bayer 1986a) but the required supportive data appear to be unpublished.

[3]Some very general information has been published by Neuhauser (1982) but LC_{50} figures for specific fish species and the required supportive data appear to be unpublished.

whose animals graze on roadsides, vacant lots in the city and extensive tracts of unfenced government and private land that include areas in and around mountain forests and very near the ocean. Livestock needs frequent watering, so unrestrained animals usually range near water and owners keep tethered livestock near a stream or pond. These circumstances increase the chances of Bayticol directly contacting bodies of water and of Bayticol containers being washed in them.

Although Bayticol pour-on is more water-fast than water-based sprays, no data is available to indicate how close it comes to 100% water-fastness. Therefore it is impossible to know to what degree a body of water might become polluted during the dry season when many animals repeatedly congregate to wade in and drink. Also, tropical rainfall on Antigua promotes the pollution of bodies of water by chemicals from nearby soil through erosion, leaching and runoff during the rainy season.

Under these circumstances, the lack of specific data on Bayticol's metabolism and movement in soil and its toxicity to fish and freshwater invertebrates is of concern. Some of the missing information on product chemistry (solubility and the octanol/water partition coefficient, for example) are also relevant to Bayticol's potential impact on aquatic animals.

Because of the way it is used, Bayticol would not be expected to create serious problems with regard to birds. Exposure of birds to Bayticol should be minimal and its toxicity to them appears to be low (see III.E.4.).

In the bont tick project on Antigua, Bayticol would be applied to livestock every 14 days over a long period (two years). Nevertheless, no chronic toxicity studies of any sort were among the data examined. Residue studies appear to be adequate, but the lack of oncogenicity studies, a two-generation reproduction study and a teratogenicity study for a species other than the rat is critical.

Some information on the inert ingredients in Bayticol was available in the German registration data. Although none of that information indicated unacceptable toxicity to animals, it was insufficiently detailed to allow reviewers to rule out the possibility.

Not only are the data available for review insufficient to register Bayticol 1% pour-on in the U.S., but the missing data - required by EPA even for chemicals that are never used outside of barnyards - are essential for its consideration for use in the Antigua bont tick eradication program. Therefore, U.S.A.I.D. should not authorize the use of Bayticol pour-on in the project.

B. <u>The basis for selection of the requested pesticide....relative to acaricides previously approved for the control of the tropical bont tick (and other tick species) present in Antigua</u>.

1. Efficacy

Numerous efficacy trials have shown that Bayticol 1% pour-on is effective against the tropical bont tick (see III.F for a full discussion of efficacy).

2. Environmental Impacts and Safety

Synthetic pyrethroids such as flumethrin are in toxicity class III, pesticides with the lowest toxicity to mammals and minimizing human health risks. They are also relatively nontoxic to birds. Like amitraz, pyrethroids are not very water soluble, will not move well in soil, and degrade rapidly in soil. In general they have a relatively low probability of contaminating water sources, but that probability varies with use pattern and environmental circumstances.

Bayticol's great safety advantage is that its pour-on formulation would reduce exposure of applicators and the environment to the pesticide. Proper amitraz spray application will require that the livestock be placed in an alleyway (see 1987 EA p. 11-13). Three- or 4-person application teams will be necessary. Accidental spraying of applicators and handlers is very probable. Because of the spray volume used, mixing in the field is necessary, thus increasing the probability of spills at water sources. Bayticol's 1-litre ready-to-use pour-on bottles eliminate the need for mixing, spray solution transport, sprayer loading, extensive splattering of the applicator and animal handler(s), runoff, and disposal of unused spray mixture. USDA is considering the use of a Bayticol application kit consisting of a 5-litre Flexi-pack backpack attached to a calibrated application gun. This backpack would have most of the environmental and safety advantages of the bottle except for the possibility of leaks onto the applicator's back.

3. Logistical considerations

The use of Bayticol 1% pour-on has a number of logistical advantages for the treatment of cattle, sheep and goats in the pilot eradication program on Antigua. The proposed project (as reviewed in the 1987 EA, p. 5) calls for treating cattle, sheep and goats (and dogs and swine, if necessary) with amitraz, and horses and donkeys with permethrin. Both materials are to be applied by whole-body spray. These animals are considered to be the only hosts for adult bont ticks on Antigua (barring the potential of 150 to 200 fallow deer on the islet of Guiana Island; see SCWDS, 1988). Therefore, if all the animals can be treated at 2-week intervals reproduction of the bont tick could be prevented.

Spray applications of amitraz require trained teams equipped with vehicles, power sprayers, portable pens/alleys and safety equipment. (See Application of Acaricides, 1987 EA p. 11. The guidelines for such treatments are set forth in USDA/APHIS Veterinary Services Memorandum 556.1.) The following logistical considerations apply:

a. that hydraulic sprayers or portable dip vats be maintained operable and safe for use.

b. that sufficient gasoline for the power sprayers be available and portable for field use.

c. that sufficient water be available for mixing acaricide solutions. (Severe water shortages occur during periods of drought on Antigua.)

d. that the vehicles used to transport the sprayers or vats be able to reach all treatment sites during wet and dry season weather conditions.

e. that treatment delays or retreatments due to rain can be dealt with adequately without excessive extension of treatment intervals.

A pour-on application method for cattle, sheep, and goats would have substantially fewer logistical requirements than spray treatments using amitraz. The number of power spray units and requirements for spare parts, gasoline and labor for operation and maintenance would be greatly reduced. Since minimal animal restraint is required, less portable fence material would be needed. On St. Lucia we observed the ease with which tethered animals belonging to landless people were treated with Bayticol pour-on by one animal health assistant and the owner. Because of the minimal animal restraint associated with the pour-on application, a portable alleyway is still used in only one area of St. Lucia.

A pour-on acaricide would greatly reduce the need for water to prepare spray solutions on Antigua, where fresh water supplies may be critically low during the dry season. During the wet season, Bayticol's previously described rainfastness and ease of portability will reduce interruptions of treatment schedules. In all seasons a pour-on acaricide would increase the accessibility of the remote areas of Antigua where truck-mounted power sprayer units would certainly experience difficulties.

4. Cost considerations.

Major considerations which will affect the cost of the acaricides delivered to the animals during the project are:

a. Cost of the acaricide as manufactured.
b. Cost of application and safety equipment needed.
c. Cost of maintenance and operation of equipment.
d. Labor differential associated with preparation of deliverable solutions.
e. Cost differential associated with delivery (especially during inclement weather, when rain might interrupt application or make reapplication necessary).

An initial cost comparison for the pilot project on Antigua was prepared by Dr. D.D. Wilson (1988) based upon data for use of amitraz and permethrin in the tick eradication program in Puerto Rico (Garris et. al. 1989) and compared to an estimated cost of $20.00 U.S./litre for Bayticol. Dr. Franz C. M. Alexander, IICA Representative on St. Lucia, indicated that Bayticol 1% pour-on costs $20.00 U.S./litre for the current tick control projects on St. Lucia and Dominica.

The proposal under consideration calls for Bayticol 1% pour-on to be used for treatment of cattle, sheep and goats, with permethrin (Atroban) to be used for equines (horses and donkeys). This scenario differs from that evaluated by Wilson (1988), in which equines were also under consideration for treatment with Bayticol. Estimates of the number of horses and donkeys on Antigua range from 1300 to 2000. The summary of cost factors used by Wilson appears accurate and addresses considerations a-d above, with the exception that goggles should be added to the list of safety equipment for Bayticol application (an estimated cost by APHIS of $2.10 each). Table 3 summarizes comparative cost estimates for amitraz vs Bayticol for treating cattle, sheep and goats. The estimates are based on adjustments to Wilson's calculations to reflect objectives of the present proposal. It should be noted that the animal census data used by Wilson were from the 1984 Antigua and Barbuda Census of Agriculture. The 1987 EA (Risk/Benefit Analysis, Section B, page 55) suggests that these census figures are underestimated due to severe drought in 1984, so the final cost estimates obtained in this comparison are probably low and would not reflect total project costs for any acaricide used. According to Dr. James Robinson, Chief Veterinary Officer on Antigua, as of 6-27-89 more recent census data were not available.

Using Bayticol would be cheaper for several reasons. The cost per treatment of sheep and goats is lower due to treatment based upon body weight rather than having to wet the animals' entire body surface with spray (a surface area-to-weight factor). Substantially less labor and equipment are needed to treat animals with the pour-on technique. (The exact number of teams needed will depend on an accurate census and tagging of animals on Antigua as well as their distribution and accessibility.)

On St. Lucia Dr. Peter Darius Gabriel, Veterinary Officer, and Mr. Eden Compton, Sr. Animal Health Assistant, explained that their one-person teams treat up to 200 animals per day, with work concentrated during the cooler morning and evening hours and reliance on owners for assistance in handling the animals. They would prefer two-person teams, however, to assure adequate assistance in animal handling and data collection.

C. <u>The extent to which Bayticol would be part of an integrated approach to eradication of the tropical bont tick</u>.

As the pilot project is currently planned, acaricides - either amitraz (Taktic) or Bayticol on cattle, sheep and goats, and permethrin (Atroban) on equines - will be the only method for eradicating ticks. It appears that no nonchemical eradication methods appropriate under project conditions and for

TABLE 3. Comparative Estimates of Costs Associated With the Use of Amitraz Spray and Bayticol 1% Pour-on Acaricides Applied to Cattle, Sheep and Goats in the Pilot Tropical Bont Tick Eradication Program Proposed for Antigua, West Indies.

Cost Estimate	Acaricide	
	Amitraz[1]	Bayticol[2]
Base Product	$18.50/760 ml	$20.00/liter
Per unit of deliverable solution	$ 0.05/1 spray	$ 0.02/ml pour-on
Total Treatments[3]		
Cattle 11,064	$159,817	$345,197
Goats 9,548	68,028	39,720
Sheep 6,092	43,404	19,007
26,704	$271,249	$403,924
Labor[4]	$378,000	$170,000
Equipment, Fuel & Maintenance	$558,026	$207,762
Total	$1,207,275	$781,686

[1]Prepared as a 0.025% solution from 760 ml of 12.5% active ingredient in 379 liters of water and applied at the rate of 5.7 liters of finished solution per animal to cattle and 2.8 liters of finished solution per animal to sheep and goats. Animals are wetted to the skin with pressurized spray application.

[2]Prepared in a ready-to-use formulation of 1% m/v flumethrin in an oil carrier to be applied as a pour-on to cattle, sheep and goats at the rate of 1 ml/10 kg of body weight. Total volume of pour-on based on 1984 Antigua Census data for average live weight: Cattle=268 kg for 30 ml, Goats=34 kg for 4 ml, and Sheep=26 kg for 3 ml.

[3]Treatment costs based on applications of materials at 14 day intervals for two years (52 treatments).

[4]Labor costs based upon 27 3-member teams applying Amitraz to 1000 animal units/14 days/team and 17 2-member teams applying Bayticol to 1670 animal units/14 days/team.

project objectives will come available during the project period. Non-chemical alternatives are evaluated in Section III.I. Effective use of acaricides to eliminate the tropical bont tick and prevent the re-introduction of ticks and/or disease will require integration of 1.) continual accurate animal census, 2.) regulation of animals moving onto and off of the island or into and out of inter-island epidemiological zones, 3.) owner/producer compliance, 4.) application training and safety, 5.) vector population monitoring, 6.) animal disease monitoring and clinical preparedness, 7.) post-program monitoring for vectors and disease, and 8.) communication with owners, producers and government officials on progress (see 1987 EA and V, Suggestions for Program Implementation).

D. The proposed method or methods of pesticide application, including availability of appropriate application and safety equipment.

1. Method(s) of application

Label instructions for Bayticol 1% pour-on call for the ready-to-use formulation to be applied along the backline of animals starting from the neck or withers and ending at the base of the tail. Bayer's Bayticol technical bulletin recommends that the appropriate volume be applied as two fine lines, one on either side of the backbone (as opposed to one single line), to achieve optimum animal coverage. The recommended dosage rate, 1 mg of active ingredient/kg of body weight, is achieved by applying 1 ml of the commercial preparation per 10 kg. of body weight. Two application devices are commercially produced for ease of application. Bayticol comes prepackaged in 1-liter plastic squeeze bottles equipped with a spout-dosemeter (the dosemeter may be moved from spent bottles to full or refilled bottles). The dosemeter we observed on St. Lucia was calibrated in 10 ml increments (up to 50 ml) for animals weighing 100 - 500 kg. A 5-liter flexible poly-backpack equipped with a Philips gun (with wand and nozzle) is available from Bayer for application to large numbers of cattle. It delivers up to 66 adult bovine doses per 5 liters. The gun is calibrated to deliver volumes of Bayticol based on 3 settings and grip-squeeze combinations as follows:

Animal	Weight	Rate	Philips Setting	No. of Squeezes
Calf	Up to 175 Kg.	17.5 ml	17.5	1
Yearling	175-275 Kg.	27.5 ml	27.5	1
Adult	275-375 Kg.	37.5 ml	37.5	1
Heavy Adult	Over 375 Kg.	52.5 ml	17.5	3

Bayticol 1% pour-on is available in 1-, 5- and 20-litre containers. Bayticol from the larger containers can be used to refill empty application devices.

The application method and dosage rate for sheep and goats is identical but application equipment design and most literature on methods is directed toward use on cattle. The dosemeter and Philips gun are not presently suited for Bayticol application to sheep and goats because the minimum setting and calibration are not appropriate to the lighter weights

of these animals. On St. Lucia, sheep and goats have been treated with the dosemeter by estimating the appropriate volume needed BELOW the lowest calibrated mark. Animal health officers have observed loss of wool along the application line among some Barbados blackbellied and "local" breeds of sheep using this application procedure, indicating overdosage or dermal sensitivity.

Project staff should inquire whether Bayer has manufactured a dosemeter calibrated for delivery of Bayticol to animals weighing 5-100 kg (in increments of 5-10 kg). If not, this problem should be addressed by devising an alternative closed system for measuring and delivering Bayticol pour-on for application to small animals. This would not be difficult - one possibility is the use of an adjustable, multidosing drenching syringe. Project staff should be trained thoroughly in the proper use of any delivery system employed.

2. Availability of Bayticol and safety equipment

A pour-on synthetic pyrethroid was tested in 1986-87 on Antigua government cattle by scientists from the Center for Tropical Veterinary Medicine, University of Edinburgh, Scotland. Antiguan veterinary staff and producers associated with that project are thus aware of the materials and procedures involved. Mr. Alestair Rutherford, EDF Project Leader, informed us that construction of a dipping vat to control ticks on the proposed EDF Antigua Communal Farm Project had been canceled and that Bayticol pour-on purchased through the Bayer representative in Barbados would be used instead. However, Dr. James Robinson indicated that Bayticol is not currently available to Antiguan livestock producers and that pour-on parasiticides are as yet not used on Antigua.

Safety equipment for the application of Bayticol includes goggles, coveralls, plastic or rubber apron, rubber boots and gloves. If backpack equipment is used, the applicators should also put a disposable or washable plastic sheet between their back and the pesticide container. Under the outline of the proposed project, these safety devices and materials would be provided to all project personnel by APHIS and personnel would receive training in safety and the use of Bayticol. The safety devices and materials for Bayticol application are available on Antigua though they are expensive (see 1987 EA, page 17).

The safety directions and first aid instructions on the Bayticol label should be followed. These are:

> Safety Directions - Avoid contact with the eyes and skin. Repeated exposure may cause allergic disorders. Sensitive workers should use protective clothing.
>
> First Aid - If poisoning occurs contact a doctor or poisons information centre. If swallowed induce vomiting. Use IPECAC syrup (APF) if available.

E. Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed pesticide use and measures available to minimize such hazards.

1. Toxicity

Like the other synthetic pyrethroids permethrin and fenvalerate, flumethrin is relatively nontoxic to mammals (Fig. 1). Flumethrin and fenvalerate contain a halogenated acid component and an alpha cyano 3-phenoxybenzyl alcohol (Clark and Brooks 1989). Because of this they can induce writhing and salivation (Vershoyle and Aldridge 1980).

Animals are susceptible to poisoning by pyrethroids in the following order (from most to least susceptible): crustaceans>fish>mammals>birds. Fish and crustaceans lack the enzymes to break down pyrethroids rapidly like mammals and birds do. LC_{50} values for fish (the concentration of pesticide active ingredient per litre of water that will kill 50% of exposed fish) are generally below 10 μg/litre (Bradbury and Coats 1989). The lethality of pyrethroids to fish would be expected to increase with increasing octanol/water partition coefficients (a ratio that simulates the partitioning of toxic substances between body fat and blood) (Zitko et. al. 1977). However, pyrethroids like flumethrin which have an alpha cyano substituent are more lethal to fish than predicted by activity/structure relationships based only on the octanol/ water partition coefficient (Zitko et. al. 1979).

2. Exposure of and hazard to humans

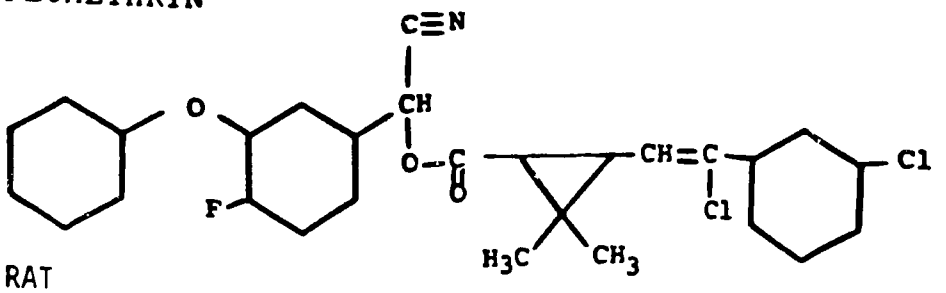
Given Bayticol's low mammalian toxicity, it would not be expected to threaten human health if used as recommended and with the appropriate safety precautions.

Applicators of Bayticol pour-on may splash themselves, spill chemical on themselves, rub against treated animals, and/or be contaminated by equipment leaks. Thus it is important that they wear safety clothing and take proper safety measures. Section III.D. of this EA discusses safety precautions and pesticide storage and disposal guidelines that reduce the risk of human exposure.

The Bayticol application demonstration on St. Lucia illustrated how livestock owners may assist in the treatment procedure by tying the animal to a tree or other stationary object with the tether line, and holding the line while the applicator estimates the animal weight and measures and applies the volume of Bayticol pour-on. The owner/handler wore no protective clothing. Under most circumstances owners would not come into contact with the material on or after application. However, owners said that on occasion they inadvertently touched the treated skin of animals or had material flicked on them by the tail. The risk of livestock owners/ handlers coming into contact with the acaricide could be minimized by insuring that they wear safety clothing and/or step out of the way during application.

FIGURE 1. Toxicity of Bayticol (flumethrin)

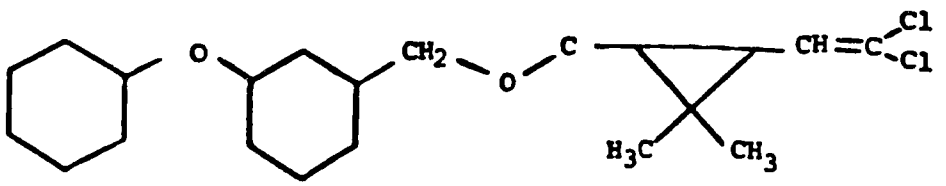
FLUMETHRIN



RAT
ORAL LD_{50}* 10,000 mg/kg when dissolved in an inert carrier (Bayer, 1986a)

DERMAL LD_{50} unpublished for active ingredient but appears to be very high (Bayer, 1986a)

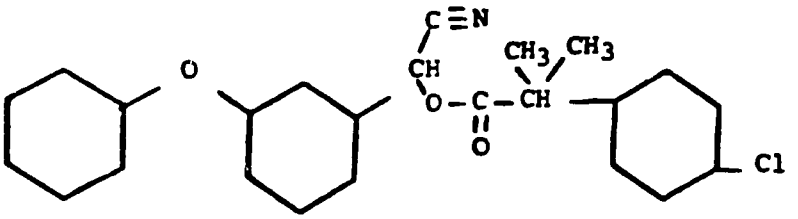
PERMETHRIN



RAT
ORAL LD_{50} 430 - 4000 mg/kg

DERMAL LD_{50} 4000 mg/kg

FENVALERATE



RAT
ORAL LD_{50} 451 mg/kg

DERMAL LD_{50} 5,000 mg/kg

*LD_{50} refers to the amount of pesticide active ingredient per kilogram of body weight that kills 50% of the test animals upon exposure.

Residues in food from the use of Bayticol 1% pour-on would not be expected to present a significant hazard. At the proposed application rate no residues of flumethrin were detected in liver, kidney or meat. In residue trials one fat sample from one animal had a residue level of 1 part in 200 million at slaughter. All other cattle in the trial showed no detectable residues in fat. Following recommended rates of application, residues were not detected in milk except in two cows out of three in one residue trial where transient residues of less than 1 part in 25 million were detected. These levels are so low that no waiting period is necessary between treatment and slaughter or milking (Bayer 1986b).

3. Potential hazards to livestock

a. Toxicity

Based on field experience to date, Bayticol's toxicity to livestock appears to be minimal. There are several indications that cattle, sheep and goats can sustain repeated exposure to flumethrin over the 2-year project period without apparent ill effects. Efficacy trials with 14-day interval treatments of cattle were conducted for six months without clinical side effects (Lemche and Pegram 1987). Stripping trials in plunge vats with cattle for 10 months and stability trials lasting 15 months in tropical environments have not produced reports of clinical difficulties. Tolerance trials involving treatment of 2398 sheep and 368 goats two times weekly with 75 ppm flumethrin in a dip for 10 months did not lead to side effects (Bayer, 1986a). Bayticol 1% pour-on has been used without significant problems in a control program on St. Lucia in which Animal Health Assistants have treated cattle, sheep, and goats at 14-day intervals for between 3 and 4 years (Dr. F.C. M. Alexander, IICA, personal communication). The Animal Health Assistants and livestock owners we met on St. Lucia were quite satisfied with Bayticol's efficacy and ease of application and the resulting improvement in general animal condition. Also, an IICA tick control project has been applying Bayticol 1% pour-on at 14-day intervals in two areas of Dominica for between 1.5 and two years without apparent side effects (Dr. F.C.M. Alexander, IICA, personal communication).

No chronic toxicity data on flumethrin's oncogenicity and reproductive effects in mammals was available for review. On that basis, the possibility of relatively subtle but harmful long-term effects on livestock can not be excluded. Pyrethroids have octanol/water partition coefficients of >10,000, indicating a potential for bioaccumulation (Hill 1985, Schimmel et. al. 1983). However, half-lives of pyrethroids in mammals and birds are in the range of six to 12 hours (Ohkawa et. al. 1979, Gaughan et. al. 1977) and would not be expected to lead to a body burden as do organochlorines like DDT.

b. The tick-borne disease hazard to livestock

As described in the 1987 EA, implementation of the bont tick eradication project will place Antiguan livestock at risk. At present, Antiguan livestock is tolerant to the tick-borne diseases prevalent on the

island. This tolerance will be lost if disease pressure disappears. Therefore, the tick eradication program may produce livestock populations that are highly susceptible to tick-borne diseases and which could be severely impacted by a break in the quarantine practices or in tick eradication. Since scientific reports indicate that Bayticol is an effective acaricide for both the tropical bont tick and the tropical cattle tick, Boophilus microplus, the project will affect the incidence of all tick-borne diseases. Once a susceptible population becomes established, monitoring animals for both ticks and any clinical signs of tick-borne diseases will be imperative as long as there is a threat of reintroduction of ticks and/or diseases. With reintroduction, a major animal health disaster could occur. If the monitoring program is ineffective, incomplete, or deteriorates over time the problem will not be noted until a significant number of animals die. The majority of Antiguan livestock could be lost and the U.S. project would be blamed.

Although this necessary monitoring program has been mentioned in project documents, no real assessment of the laboratory and personnel needs has been presented. It will have to involve laboratory equipment and trained personnel not currently available in the Caribbean. The use of laboratory services at Ames, Iowa, as recommended by USDA/APHIS, is appropriate. It will also be necessary to stockpile appropriate amounts of the various drugs (tetracycline, imidocarb, etc.) to enable a quick response should clinical cases of tick-borne diseases occur.

Both ticks and tick-borne diseases have been detected in most of the surrounding islands. As indicated in the 1987 EA, control of imported animals, including measures to prevent illegal importations, will be a necessary aspect of the tick eradication program. Paramount to this will be public education. The Antiguans need to have a complete understanding of the importance of appropriate importation practices. They must be told of the threat that untreated animals would pose to their own animals as well as to the island as a whole. In addition, government legislation may be necessary to mandate animal identification, perhaps through the use of individual animal identification tags. Such identification would be useful for the island treatment scheme as well as helping to control entry of illegal animals.

4. Exposure of and hazard to other nontarget organisms

Bayticol is a pyrethroid, which as a class of pesticides degrade rapidly in soil (permethrin half-life in soil is 3-6 days). Synthetic pyrethroids, with their high octanol/water coefficients and insolubility in water, do not move readily in soil and ordinarily do not pose much of a threat to water systems (Hague and Freed 1975, Kanazawa 1989). However, Antigua's tropical rainfall patterns and the likely sites of Bayticol application there present cause for concern.

Since Bayticol is in an oil base and not water miscible, any spills near water sources would cause a layer of oil containing flumethrin to stay on the water surface. A high octanol/water partition coefficient indicates that flumethrin would stay in the oil and not dissolve in the water. The

poisonous surface film would present a problem to surface feeding aquatic life and to zooplankton.

There isn't any fresh or salt water aquaculture in Antigua to date. However, the Fisheries Department would like to start projects in 2-5 years. In southeastern Antigua the hills drop sharply to the flat beach area. Several hundred yards of beach stretch between hills and ocean, and there are drainage ditches to funnel runoff water to the sea. This is one of many areas in which livestock range almost to the edge of the sea, creating the opportunity for acaricides to reach ocean water unless animals are moved inland for treatment.

Although flumethrin is less poisonous to fish than some other pyrethroids, it causes toxic symptoms at a concentration of 0.5 ppm in water and a concentration of 1 ppm is deadly (Neuhauser 1982). It is also toxic to reptiles (Bayer 1986a). Moreover, pyrethroids in general are considered to be highly toxic to invertebrates and estuarine/marine life. Therefore, buffer zones should be established to separate Bayticol application sites from the ocean and other bodies of water. Application of pesticides should not be conducted in or near drainage ditches. Growths of mangroves indicate an influx of ocean water, though the land may be dry at low tide. Pesticides should not be applied in mangrove areas even if these areas are dry. To reduce the chances of water source contamination, backpack application equipment should be filled and, to the extent possible, spray solutions should be mixed at the pesticide storage facility. Small plastic washtubs or trays should be used in the field to contain small spills when refilling Bayticol beakers.

Given the proposed use pattern on Antigua, Bayticol would not be expected to pose a significant hazard to mammalian wildlife, birds or honeybees (see III.A.3). Flumethrin is not very toxic to birds. The oral LD_{50} of technical flumethrin for hens is 2,500-5,000 mg/kg (Bayer 1986a). Residues in eggs do not appear to be a problem (Milillo et. al. 1984). Honeybees would not appear to be at excessive risk because flumethrin has been patented in the Federal Republic of Germany for the control of parasitic Varroa mites in honeybee colonies (Koeniger 1986).

No information on Bayticol's toxicity to other terrestrial invertebrates was available for review. They may come into contact with the chemical on trees, brush or ground where livestock have rubbed or rolled.

The mitigation measures recommended in the 1987 EA for minimizing pesticide hazards to nontarget organisms also apply to Bayticol.

F. The effectiveness of the requested pesticide(s) for the proposed use.

Published literature provides a wealth of information illustrating the effectiveness of flumethrin as an acaricide. In the form of Bayticol 1% pour-on, it is applied to cattle via squeeze applicator at the rate of 1mg of active ingredient per kg of body weight for control of the tropical bont tick and the non-target tropical cattle tick in tropical environments (Cordoves, et. al. 1986, Dorn and Pulga 1985, Dorn et. al. 1986, Hamel and

Van Amelsfoort 1985, Hamel and Duncan 1986, Hamel 1987, Hopkins et. al. 1985, Lemche and Pegram 1987, Petraccia et. al. 1988, Rinkanya and Tatchell 1988, Sosa 1985, Taylor and Elliot 1987). Reports on flumethrin applied to sheep and/or goats are considerably fewer. Due to dermal irritation in horses, Bayticol 1% pour-on is not recommended for use on equines (including donkeys). A kennel treatment with permethrin combined with topical application of a 40 ppm flumethrin solution has been tested for the control of the kennel tick on dogs (Prosl and Kutzer 1986).

Studies cited above in which the 1% pour-on formulation was applied to cattle at 14-day or a combination of 14- and 21-day intervals under tropical field conditions report 95% to 100% tick control for test periods of up to six months. Efficacy in these studies is most frequently determined on the basis of number of attached ticks and/or the production of viable eggs.

Efficacy of flumethrin pour-on for tick control in sheep may vary with breed type. Hamel (1987) reported that flumethrin 1% pour-on eliminated the tick Hyalomma truncatum from the interdigital clefts of Karakul sheep within one week, but also observed that unreferenced trials with Dorper sheep, mutton merinos and merinos suggest there is variation in flumethrin coverage across sheep breeds which may affect efficacy.

Comparative studies with other synthetic pyrethroids have shown flumethrin to be superior or comparable, depending on test procedures and target species. Wilkins and Badenhorst (1984) evaluated six synthetic pyrethroids (cyhalothrin, cypermethrin, cypothrin, deltamethrin, fenvalerate, and flumethrin) applied to cattle and using the tropical bont tick as a test animal and found flumethrin to be superior to all others. Taylor and Elliot (1987) evaluated flumethrin and deltamethrin, both formulated as 1% m/v pour-on, and applied as a single treatment to cattle turned onto adjacent infected with the sheep tick (Ixodes ricinus). Treated animals experienced significantly lower infestations compared to untreated animals, and deltamethrin was significantly better than flumethrin from day 18 to 28 of the 42 day-long test. Rinkanya and Tatchell (1988) compared efficacies of a single treatment with pour-on formulations of three synthetic pyrethroids (flumethrin, cypermethrin of mixed isomers, and alpha cypermethrin) and an organophosphate, Phosmet, against the brown ear tick (Rhipicephalus appendiculatus) and other less numerous ticks. Flumethrin was significantly more effective than all other treatments. Flumethrin, in its 1% pour-on formulation, appears to be as efficacious for ticks, including A. variegatum, as are any of the current generation synthetic pyrethroids. We are not aware of any literature reporting direct comparisons of flumethrin to amitraz for efficacy against ticks on cattle, sheep, or goats.

The research component of the Antigua tick eradication project should investigate the incorporation of flumethrin with tick pheromones and CO_2, which have been tested as an attractant for use in off-host tick surveillance. The combination might control ticks while exerting only minimal effects on nontarget species (Gothe et. al. 1984).

Several characteristics of flumethrin and its 1% pour-on formulation are pertinent to its efficacy and safety under field conditions. First, flumethrin pour-on has repeatedly been shown to be relatively rainfast. Data from artificial rain tests (Stendel 1985), field tests in which flumethrin pour-on is applied just prior to or shortly after rainfall (Hamel and Van Amelsfoort 1985), and field tests conducted through tropical rainy seasons (Hamel and Duncan 1986, Lemche and Pegram 1987) indicate that flumethrin efficacy is not significantly diminished. Second, flumethrin, like other synthetic pyrethroids, will readily rub off treated animals onto untreated ones, thus providing an efficacy safety margin. Time-distribution relationships following treatment on individual bovines have been evaluated by Stendel (1986) and Hamel and Van Amelsfoort (1986). Rub-off to untreated cattle kept on pastures with treated animals was found sufficient to provide partial tick control (Lemche and Pegram 1987, Rinkanya and Tatchell 1988). A rub-off effect may be advantageous for treatment of sheep and goats in remote areas of Antigua where complete gathering and treatment of a flock at 2-week intervals will be difficult. Third, tests of flumethrin co-administered with certain anthelminthics (levamisole, febantol, albendozole, rafoxamide) appear to cause no clinical toxicity (Hopkins et. al. 1985). Fourth, Bayer product bulletins and published results (Hamel and Duncan 1986) indicate that prolonged residual action is achieved against multihost ticks, thus offering extended protection in the event (such as weather) that a 14-day treatment is missed. However, this is not to suggest that the planned 14-day interval between routine treatments could be lengthened. Bayticol's level of efficacy wanes after 14 days and immature bont ticks may feed successfully if a subsequent treatment is delayed too long.

A beneficial side effect of Bayticol use would be to control of horn fly on cattle, which Antiguan farmers perceive to be a problem. Pyrethroids are known to be highly effective against horn flies in the U.S. and Bayticol is registered in Australia for buffalo fly control (see Annex 2). Of the two acaricides presently approved for use in the project (amitraz and permethrin), only permethrin has a similar fly-controlling effect (see 1987 EA pp. 5-6).

G. Compatibility of the proposed pesticide(s) with target and nontarget ecosystems.

See III.B.2., C and E.

H. The conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils.

See 1987 EA, pp. 3-5 and 26-30.

I. The availability and effectiveness of other pesticides or nonchemical control methods.

1. Previously proposed acaricides

Taktic (amitraz) for spray treatment of cattle, sheep and goats, and Atroban (permethrin) for spray treatment of equines were evaluated in the 1987 EA. These materials are EPA-registered for their intended use and were selected for the project based on efficacy against ticks and USDA's previous experience with these compounds in similar tick programs (1987 EA p. 5). Other acaricides registered by EPA for these use patterns are no more effective than Taktic or Atroban, or pose particular limitations under the project objectives or conditions or for environmental safety.

2. U.S.-registered pour-on products

Pour-on formulation and application technology can offer significant benefits to the proposed pilot project. Acaricides formulated for pour-on or other novel modes of delivery should be evaluated under the proposed project research component (1987 EA pp. 48-54). In addition to efficacy, evaluations of body coverage, dermal irritation and rainfastness should be made of these materials for use in tropical environments against "body" ticks.

Permethrin, the active ingredient of Atroban which is proposed for treatment of equines in the Antigua project, is now commercially available in the U.S. in two pour-on formulations with recommended use patterns similar or identical to that proposed in Antigua. Between them, if found effective, they could cover the needs of the pilot bont tick eradication program.

A 1% pour-on permethrin formulation called "Delice" is manufactured by Coopers Animal Health, Inc., 2000 South Street, Kansas City, Kansas 66103 (phone: 800/255-4456), and has been marketed for three years with EPA registration (No. 59-215) primarily for control of lice and flies on beef and dairy cattle. This particular formulation of permethrin has not been labeled specifically for ticks, but carries the caveat "aids in control of...ticks" (see label, Appendix 4). Delice is applied with a dipper (1/2 or 1 ounce) at a suggested rate of 1/2 fluid ounce (15 mls) per 100 lbs (45 kg) with a maximum of 5 ounces (150 mls), as opposed to 10 mls per 100 kg for Bayticol. Application by pouring into a dipper from a gallon container is less advantageous than the Bayticol dosemeter since it increases the probability of spills. Other measuring and delivery systems could be devised. Its future registration by Coopers for other pests is uncertain.

The second commercially available product is a pour-on formulation of microencapsulated permethrin called "Poridon," manufactured by Fearing Manufacturing Co., Inc., 490 Villaume Avenue, South St. Paul, Minnesota 55075 (phone: 612/455-1521). The product has been EPA registered (No. 44716-3) for three years "for use on horses...Aids in the control of [many ectoparasites]...and ticks" (see label, Appendix 5). However, Poridon has not been evaluated against ticks on horses or other livestock (R.K. Geissler, Fearing Manufacturing Co., personal communication). In addition it controls ticks on dogs (P.A.C.E. International 1986), which might also be useful in the Antigua project. Poridon is more viscous than Bayticol. It

is marketed in 16 oz. plastic (shampoo type) squeeze bottles fitted with a screw-on, flip-up cap. The 1/8" orifice allows a bead to be squeezed out easily during application. Approximately 2-4 oz. of Poridon is applied to horses by pouring a line bead from the poll along the neck and continuing down the back along the spine. It may also be applied as a wipe-on. Completeness of body coverage and rainfastness have not been determined.

Efficacy data against ticks would have to be developed for permethrin in these formulations, but toxicological data would be available since they are registered in the U.S. Residue data is also available on Delice used against keds and lice on sheep.

3. Pour-on products under development

Pour-on formulations of other pyrethroids are being developed and tested. A 1% deltamethrin pour-on (a Coopers Animal Health product referred to as "Spot on") has been found to be as effective against ticks as 1% Bayticol pour-on based on single treatment evaluations (Taylor and Elliott 1987). Coopers is also developing a pour-on formulation of ʃ-cyhalothrin for lice and fly control on cattle.

Ivermectin, an avermectin compound derived from the natural fermentation product of the soil fungus Streptomyces avermectilus, has been developed by the Merck Sharp and Dohme Company (P. O. Box 1000, Rahway, New Jersey 07065). It is EPA-approved and marketed in the U.S. in paste formulation for horses (e.g. Zimectrin), intra-muscular injection of a suspension for cattle (e.g. Ivomec), and liquid drench for sheep. The general recommended dosage rate is 200 µg/kg. The registration of a pour-on formulation for control of lice and flies on cattle is imminent. One overseas label for the pour-on adds "...aids in control of Boophilus" (Dr. J. Cox, Merck, personal communication).

Ivermectin is a systemically active, broad-spectrum parasiticide (Benz 1985) which is active against ticks (Drummond 1985), but it is not currently labeled specifically for tick control in the U.S. Topical applications (i.e. pour-on) have recently been evaluated against tropical cattle ticks (B. microplus) (Cramer et. al. 1988). These studies show topical administration of at least 500 µg/kg along the backline were necessary to achieve equivalent control to that achieved by treatment with 200 µg/kg administered subcutaneously. It is not likely that this compound could be considered for use in the Antigua project. Ivermectin has been deemed impractical for repeated application programs (Benz 1985) because of its high cost (commercial retail of $8-10.00 U.S. for treatment of each 1000 lb. animal at 200 µm/kg) and lengthy withdrawal times ranging from 35 days in the U.S. and 21 to 45 days internationally. Formulation for topical application does not lessen the magnitude of these problems.

4. Non-chemical control methods

Non-chemical alternatives for tick control on Antigua have been addressed in the 1987 EA (pp. 44-48). The EA discusses the components of integrated tick management programs and various IPM and eradication options which are still appropriate to the Antigua tropical bont tick problem.

Under current Antiguan livestock management schemes and land tenure, non-chemical alternatives are not realistic. The majority of animals are owned by part-time farmers/livestock owners. In general, these owners are not concerned about the quality of their animals, only their quantity. In addition, little capital or time is expended on their care. The concept of non-chemical management practices to control ticks is beyond their consideration. The land tenure situation precludes the use of any pasture management programs. The majority of animals are grazed free on government lands. Neither the livestock owners nor the government have any incentive to initiate any type of pasture improvement programs.

5. Use of a heartwater vaccine

A vaccine for heartwater would offer a non-chemical (ie. non-pesticide, in the traditional sense) method of disease control and prevention that could be of value in management options for the tick and tickborne disease complex on Antigua. The following evaluation of progress toward a heartwater vaccine and the potential use of vaccines is germane.

Currently, the only vaccination available involves treatment of experimentally-induced infections (USDA/APHIS 1989, Losos 1986, Uilenburg 1983). Cattle are infected intravenously with the organism and the body temperature of each animal is monitored daily. Once the animal becomes febrile, treatment with tetracycline is initiated. Such vaccination results in solid immunity against natural infections. However, these procedures involve close veterinary supervision. Infection is given intravenously, necessitating a trained individual. Each animal must be monitored individually since the course of infection varies. Thus, only limited numbers of animals may be treated at any one time. Labor costs are prohibitive for even a small number of animals. Treatment too early does not produce strong immunity and treatment too late can result in disease and even death. Thus, for a variety of reasons, this method of vaccination is totally unacceptable for appreciable numbers of animals. It is not feasible in Antigua.

Research into the development of a more applicable vaccine is ongoing. Such research has resulted in improved methods of diagnosis (USDA/APHIS 1989, Burridge 1989, Kocan et. al. 1987). In the past, the organism could only be studied in stabilates of infected animal blood or tick extracts. Tissue culture forms of the organism have been isolated and are being maintained. Currently these are serving as the sources of antigens for diagnostic tests, strain identification and epidemiological studies. Vital to the development of a viable vaccine is a better understanding of the immune response of infected animals and identification of the antigenic and immunogenic components of the organism. Such studies should result in the

identification of the organism's immunogenic genome and its subsequent cloning. This procedure may be the only way to produce sufficient amounts of immunogen for a successful vaccine (Burridge 1989). Due to the complexity of these studies and procedures, it will likely be several years before a vaccine will be available for even experimental field studies.

Vaccines against rickettsial organisms are limited and of varying success and may or may not indicate the future efficacy of a heartwater vaccine. Development of the vaccine against Q fever demonstrated that different growth stages of the organism produced different levels of protection. Further, although the vaccine protected the animals from clinical disease, it did not prevent these animals from being reservoirs and from shedding the organism (Losos 1986). The vaccine against Potomac horse fever (Ehrlichia risticii) has also had questionable success. Initial research reports indicated the necessity of frequent booster vaccinations (every 3-6 months) and recent epidemiological reports in Maryland have demonstrated that even vaccinated horses are becoming naturally infected and showing signs of clinical disease (Stephenson, VA-MD Regional College of Veterinary Medicine, personal communication).

The limited success of these vaccines may be a result of their crude preparation (killed organisms) and may not allow for adequate expression of the protective immunogens. The use of a cloned vaccine may provide better protection. However, due to the limited success of these two rickettsial vaccines, the chances for a successful heartwater vaccine should be viewed with some skepticism. This is particularly true from a control standpoint. For a disease eradication program, a successful vaccine must produce sterile immunity. Specifically, it must not only protect the animals from clinical disease but it must protect the animal from infection itself, thus, ensuring that the animal will not be a reservoir host. Whether or not this is feasible with a rickettsial organism has yet to be demonstrated.

J. The Requesting country's ability to regulate or control the distribution, storage, use and disposal of the requested pesticide.

Our own observations and a review of project documents, especially the 1987 EA detailing Antiguan use of and regard for pesticides, leads to the conclusion that the Government of Antigua is not capable of effective regulation and control of the requested pesticides at present. Dr. Hayden Thomas, Government Chief Chemist and Food Technologist, noted that the Antiguan Government had earlier assembled a Pesticide Control Board which became "dormant" in attempting to deal with the issues of rebottling and relabeling of pesticides for retail sale.

The transportation, storage, inventory, distribution and disposal of pesticides selected for use in the pilot project are to be under direct control of U.S. project personnel (1987 EA, pp. 40-41) as outlined under directives of APHIS/VS Memorandum 556.1, Supplement No. 9. The proposed storage site for the acaricides to be used on Antigua is a warehouse located on government property near St. John's and belonging to Antigua Sugar Industries Corp. Mr. N.C. Abbott is the general manager and reports directly to the Minister of Agriculture. Mr. Abbott showed us a locked

metal warehouse with a concrete floor where they currently store pesticides for the 300-400 acre government farm, which is engaged in vegetable production. The building was a parts and machine shop for the sugar mill during its operation, and still contains much of the original parts inventory. The warehouse is one of several buildings behind a chainlink fence, and according to Mr. Abbott it is under 24 hour security. The aged building appears to offer a dry environment and flow-through ventilation in the roof is provided by a split level design. If this facility is selected as the storage facility, ventilation should be improved by the addition of wall- or ceiling-mounted fans, and spill trays should be provided. Large pesticide containers should be equipped with hand pumps to insure safety and decrease spills.

The warehouse is directly accessible from paved roads leading from St. John's harbor or the airport. Drainage from the site leads to the ocean, approximately 1/8 mile away. Measures must be taken to prevent pesticides from reaching the ocean from spill trays or from other spills inside or outside the storehouse. Inside spills should be thoroughly absorbed onto sawdust or vermiculite which is then put into clearly labeled resealable 55-gallon drums especially reserved for the storage of toxic wastes. Outdoor spills should be treated the same way except that soil contaminated with spilled pesticide should be shoveled up and put into the storage drums as well. Full drums should be shipped to the U.S. for landfill disposal since no suitable disposal sites are available on Antigua.

Use of Bayticol beakers and Flexi-paks will lead to a problem of disposal. Plastic doesn't burn completely (it just melts) and it doesn't biodegrade very rapidly. Larger containers of Bayticol 1% pour-on could be purchased so that the 1-litre beakers could be refilled and re-used. With 100 sheep and goats treated per 1-litre beaker and 25,000 animals treated every two weeks, 13,000 new Bayticol beakers would be used in two years versus a few dozen if they were refilled and re-used.

There aren't any incinerators on Antigua to burn and reduce the volume of plastic nor any landfills which can be used safely for disposal of any volume of pesticide containers. Atroban (permethrin) 42.5% E.C. used for making the spray solution for horses and donkeys is available in 1-pint containers. The dilution recommended for ticks on horses is one pint to 100 gallons of water. This will treat approximately 200 animals (two quarts/animal). If a 1-pint container treats 200 animals and 2,500 animals are to be treated every two weeks, 650 containers will be generated over a 2-year period. These glass containers should be rinsed three times and the rinse added to the spray. The glass containers can then be safely disposed of in a U.S. landfill.

K. Provisions for training of users and applicators.

Section 4, pp. 38-40 of the 1987 EA describes "Training and Safety of Personnel" for use of amitraz and permethrin, including requirements for applicator certification. That section is germane to training and safety for the use of flumethrin. The training course topics required for

certification are outlined and are all pertinent to the use of Bayticol pour-on.

L. Provisions for monitoring the use and effectiveness of the pesticide.

A USDA/APHIS organizational plan (Annex 6) calls for two treatment evaluation teams whose responsibilities are to accompany treatment teams for tick collection and observation of treatment techniques (safety and thoroughness). This approach provides an avenue for critical evaluation of program effectiveness, safety and progress and is appropriate for the inclusion of Bayticol pour-on. It is important that these teams be very knowledgeable in aspects of tick surveillance (biology, ecology, host-parasite relations), pesticide application and human and environmental safety, as well as other potential areas for evaluation. The teams could also provide important assistance with research data collection.

At present, plans call for only one authoritative USDA officer to be attached to the project full-time. This person would be responsible for project administration and money matters as well as for higher-level relations with Antiguan counterparts. A considerable amount of office work would be inevitable. For the project to be successful and to insure that acaricides are used properly, all field teams should report to and be closely supervised by a second USDA/APHIS officer. This officer should have previous experience in tick programs and have full-time responsibility to direct and monitor field operations. This person should be very responsible, energetic and capable and, if possible, relatively non-susceptible to Antiguan social and political pressures.

IV. SUMMARY OF MITIGATIVE MEASURES AND REQUIREMENTS

A. Mitigative measures

These mitigative measures should be added to those recommended in the 1987 EA for the use of amitraz (Taktic) and permethrin (Atroban).

1. Application methods

a. If Bayer has not manufactured a Bayticol pour-on dosemeter appropriate for small animals, an alternative should be devised. Staff should be trained in the proper use of any delivery system employed. p. 16

2. Availability of safety clothing/devices

a. If backpack equipment is used, the applicators should put a plastic sheet between their back and the pesticide container. p. 17

3. Pesticide application

a. Insure that livestock owners who assist by restraining their animals either wear safety clothing/devices or step out of the way during pesticide application. p. 18

b. Buffer zones should be established to separate pesticide application sites from the ocean and other bodies of water. p. 22

c. Backpack application equipment should be filled and, to the extent possible, spray solutions should be mixed at the pesticide storage facility. p. 22

d. Small plastic washtubs or trays should be used in the field to contain small spills when refilling Bayticol beakers. p. 22

4. Pesticide storage and handling

a. Provide wall- or ceiling-mounted fans for better ventilation in the pesticide warehouse. p. 29

b. A spill tray should be constructed in the area used for filling the application equipment with acaricide. The ideal location would be inside the building near the door. p. 29

c. Large containers (5-55 gallons) should be equipped with hand pumps to insure safety and decrease spills. p. 29

5. Disposal of toxic wastes/pesticide containers

a. Clean up spills in the warehouse areas with sorptive materials that can then be placed in clearly-labeled 55-gallon drums especially reserved for the storage of toxic wastes. p. 29

b. Empty pesticide containers and full drums of toxic wastes should be shipped to the U.S. for landfill disposal. p. 29

c. Bayer 1-litre pour-on beakers should be refilled and re-used for routine Bayticol applications to cut down the number of empty pesticide containers generated. p. 29

6. Monitoring/encouragement of proper pesticide use

a. All field teams should report to and be closely supervised by a USDA/APHIS officer with full-time responsibility to direct and monitor field operations. p. 30

b. Provide incentives for treatment teams to do safe and careful work. p. 33

7. General

As U.S.A.I.D. regulations now require, this project must abide by Antiguan law. The Government of Antigua must approve all aspects of the project including the use of pesticides.

B. Requirements

Most of these mitigative measures should be inexpensive: dosemeters, plastic trays for field use, sorptive materials, hand pumps. The spill tray for the warehouse can probably be constructed cheaply with local labor. The ceiling or wall fan(s) might cost $1,000 - 3,000.

Veterinary training for project field teams can be organized on Antigua with instruction by senior Veterinary Services officers and USDA staff. The main expenses should be transportation, catering and training materials.

Posting a second American USDA staff member to the Antigua project would cost approximately $100,000/yr.

V. SUGGESTIONS FOR PROGRAM IMPLEMENTATION

A. Incentives for livestock owners

As the 1987 EA states, a strong public education program in support of the bont tick eradication effort is an absolute necessity. Currently, neither Antiguan Agricultural Extension nor their Veterinary Services provides adequate livestock owner contact or education. As stated in the report, livestock owners will probably cooperate at the beginning. Free treatment for problems they can readily perceive (ticks and dermatophilosis) will make them want to. Once tick control occurs, however, that incentive will no longer operate. Since Bayticol is also an effective fly control agent the owners may find that sufficient incentive to continue in the program.

If the tick eradication teams can provide veterinary and other management assistance as well, the owners will have much more incentive to continue cooperating with the program. The tick control project should be incorporated into an integrated veterinary care program for the island. This project should be seen as a means of improving the Antiguan infrastructure for assisting the Antiguan livestock owner on the long term. Such support would include both the Extension and Veterinary Services. After termination of the project, the treatment team members should be

employed by the government to continue supplying this assistance. In this way a continued tick control program could be incorporated into an Antiguan-operated animal health and management program. Such a program will be a necessity to ensure that the island does not become reinfested with ticks and tick-borne diseases.

B. Incentives for the treatment teams

Treatment team members will have to be perceived by livestock owners as helpful. Thus, the team members must be committed to the program and to providing good service. Since the job will not be easy, incentives must be developed to encourage them to do complete and thorough acaricide treatments. If this program can incorporate veterinary training, there would be important long term benefits. Motivated individuals honestly interested in veterinary care would be more inclined to apply for the job. Such trained individuals would be able to interact better with livestock owners and provide other valuable services that would help generate good will toward the program and give owners an additional incentive for owner cooperation. The training and the resulting services so provided would help improve the quality and quantity of animals on Antigua. Finally, the program would produce trained animal handlers and veterinary assistants who could provide veterinary care on Antigua and perhaps on other islands after the project terminates. The Antiguan government should be encouraged to hire the more successful and motivated members of the treatment teams as veterinary assistants. If this long-term job opportunity is presented to treatment team members they would have an additional reason to perform their project tasks well.

C. Epidemiological studies

On Antigua, the epidemiological status of the tick-borne diseases anaplasmosis, babesiasis and heartwater is not well documented. No systematic studies have been performed. The tick eradication project provides an opportunity for a controlled study of the prevalence and incidence of these diseases in an endemic population of animals and of how these parameters change during the course of a tick eradication program. Such studies will be very important for successful completion of the project.

Several project papers presented organizational charts which indicated there will be a staff epidemiologist and veterinarian. Their expertise will be necessary for the studies. Sampling the livestock population for both the presence of disease and antibodies against diseases will help determine to what extent the animals have been exposed to disease organisms and, in turn, to ticks. These data will be useful corollaries to the findings of field workers monitoring tick burdens.

D. Antiguan government commitment

In order for the eradication program to be successful, the Antiguan government must be prepared to provide appropriate support both during the project and after its completion. Such support will have to include

suitable legislation. Mandatory animal identification, animal treatment and, later, quarantines will be necessary. The government must be willing to legislate and enforce these programs in a timely and effective manner. It must also be willing (and able) to continue monitoring and treatment programs after the project's completion. The Antiguan government should commit itself to continuing the provision of veterinary care and animal management assistance to livestock owners after the completion of the project.

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VII. ANNEXES

1989 EA COMPUTER LITERATURE SEARCH FOR BAYTICOL/FLUMETHRIN DATA

The following databases were searched (*through abstract level where possible) using key words "flumethrin(e)" and "Bayticol" and CAS registry no. 69770-45-2:

AGRICOLA 1979 - July 1989
AGRIS* 1979-89
AQUATIC SCIENCES AND FISHERIES ABSTRACTS* 1982-89
BIOSIS* 1979-89
CAB ABSTRACTS* 1979-89
CHEMISTRY ABSTRACTS 1979-89
ENVIRONMENTAL BIBLIOGRAPHY 1979-89
LIFE SCIENCES* 1982-88
MEDLINE* 1979-89
TOXLINE* 1981-89
ZOOLOGICAL RECORD 1979-89

References relevant to the use of Bayticol pour-on in the Antigua bont tick project are in the EA bibliography.

WARNING

KEEP OUT OF REACH OF CHILDREN

READ SAFETY DIRECTIONS BEFORE OPENING

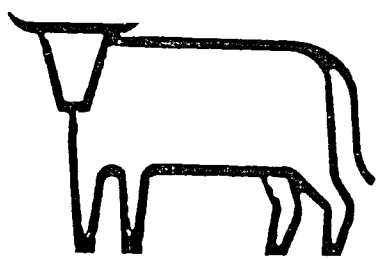
FOR ANIMAL TREATMENT ONLY

Bayticol

Pour-on

cattle tickicide

Active Constituent: 10 g/L FLUMETHRIN



For the control of cattle tick (Boophilus microplus) including chlorinated hydrocarbon (DDT), organophosphorus, and amidine resistant strains. For the control of Paralysis Tick (Ixodes holocyclus) and New Zealand Cattle Tick (Haemaphysalis longicornis). For control of Buffalo Fly (Haematobia irritans ex

20 LITRES

Bayer

Bayer Australia Ltd.
47-67 Wilson Street
Botany N.S.W. 2019

BAYTICOL POUR-ON CATTLE TICKICIDE

DIRECTIONS FOR USE: (in QLD, N.S.W., W.A. only)

RESTRAINTS Do NOT apply as a single spot.

DOSE VOLUME

Class of Animal	Live Bodyweight	Dose Applied
Calf	up to 150 kg	35 mL
Yearling	151-300 kg	55 mL
Adult*	301-500 kg	75 mL

*Very heavy adults (501 to 750 kg) should receive 112.5 mL Bayticol Pour-On.

For animals with a hump or prominent spine, the recommended dose should be divided and applied as two strips on each side of the midline.

NOT TO BE USED FOR ANY PURPOSE, OR IN ANY MANNER, CONTRARY TO THIS LABEL UNLESS AUTHORISED UNDER APPROPRIATE LEGISLATION.

PRECAUTION

Toxic to fish. Do not contaminate dams, ponds, rivers, waterways or drains with pesticide or used containers

SAFETY DIRECTIONS

AVOID CONTACT WITH THE EYES AND SKIN. REPEATED EXPOSURE MAY CAUSE ALLERGIC DISORDERS. SENSITIVE WORKERS SHOULD USE PROTECTIVE CLOTHING.

FIRST AID

IF POISONING OCCURS CONTACT A DOCTOR OR POISONS INFORMATION CENTRE. IF SWALLOWED INDUCE VOMITING. USE IPECAC SYRUP (APF) IF AVAILABLE.

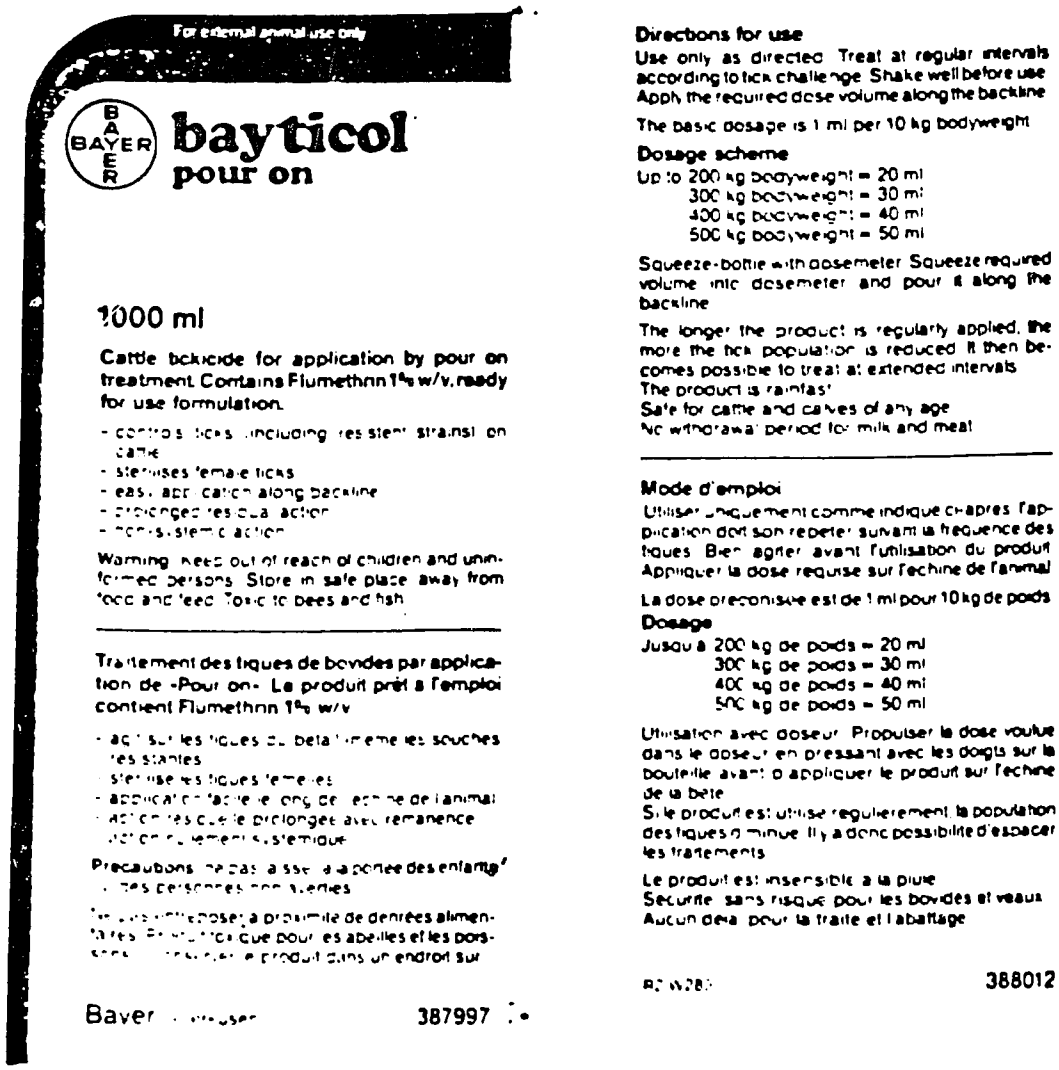
NOTE

Purchaser assumes all risk of use and handling where the product is not used in accordance with the directions given.

ANNEX 2

Australian Label for Bayticol 1% Pour-on.

Label From Bayticol 1% Pour-on Squeeze Bottle Used on St. Lucia



For external animal use only

BAYER

bayticol
pour on

1000 ml

Cattle bckicide for application by pour on treatment. Contains Flumethrin 1% w/v, ready for use formulation.

- controls ticks including resistant strains on cattle
- sterilises female ticks
- easy application along backline
- prolonged residual action
- non-systemic action

Warning: Keep out of reach of children and unin-formed persons. Store in safe place away from food and feed. Toxic to bees and fish.

Traitement des tiques de bovidés par application de «Pour on». Le produit prêt à l'emploi contient Flumethrin 1% w/v

- agit sur les tiques du bétail même les souches résistantes
- stérilise les tiques femelles
- application facile le long de l'échine de l'animal
- action résiduelle prolongée avec rémanence
- action non systémique

Précautions: ne pas laisser à la portée des enfants et des personnes non avisées.

[illegible] à proximité de denrées alimentaires. Dangereux pour les abeilles et les poissons. [illegible] le produit dans un endroit sur

Bayer [illegible] 387997

Directions for use

Use only as directed. Treat at regular intervals according to tick challenge. Shake well before use. Apply the required dose volume along the backline.

The basic dosage is 1 ml per 10 kg bodyweight.

Dosage scheme

Up to 200 kg bodyweight = 20 ml
300 kg bodyweight = 30 ml
400 kg bodyweight = 40 ml
500 kg bodyweight = 50 ml

Squeeze-bottle with dosemeter. Squeeze required volume into dosemeter and pour it along the backline.

The longer the product is regularly applied, the more the tick population is reduced. It then becomes possible to treat at extended intervals.
The product is rainfast.
Safe for cattle and calves of any age.
No withdrawal period for milk and meat.

Mode d'emploi

Utiliser uniquement comme indiqué ci-après. L'application doit son répéter suivant la fréquence des tiques. Bien agiter avant l'utilisation du produit. Appliquer la dose requise sur l'échine de l'animal.

La dose préconisée est de 1 ml pour 10 kg de poids.

Dosage

Jusqu'à 200 kg de poids = 20 ml
300 kg de poids = 30 ml
400 kg de poids = 40 ml
500 kg de poids = 50 ml

Utilisation avec doseur. Propulser la dose voulue dans le doseur en pressant avec les doigts sur la bouteille avant d'appliquer le produit sur l'échine de la bête.
Si le produit est utilisé régulièrement, la population des tiques diminue. Il y a donc possibilité d'espacer les traitements.

Le produit est insensible à la pluie.
Sécurité sans risque pour les bovidés et veaux.
Aucun délai pour la traite et l'abattage.

[illegible] 388012

Atroban®

DeLice®

Pour-On Insecticide

- **Non-Systemic Pour-On For Beef, Lactating And Non-Lactating Dairy Cattle**
- **Controls LICE And Flies On Cattle**
- **Controls Keds And Lice On Sheep**

Active Ingredient

Permethrin (3-phenoxyphenyl) methyl (±) cis, trans-3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate*	1.0%
Inert Ingredients	99.0%**
	100.0%

*cis/trans ratio: Min 35% (±) cis and max 65% (±) trans

**Contains petroleum distillates

KEEP OUT OF REACH OF CHILDREN

CAUTION

SEE BACK PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

Net Contents One U.S. Gallon (3.785 L)

EPA Est. No. 6175-LA-1

EPA Reg. No. 59-215

COOPERS

Coopers Animal Health Inc.
Kansas City, KS 66103-1438 U.S.A.
U.S. Patent No. 4,024,163
56 526015 2

Atroban® Delice® Pour-On Insecticide

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION

Avoid contact with eyes.

STATEMENT OF PRACTICAL TREATMENT

If In Eyes: Immediately flush eyes with plenty of water. Get medical attention if discomfort persists.
If Swallowed: Call a physician immediately. DO NOT INDUCE VOMITING UNLESS UNDER MEDICAL ATTENTION.
Note to Physician: Solvent presents aspiration hazard. Gastric lavage is indicated if material was taken internally.

ENVIRONMENTAL HAZARDS

This pesticide is extremely toxic to fish. Use with care when applying to areas adjacent to any body of water. Do not add directly to water. Do not contaminate water by cleaning of equipment or disposal of wastes. Apply this product only as specified on this label.

PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.
Storage: Keep container closed when not in use. Do not store near food or feed.
Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.
Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or if allowed by State and local authorities, by burning. If burned, stay out of smoke.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
READY TO USE: No dilution necessary.

Apply To	Target Insects	Application Instructions
Lactating and Non-Lactating Dairy Cattle and Beef Cattle and Calves	LICE Horn Flies, Face Flies and Aids in Control of Horse Flies, Stable Flies, Mosquitos, Blackflies and Ticks	Pour along back and down face. Apply 1/2 fl oz (15 cc) per 100 lbs body wt of animal up to a maximum of 5 fl oz for any one animal.
Sheep	SHEEP KEDS Lice	Pour along back. Apply 1/4 fl oz (7.5 cc) per 50 lbs body wt of animal up to a maximum of 3 fl oz for any one animal.

For cattle and sheep: repeat treatment as needed, but not more than once every 2 weeks. For optimum lice control, two treatments at 14 day intervals are recommended.

Special Note: Atroban Delice Pour-On Insecticide [illegible]

NOTICE OF WARRANTY

COOPER ANIMAL HEALTH [illegible] WARRANTY [illegible] FOR ANY PARTICULAR PURPOSE OR OTHERWISE EXPRESSED OR IMPLIED [illegible] THE PRODUCT UNDER NORMAL CONDITIONS IN ACCORD WITH THE [illegible]

Poridon

INSECTICIDAL POUR-ON FOR HORSES

For use on horses. Aids in the control of house flies, stable flies, horn flies, face flies, horse flies, deer flies, mosquitos, gnats, lice and ticks.

DIRECTIONS FOR USE & APPLICATION

Apply approximately 2-4 oz. per animal. Start by pouring a line bead from the poll, along the neck and continue posteriorly down the back parallel with the spinal column. Or apply as a wipe-on. If used as a wipe, apply with a clean absorbent cloth or sponge to animal's hair. Reapply as needed. Do not apply with bare hands. Shake well.

It is a violation of Federal Law to use this product in a manner inconsistent with its Labeling. Do not use on horses intended for food.

PRECAUTIONARY STATEMENTS, HAZARDS TO HUMANS & DOMESTIC ANIMALS

WARNING

Harmful if swallowed, inhaled or comes in contact with skin. Avoid breathing vapors. Causes eye & skin irritation. Do not get in eyes or on skin or on clothing. Wash thoroughly with soap & water after handling. Remove contaminated clothing & wash before reuse. Wear goggles or safety glasses. In case of contact, flush with plenty of water. Get medical attention if irritation persists.

KEEP OUT OF REACH OF CHILDREN

STATEMENT OF PRACTICAL TREATMENT

If Swallowed: Call physician or poison control center. Drink 1 or 2 glasses of water & induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person.
If In Eyes: Flush with plenty of water. Get attention if irritation persists.

ENVIRONMENTAL HAZARDS

Do not add directly to water. Do not contaminate water by cleaning of equipment or disposal of wastes.

PHYSICAL & CHEMICAL HAZARDS

Flammable. Keep away from heat and open flame.

STORAGE AND DISPOSAL

Store in cool dry area away from heat or open flame. Do not contaminate water, food or feed by storage or disposal. Do not reuse empty container. Wrap container & put in trash.

LIMITED WARRANTY

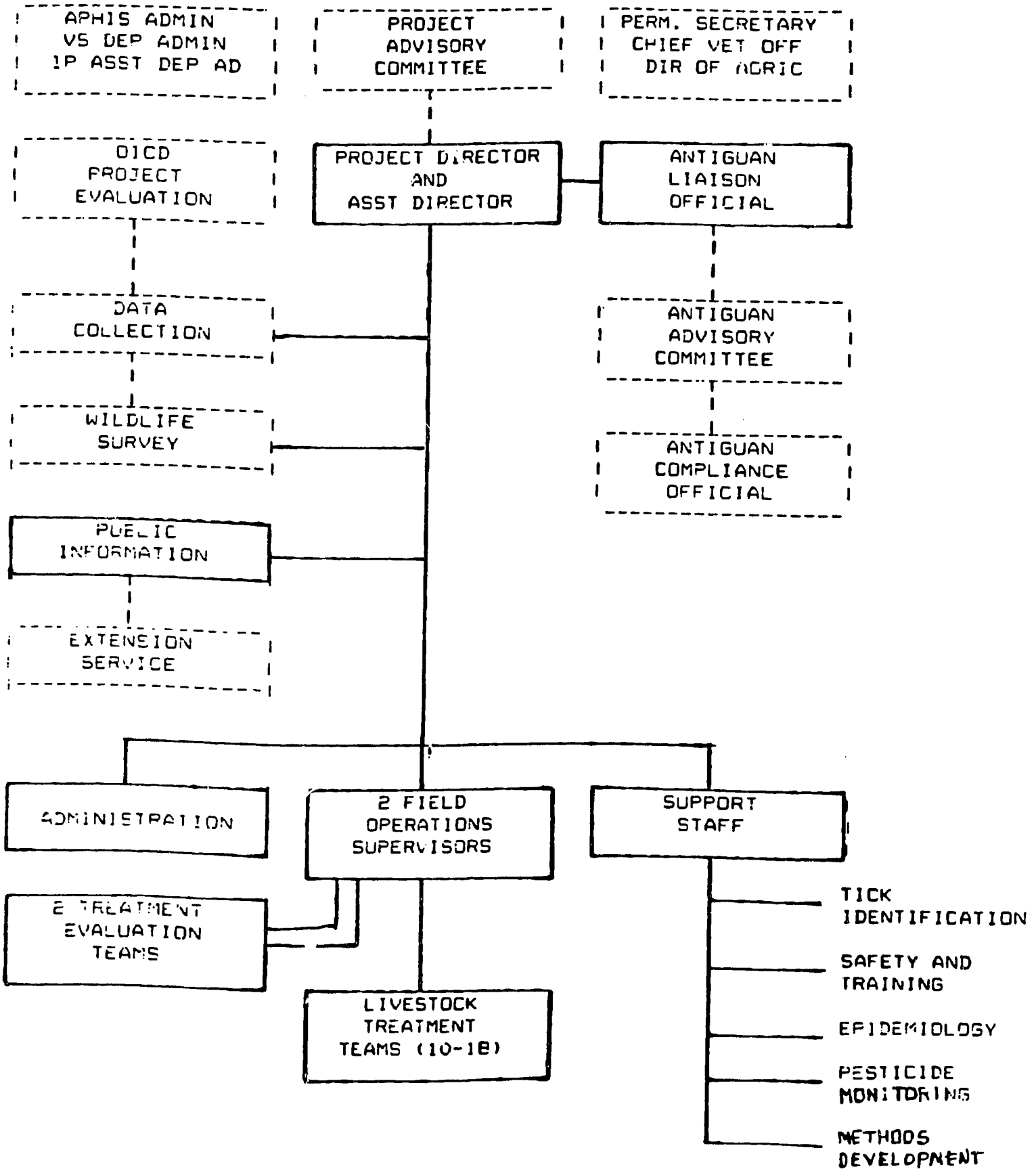
Fearing Manufacturing Co., Inc. makes no warranty of merchantability, fitness for any particular purpose or otherwise expressed or implied, concerning this product or its uses which extend beyond the use of the product under normal conditions in accord with the statements made on its label, and furthermore in no event shall Fearing Manufacturing Co., Inc. be liable for any consequential, incidental or special damages related in any way to this product or its uses or for any damages related in any way to resistance to insecticides.

Manufactured by:
FEARING MANUFACTURING COMPANY, INCORPORATED
990 VILLAUME AVE., SO. ST. PAUL, MN 55075 (PH) 612-455-1621.

FEARING
THE ANIMAL CARE COMPANY

PATENT PENDING

TROPICAL BONT TICK DEMONSTRATION PROJECT ORGANIZATIONAL CHART



MEMO

July 6, 1989

To: Dr. Lonnie J. King, Deputy Administrator, Veterinary Services, USDA/APHIS

From: Dr. Patricia C. Matteson, Team Leader/Environmental Specialist for the Environmental Assessment of the use of Bayticol in the pilot eradication project for the tropical bont tick in Antigua.

Subject: Bayticol registration data for review by the EA team.

Our EA team would like to do a thorough and careful review of all relevant Bayticol data before making a recommendation about its use by AID/USDA in Antigua. All parties are assuming that USDA will continue to be responsible for obtaining Bayticol registration data for our consideration--please let us know if that is not correct.

Whether or not you will need to ask Mobay/Bayer to replace the misplaced registration data for Germany, I would like to suggest that you query them about the availability of additional, complementary data that may have been used to register the chemical in other countries such as Australia. It would be to USDA's advantage: the more complete the data we can examine, the more likelihood of a positive recommendation.

Please inform us as soon as any of the registration data can be sent to Dr. Bruce Mann in Miami. My telephone number is (919) 851-7838, and Dr. Mann's is (305) 284-7326.

Thank you.

cc: Dr. A. L. Steinhauer
Dr. D. G. Bottrell
Mr. J Hester
Mr. Bruce Mann
Dr. K. Nepote
Dr. P. Teel
Dr. W Garnett
Dr. D. Wilson

MEMO

July 28, 1989

To: Dr. L. J. King, Deputy Administrator, Veterinary Services, USDA/APHIS.

From: Dr. P. C. Matteson, Team Leader/Environmental Specialist for the Environmental Assessment of the use of Bayticol pour-on acaricide in the pilot eradication project for the bont tick in Antigua.

Subject: Bayticol registration data to be reviewed by the EA team.

* * * * * *

Our EA team has discovered that Bayticol pour-on is registered in twelve countries: Algeria, Argentina, Australia, Barbados, Brazil, Japan, Mali, New Zealand, Peru, Turkey, the United Kingdom, and Uruguay. We do not know whether the German registration data that APHIS is having Mobay provide to us contains all the information used to register the chemical in these other countries. If not, the German data might be supplemented usefully with data submitted for some of these other registrations, namely Japan, the United Kingdom, Australia and New Zealand.

Since USDA/APHIS has assumed responsibility for providing Bayticol registration data for consideration by the EA team, the decision as to what data we review is yours. The EA team should do as thorough and comprehensive a review as possible, and the more complete the data we can consider, the more likely is a positive recommendation. Therefore I suggest that you check to see whether complementary data on Bayticol does exist, and, if it does, that you take steps to obtain it for our team to review.

If APHIS wishes us to review only the German registration data, I would appreciate your saying so in a letter to me.

Thank you.

cc: J. Hester, USAID
L. Laird, USAID
A. L. Steinhauer, CICP
J. B. Mann
K. Nepote
L. Armstrong, USAID
B. Waite, USAID
D. G. Bottrell, CICP
P. Teel

VIII. LIST OF PREPARERS

Members of the team assembled by CICP to carry out the Environmental Assessment:

Environmental Specialist/Team Leader: Patricia C. Matteson, Ph.D. Private consultant, pest and pesticide management.

Tick Control Expert: Pete D. Teel, Ph.D. Associate Professor, Tick Biology, Ecology, Epidemiology and Management, Department of Entomology, Texas A&M University.

Toxicologist: Jon Bruce Mann, B.S. Research Assistant Professor, Department of Epidemiology and Public Health, University of Miami School of Medicine.

Veterinary Medical Program Officer: Kathryn H. Nepote, V.M.D., M.P.H. Director of Laboratory Animal Care, University of Maryland, College Park.

IX. PERSONS CONTACTED

College Park, MD

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Dr. D. G. Bottrell, Pest Management Specialist

VA-MD Regional College of Veterinary Medicine
Dr. E. Stephenson

Washington, D.C.

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Mr. Raul Hinojosa, Livestock Advisor
Mr. James Hester, Chief, Environment, Energy and Science (Phone: 202-647-8093)
Dr. John Wilson, Deputy Environmental Officer

USDA/APHIS
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Dr. Keith A. Hard, Officer at Large, International Services
Dr. Lonnie J. King, Deputy Administrator, Veterinary Services, Room 320-E, Administration Bldg., 14th and Independence, P. O. Box 96464, Washington, D.C. 20090-6464 (Phone: 202-447-5193)

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Dr. Elmer Ahrens (Phone: 512-585-6788)

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Dr. Bill Plapp, Pesticide Toxicologist, Department of Entomology

University of California, Berkeley (telephone contact only)

Dr. J. E. Casida, Pesticide Toxicologist, Department of Entomological Sciences (Phone: 415-642-5424)

Barbados, W.I. (telephone contact only)

U.S.A.I.D.
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Mr. Howard Batson

St. John's, Antigua, W.I.

U.S. Embassy
Ms. Annette J. Moore, Administrative Officer (Phone: 809-462-3505)

Ministry of Agriculture, Fisheries and Lands
Mr. Ernest Benjamin, Permanent Secretary
Dr. Joseph Robinson, Chief Veterinary Officer and Head of Veterinary Division
Mr. Eustace Royer, Chief Fisheries Officer, Point Wharf (Phone: 809-462-1372)
Dr. Hayden Thomas, Chief Chemist and Food Technologist and Member, Pesticide Control Board (Phone: 809-462-4373/4502)
Mr. Keith Joseph, Sr. Field Officer
Mr. Sere Benjamin, Supervisor, Training and Information, Extension Division

EDF Livestock Development Project
Mr. Alistair Rutherford, Project Manager
Mr. Karsten Schleiss, Extension Specialist

Caribbean Agricultural Research and Development Institute (CARDI), c/o P. O. Box 766, Friars Hill, St. John's (Phone: 809-462-0661/1666)
Dr. Brian Cooper, Systems Agronomist
Dr. Iftekhar Ameen, CARDI Representative for Antigua and Barbuda

Antigua Sugar Industries Corp. (site of proposed pesticide storage facility)
Mr. M. C. Abbott, General Manager

Antigua and Barbuda Livestock Improvement Cooperative Society, Ltd.
Mr. Lasman Wilson

Mr. Gerald Pryce, Public Utilities Worker/Cattle Owner (2 cows)

Castries, St. Lucia, W.I.

Ministry of Agriculture, Lands, Fisheries and Cooperatives, Veterinary Division
Dr. Peter Darius Gabriel, Veterinary Officer
Mr. Eden Compton, Sr. Animal Health Assistant

4 livestock owners participating in the tick control program

Inter-American Institute for Cooperation on Agriculture (IICA), P. O. Box 1223, Castries (Phone: 25482)
Dr. Franz C. M. (Jerry) Alexander, Representative, Antigua and Barbuda, Dominica, Grenada, St. Lucia, St. Vincent and the Grenadines
Ms. Judy Mann, Peace Corps Volunteer Entomologist

United Kingdom (telephone contact only)

Dr. Norman Janes, Consultant to Department of Insecticides and Fungicides, Rothamsted Experimental Station, Harpenden, Herts., England AL5 2JQ (Phone: 0582-763133)

X. RECOMMENDED DISTRIBUTION

U.S.A.I.D.

G. Rozell, Chief, Agriculture and Rural Development
R. Hinojosa, Livestock Advisor
L. Armstrong, Deputy Director, Regional Development Office for the Caribbean
L. Laird, Chief, Agriculture, U.S.A.I.D./Barbados
B. Waite, A.I.D./S&T, Acting Project Manager for CICP

USDA/APHIS

L. J. King, Deputy Administrator, Veterinary Services
W. H. Garnett, Associate Director, International Services
D. Wilson, International Services

USDA/OICD

J. Butcher

Government of Antigua

E. Benjamin, Permanent Secretary, Ministry of Agriculture, Fisheries and Lands
J. Robinson, Chief Veterinary Officer and Head of Veterinary Division