Regulating pesticides in Texas

Lyndon B. Johnson School of Public Affairs
The University of Texas at Austin
Policy Research Project

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FOREWORD

The Lyndon B. Johnson School of Public Affairs has established interdisciplinary research on policy problems as the core of its educational program. A major part of this program is the nine-month policy research project, in the course of which two or three faculty members from different disciplines direct the research of ten to twenty graduate students of diverse backgrounds on a policy issue of concern to a government agency. This "client orientation" brings the students face to face with administrators, legislators, and other officials active in the policy process, and demonstrates that research in a policy environment demands special talents. It also illuminates the occasional difficulties of relating research findings to the world of political realities.

This analysis of pesticide regulation in Texas is the product of a policy research project conducted at the LBJ School in 1983-84. Publication was funded and overseen by the Texas Department of Agriculture, which commissioned the study. A second volume emphasizing the health effects of exposure to pesticides is being published in the same manner as a companion volume.

The curriculum of the LBJ School is intended not only to develop effective public servants but also to produce research that will enlighten and inform those already engaged in the policy process. The project that resulted in this report has helped to accomplish the first task; it is our hope and expectation that the report itself will contribute to the second.

Finally, it should be noted that neither the LBJ School nor The University of Texas at Austin necessarily endorses the views or findings of this study.

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1. INTRODUCTION

Pesticides are used quite extensively in both agricultural and urban settings in the United States in general and in Texas in particular. Pesticides have proven to be a great boon by reducing crop damage caused by various pests, as well as by killing pests that transmit diseases. However, many pesticides have also placed a great burden on people and the environment. Some pesticides have been shown to have acute and chronic effects on humans, including poisonings at low doses, cancer, genetic mutations, and birth defects. Similarly, some pesticides have been found to damage aquatic and terrestrial ecosystems. As a result, in order to protect the public and the environment, yet still benefit from the use of pesticides, federal and state governments have acted to regulate the use of pesticides. This report examines and evaluates the current pesticide regulatory programs at the Texas Department of Agriculture (TDA), the lead agency for regulating the use of pesticides in Texas, and develops and assesses policy options available to TDA for improving the programs.

In 1980, almost 1.2 billion pounds of pesticides were used in the United States.[1] Pesticides are used extensively in both agricultural and urban settings. For instance, the United States Department of Agriculture (USDA) estimates that 225 to 250 million acres, or about two-thirds of American crop lands, are treated annually with pesticides.[2] Moreover, of the $5 billion to $6 billion per year that U.S. farmers spend on pest control, the majority goes toward purchasing pesticides.[3] USDA estimates that, excluding the cost of land, pesticides account for 2 to 13 percent of the total production costs for major field crops.[4]

While the agricultural sector uses the majority of the pesticides sold in the United States, urban areas also seem to use pesticides on a broad scale. For example, a 1979 study by the Environmental Protection Agency (EPA) found that 90.7 percent of the households surveyed used pesticides in the house, garden, or yard.[5] This study confirmed the results of several previous studies on urban pesticide use.[6] Urban dwellers not only use pesticides commonly, but they appear to use large quantities of them. The authors of a 1972 study on pesticide use in three urban areas (Philadelphia, Pennsylvania; Dallas, Texas; and Lansing, Michigan) estimated the average deposit of active pesticide ingredients in those areas to be between 5.3 and 10.6 pounds per acre.[7]

According to a 1974 EPA study, Texas is ranked second in the nation in its use of pesticides. However, since Texas does not have a system to collect data on the quantity of pesticides used, it is nearly impossible to determine the exact amount used in the state. Estimates of pesticide use in Texas range widely. The 1974 EPA study estimated that at least 89 million pounds of pesticides were applied in Texas,[8] while a more recent study estimated that in 1977 between 100 and 150 million pounds of pesticides were used in Texas.[9] Pesticide use in Texas appears to be on an upward trend.[10]

Most of the pesticides sold in Texas are used in the agricultural sector. Texas agriculture is ranked second in the nation in the total cash receipts for farm production, and first in the nation in total number of farms and amount of farm and ranch acreage.[11] A survey done in 1980 indicated that 54 percent of Texas farm and ranch acres received pesticide applications.[12]

Nevertheless, Texas appears to be similar to the rest of the nation in that,

although the majority of pesticides are used for agricultural purposes, urban use of pesticides is also quite high. A 1980 survey of Texas households found that professional pesticide applicators applied chemicals in about one-half of all households, while two-thirds of those households surveyed sprayed their own homes.[13]

The lead agency responsible for regulating the use of pesticides in Texas is the Texas Department of Agriculture. The purpose of this Policy Research Project is to develop and assess policy options available to TDA for regulating the use of pesticides. We have chosen seven major areas of pesticide regulation on which to focus: special local needs registrations, applicator certification, enforcement, aerial application, urban pesticide use, pesticides in foods, and farmworker health and safety. Each of the following chapters describes current regulatory policy in one of these areas, considers problems, and develops and assesses policy options to correct these problems. The last chapter presents an overview of the pesticide regulation program in Texas and consider three broader problems: information needs of the agency, coordination, and consistency. A final section considers the role of information more generally in pesticide regulation.

In order to evaluate the various policy options that we will propose, we have developed a set of evaluative tools. First, we have defined what we believe to be the implicit and explicit goals of pesticide regulation, and we analyze how effectively the existing regulatory system and alternative policy options meet these goals. Second, we have developed a set of general criteria that seem to be desirable characteristics of any good policy, and we also evaluate the existing arrangements and policy options against these criteria.

It should be noted at the outset, however, that we have only used these evaluative tools where we felt they were appropriate.

The rest of this chapter develops these evaluative tools. The next section provides the historical development of federal pesticide regulation in the twentieth century by pointing out the implicit and explicit goals of pesticide regulation. The section after that introduces Texas pesticide laws, while the final section describes and defines the administrative criteria that we have developed.

1.1 HISTORY OF FEDERAL PESTICIDE REGULATION

The regulation of pesticides is a function of both the state and federal governments. This section provides a brief description of the evolution of the current federal pesticide regulatory program. The federal program has changed dramatically over time. Although several factors have influenced these changes, one key factor has been that, as time has passed, Congress has sought to address an increasing number of societal goals through the pesticide regulatory program. As these goals have grown, so has the program. Thus, the following section not only describes the development of the federal pesticide regulatory program, but also points out the societal goals that are implicit in the program's evolution.

1.1.1 The Federal Insecticide Act of 1910

The first chemical pesticides were developed in the mid 1800s in response to the rapidly increasing problem of crop damage from insect pests, and by the end of the nineteenth century, these pesticides were in widespread use.[14] These pesticides were, for the most part, developed from materials that occurred naturally in the environment. For instance, the first chemical

pesticides consisted of rotenone and pyrithrins made from plant materials, Paris Green and other compounds containing an arsenic base, and compounds of mercury, copper and sulfur.[15] The formulas of these pesticides were quite simple, and thus compounds were often sold by small itinerant dealers, or mixed by the farmers themselves using ingredients ordered through the mail.[16] The decentralized distribution system of this new technology made consumers of pesticides vulnerable to widespread deceit. Pesticide manufacturers and distributors could easily pass off adulterated goods, or make inflated claims about the pesticides' effectiveness, with little or no chance of being caught.[17]

In response to this problem, the U.S. Department of Agriculture and a variety of farm organizations pressured Congress into taking action to solve the pesticide fraud problem. As a result, Congress enacted the Federal Insecticide Act of 1910. The Federal Insecticide Act was a simple statute that:

1. Prohibited the manufacture, sale or transportation of adulterated or misbranded insecticides and fungicides.
2. Specified the percentage of certain ingredients for Paris Green and lead arsenate.
3. Set general standards for the composition of other insecticides and fungicides.[18]

Thus, the major societal goal that Congress addressed in passing the Federal Insecticide Act of 1910 was that of consumer protection. The Act was designed to protect farmers from purchasing fraudulent, ineffective, or misbranded compounds, by setting standards for the composition of the pesticides, and by making it illegal to sell adulterated or misbranded pesticides. The Federal

Insecticide Act of 1910 was considered an adequate response to the pesticide fraud problem until 1947.

1.1.2 The Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (FIFRA)

The period around World War II marked the second major turning point in the history of pest management and federal pesticide regulation. In 1939, the insecticidal properties of DDT were discovered, and it was rapidly and widely adopted. Moreover, during World War II military scientists found that many of the compounds that they had developed for chemical warfare against humans were also effective in killing insects and other pests. Thus, by 1946 the older "simple" pesticides, such as Paris Green and rotenone, were almost completely replaced by newer, much more complex, synthetic organic pesticides. These new pesticides were much more toxic than the old ones, and they were more likely to harm nontarget species.[19] Furthermore, while the older pesticides were used almost solely on insects and fungi, many of the newer pesticides were used for rodent and weed control. Consequently, the new pesticides were being used for different purposes and in much greater quantities than ever before.[20]

Because farmers were using new, more toxic pesticides in greater and greater quantities, Congress enacted the Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (FIFRA). FIFRA was designed to give further protection to consumers of pesticides against purchasing products that were not effective or were adulterated, and to ensure that consumers were aware that the pesticides they were purchasing could be acutely toxic to humans or livestock if used incorrectly. Specifically, FIFRA required:

1. The registration of pesticides with the Department of Agriculture prior to their sale or movement in interstate or foreign commerce.
2. The prominent display of poison warnings on the labels of highly

toxic pesticides.

3. The coloring or discoloring of dangerous white powdered pesticides to prevent their being mistaken for flour, sugar, or other foodstuffs.

4. The inclusion of a warning or caution statement on the label of pesticides to prevent injury to people, animals, and plants.

5. The inclusion of instructions on pesticides to provide adequate protection for the public.

6. The declaration of pesticides as misbranded if they are injurious to humans, animals, or vegetation, when improperly used.[21]

It should be noted that the law also contained a "loophole" provision that allowed a manufacturer to market a product even if USDA refused to register it, by requesting the secretary of USDA to "register it under protest."[22] This provided little incentive for USDA to administer the registration process stringently, since pesticides that were denied registration could be marketed anyway.[23]

The major goal of FIFRA was again consumer protection. The underlying assumption behind FIFRA was that the consumer's inability to assess the efficacy of pesticides was the major problem associated with their use. Consequently, Congress gave the USDA powers to register pesticides to prevent nonefficacious pesticides from being marketed. Senator Ellender stated this quite clearly when he presented FIFRA to the whole Senate for a vote:

> Frequently, serious damage is suffered by agricultural producers and other users of economic poisons [pesticides] through the use of misbranded or adulterated economic poisons before enforcement officials have any knowledge of the existence of such articles.... Under this bill, any economic poison subject to the provisions thereof will be brought to the attention of the enforcement officials who will have an opportunity to become familiar with the formula, label, and claims made with respect to any such economic poison before it is offered to the public. It should be possible, therefore, in a great majority of instances, to prevent false and misleading claims, and to

prevent worthless articles from being marketed.[24]

FIFRA incorporated the objectives of classical consumer protection theory in that it assumed people were rational and defined the problem as disclosing sufficient information via the pesticide label for the users to make an informed choice.[25]

While the major goal of FIFRA was consumer protection from adulterated or ineffective products, it is evident that Congress was also becoming concerned about the acute risk to humans and the environment from pesticides. The provisions of FIFRA that required pesticides that resemble flour, sugar, and other foodstuff to be dyed before being marketed indicated its concern about accidental poisonings from pesticides. Moreover, the provision that declared pesticides to be "misbranded" if they were injurious to humans, vertebrate animals, or vegetation, *when used improperly*, indicates a growing concern about the acute hazards of pesticides.

Nevertheless, the major concern was efficacy, and USDA administered FIFRA in a manner to ensure this. As a result, most of its pesticide regulatory activities were designed to ensure that pesticides were labeled correctly.[26]

1.1.3 Silent Spring

Until the early 1960s, the main concern of Congress, USDA, and most agricultural organizations with regard to pesticides continued to be protecting the consumer against purchasing ineffective or mislabeled pesticides. However, beginning in 1962, the focus of concern changed. In that year, Rachel Carson wrote a book entitled *Silent Spring* in which she challenged the assumption that efficacy was the major problem, and contended,

rather, that harm to human health and the environment were the critical issues. Rachel Carson noted that pesticides are potentially unsafe because they have unanticipated effects on nontarget organisms, and thus pose a danger to human health and the environment.[27] Carson's book provided documented accounts of human and environmental damage from pesticide use, and provided evidence to indicate that many insect populations were becoming resistant to the pesticides that were being used on them. Thus, over time, pesticides previously believed to be efficacious became less effective or ineffective.[28]

Rachel Carson's book resulted in an increased concern about the safety of pesticides for both humans and the environment. As a result of *Silent Spring*, many state and local governments developed boards and commissions to study this problem, and the Science Advisory Committee under presidents Kennedy and Johnson produced extensive reports about the potential hazards associated with pesticide use.[29]

1.1.4 The FIFRA Amendments of 1964

In 1964, as a direct result of the concerns raised in *Silent Spring* and by the President's Science Advisory Committee, Congress took action to amend FIFRA. The key provision of the amendment was the elimination of "registrations under protest," which, as described above, allowed the marketing of pesticides that were denied registration by USDA. The amendment also made it easier for USDA to cancel or suspend hazardous pesticides. These actions are very significant in that they mark the turning point from a legislative emphasis on concern for protecting easily deceived consumers to concern for human safety in pesticide use.[30] This new concern for human safety was reflected in comments made by Senator Abe Ribicoff during Congressional debates on the 1964 amendments: "The policy of this nation should always be

that a pesticide should not come onto the market until adequate proof of safety has been established, and it should not be left to the public to play out the role of guinea pig."[31] Thus, the 1964 amendments mark the point at which a new societal goal was openly added to the previous goal of consumer protection--protection of human health.

1.1.5 Federal Environmental Pesticide Control Act of 1972

In 1970, the authority to regulate pesticides was transferred from the U.S. Department of Agriculture to the newly created Environmental Protection Agency. The transfer occurred because Congress felt that USDA suffered from a conflict of interest by both promoting agriculture and regulating pesticides. The transfer of pesticide regulatory authority to an agency designed to protect the environment was the first step toward including another societal goal in pesticide regulation--protecting the environment.

In 1972, Congress again amended FIFRA and passed the Federal Environmental Pesticide Control Act (FEPCA). Through FEPCA, Congress for the first time explicitly recognized the protection of the environment as a societal goal, and it took greater steps to provide for the protection of human health. The major sections of FEPCA included:

1. Extending FIFRA to cover substances manufactured and used within the same state [previously, FIFRA only applied to pesticides sold or transported between states].
2. Requiring the administrator of EPA to classify pesticides, upon registration, as either restricted use or general use. Restricted-use products could only be used by certified applicators, thus limiting the number of people exposed to highly dangerous pesticides.
3. Prescribing criteria for the registration of pesticides.
    a. The pesticide's composition is such as to warrant the

proposed claims for it (it is efficacious);

b. The pesticide's labeling and other materials submitted to support registration comply with the act;

c. The pesticide will perform its intended function, with *no unreasonable adverse effects on the environment*[32] [emphasis added]. "Unreasonable adverse effects" is defined elsewhere as "any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide."[33]

4. Requiring EPA to review the registrations of previously registered pesticides.

The third criterion for registering a pesticide indicates an explicit concern for protecting the environment, and this concern was similarly brought out in Congressional hearings on the Federal Environmental Pesticide Control Act.[34] It should be noted that in the definition of "an unreasonable adverse environmental effect," Congress has required EPA to conduct cost-benefit analysis when registering pesticides. This action essentially ensured the availability of pesticides to increase crop production. For instance, if a pesticide had harmful effects on the environment, yet was designed to combat a pest for which there were no current controls, the benefits of the pesticide would probably be so high as to guarantee that its registration was approved. Thus by ensuring the availability of pesticides to increase crop production, Congress provided an implicit goal of pesticide regulation--ensuring economic benefits for farmers.

Another goal of FEPCA was brought out in a Senate Committee report. The Senate Commerce Committee, which considered FEPCA along with the Agriculture Committee, sought to add amendments which would explicitly state that farmworkers were covered under the act. The Senate Agriculture Committee

opposed the amendments, stating that the act was designed to protect all people, including farmworkers. The Agriculture Committee emphasized that "th bill requires the Administrator to require that the labeling an classification of pesticides be such as to protect farmers, farmworkers, an others coming in contact with pesticides or pesticide residues."[35] The Agriculture Committee observed that: "The farmer and the farmworker are the persons most likely to be adversely and immediately affected by pesticides and *they are the most obvious objects of the bill's protection* [emphasis added]. If there is any question as to whether they are fully protected, we do not know what it could be."[36] Therefore, while the amendment was defeated, an explicit goal of pesticide regulation seems to be the protection of those coming into direct contact with the pesticides--the farmer and the farmworker.

The FEPCA amendments implicitly added another societal goal to the regulation of pesticides. In developing the amendment, Congress specifically decided that "lack of essentiality" or the existence of other pesticides that performed the same function was *not* an acceptable reason for denying registration, and this was written into the legislation.[37] In making this decision, Congress implicitly determined that a desirable goal for pesticide regulation is to allow pesticide manufacturers to reap an economic benefit. Thus, economic benefit to producers of pesticides is another goal of pesticide regulation.

1.1.6 The FIFRA Amendments of 1975

FIFRA was again amended in 1975. The main focus of these amendments was to ensure that EPA took into account the effects of cancellation and suspension of a pesticide's registration upon the production and prices of the relevant agricultural products when it issued a cancellation or suspension notice.[38] In

order to ensure this, Congress required the administrator of EPA to send proposed cancellation and suspension notices to the secretary of agriculture. The secretary could then notify the administrator of EPA of the potential impacts that the agency's action might have on crop production, and the administrator was required to weigh these impacts in making a decision. This action formally added another goal to pesticide regulation--protecting the economic interests of the farmers.

Another, less important provision of the amendments was a requirement that directed EPA to furnish, upon request, information on Integrated Pest Management, through a USDA extension agent. Integrated Pest Management (IPM) is a pest management methodology that seeks to use as little pesticide as possible by using other pest control techniques (such as natural controls) in addition to pesticides. It should be noted that pesticides play an important role in IPM, and that it in no way attempts to eliminate pesticide use, but rather tries to minimize it. By including this provision in the act, Congress implicitly added another societal goal to pesticide regulation--reducing the use of pesticides.

1.1.7 FIFRA Amendments of 1978

In 1978, Congress again amended FIFRA. Two of the major parts of the legislation were:

1. A provision establishing requirements for EPA to include long-term health effects and environmental effects of pesticides when reviewing them for reregistration (reregistration was required in 1972).
2. A provision allowing EPA to waive the efficacy data requirements so that it could divert resources from efficacy evaluation to health and safety testing.[39]

These provisions were important because they indicated that the societal goals of federal pesticide regulation were no longer to provide consumer protection by ensuring that pesticides were efficacious. Rather, they emphasize a concern for protecting human health and the environment, as well as for ensuring economic benefits for manufacturers and farmers.

1.1.8 Summary

This section has examined the evolution of the current federal pesticide regulatory law and analyzed the societal goals that Congress has sought to address by developing or changing the law. The goals of current pesticide regulatory law are:

1. Protecting consumers from purchasing ineffective or misbranded compounds.
2. Protecting human health from the hazards of pesticides use.
3. Protecting those coming in direct contact with pesticides, most notably farmers and farmworkers, from the health hazards of pesticide.
4. Protecting the environment from the hazards of pesticide use.
5. Enabling pesticide manufacturers to reap economic benefits.
6. Minimizing the use of pesticides.
7. Protecting the economic interests of farmers.

The reader will immediately recognize that many of these goals contradict one another. For instance, minimizing the use of pesticides and assisting pesticide manufacturers may well be conflicting goals. Similarly, protecting the environment and human health may conflict with ensuring producer profits. This creates a constant struggle of interests within the pesticide regulatory arena. The EPA has tried to reconcile these interests through its cost-benefit analysis. Nevertheless, the conflict among goals of regulation helps to

account for the inconsistencies and lack of coordination that, as we shall see, characterize pesticide regulation.

1.2 TEXAS PESTICIDE LAWS

We have seen that in the 1972 FEPCA Congress granted states the authority to regulate pesticides more stringently than the federal government does.[40] This was a response to strong evidence that pesticides act differently under various local conditions. For instance, since high temperatures cause liquids to evaporate, there is a greater amount of pesticide vapor under hot conditions than under cool conditions. Therefore, workers applying a liquid pesticide under very hot conditions are likely to inhale more of the pesticide than workers applying it under cooler conditions. Similarly, a pesticide that is hydrophilic (strongly attracted to water) may pose a greater risk to the environment in areas that receive heavy rainfalls or that use flood irrigation than in dry areas or areas that use drip irrigation. Federal regulatory procedures cannot take into account the varying local conditions under which pesticides are used; thus, EPA may approve recommendations for dosages and application rates that are not attuned to local and regional conditions.

Congress did not expect EPA to be able to account for the varying local conditions; rather it expected individual state governments to help EPA in this function. As Dr. Jorge Marning of the National Wildlife Federation noted, "States are...able to respond to their individual needs and requirements associated with population distribution, watersheds, soil characteristics, cropping patterns, climate, and methods of farming."[41] In Texas, the Department of Agriculture is empowered to regulate pesticides because it is more attuned to local conditions. In considering the state regulatory program, therefore, it is important to consider whether it is

especially responsive to local conditions.

1.2.1 The Texas Pesticide Control Act

The Texas Pesticide Control Act is the major pesticide legislation in the state of Texas. In most areas the act follows FIFRA. Pesticides must be properly labeled and must be registered with TDA. State registrations expire on December 31 of each year and must be renewed. TDA is also empowered to adopt rules governing the storage and disposal of pesticides and pesticide containers, and to enter buildings to inspect equipment or pesticide use.

One of the most significant provisions of the Texas law allows TDA to create a category of "state-limited-use" pesticides. This provision is intended to apply to pesticides which, when used as directed, require additional restrictions to prevent "unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of use of the pesticide."[42] TDA must first give notice and hold a public hearing before it can designate a pesticide as state-limited-use. TDA may regulate the time and conditions of use of a state-limited-use pesticide.[43]

Dealers who sell restricted-use or state-limited-use pesticides must be licensed by TDA. The dealers must renew their licenses every year and must maintain records of each limited-use pesticide sold for a period of two years. TDA also licenses applicators of the limited-use pesticides.

1.2.2 Herbicide Law

The herbicide law is an unusual feature of Texas pesticide regulation. It applies only to herbicides, and most of its provisions apply only in some counties. Its purpose is to limit harm to desirable vegetation from the

application of herbicides. The substances regulated under the herbicide law are also regulated under the pesticide act, and must be registered and applied in accordance with its provisions. However, the few substances regulated by the herbicide law are subject to additional constraints.[44]

The herbicide law authorizes TDA to license dealers of herbicides, and requires these dealers to fulfill certain conditions. Herbicide dealers must *submit* records of sales to TDA, rather than simply maintaining these records as required under the pesticide act. The provisions of the herbicide law that state the conditions for selling herbicides are applicable to dealers throughout the state.

In contrast, the provisions of the herbicide law which regulate the use of herbicides are applicable only in certain parts of Texas. Most counties are exempt from the law, and only the county commissioners' courts can decide to bring their counties under the purview of the optional sections of the herbicide law.[45] In those areas where the sections on herbicide use do apply, the herbicide law mandates that all users, except those who treat less than ten acres a year, must obtain a permit, provide advance notice of spraying, and submit records of applications to the department. Custom appliers of herbicides must also carry crop damage insurance.

The county commissioners' courts are empowered by law to make other determinations about herbicide use in their areas. For instance, a commissioners' court may bring only a portion of its county under the use sections of the law. Although TDA is responsible for enforcing the law, the counties may appoint and reimburse their own herbicide inspectors. Thus, the

law explicitly provides for a significant amount of local decisionmaking. The herbicide act, which presents special difficulties to TDA in enforcing safe use of pesticides in Texas, is discussed in more detail in chapter 3.

1.3 EVALUATIVE CRITERIA

The research group has developed a set of criteria which can be used to evaluate both current TDA policy and the policy options presented below. The criteria are general ones that can be used to evaluate any program, and derive from a variety of sources, including our own priorities and those that TDA expressed to us.

1. *Resource Requirements*--the people, money, etc., and so forth required by the agency to implement the policy or program. Since the resources of any agency, including TDA, are limited, the agency may not be able to address fully all of its goals. Often the agency must make trade-offs between different policies and programs. Therefore, it is important to provide the agency with an idea of how many resources will be required to implement each program or policy, so that it may make the most effective trade-offs.

2. *Reliability*--the extent to which the agency performs consistently and predictably.

3. *Adaptability*--the ability of the program or policy to respond to changing conditions. It is important to determine the adaptability of a program, since conditions both inside and outside of the agency change constantly. A program that is likely to break down quickly because it cannot adapt to changing conditions is undesirable, since the resource requirements of developing a replacement program can be great.

4. *Political Feasibility*--the likelihood that a program or policy will be accepted outside of the agency, and therefore will be implemented. The actions of TDA are subject to various constraints by the legislature and, to a lesser extent, by the executive branch. Therefore, while agency actions rarely please all of the people all of the time, the action must satisfy enough people so that the legislature will not take action to stop its implementation. It is important to inform TDA of the likelihood that the policy actually can be implemented.

5. *Effectiveness*--to what extent does the policy accomplish its goals, and does it cause any spill-over effects?

6. *Individual Autonomy*--the extent to which individuals are free to

make their own decisions. A policy of the Hightower Administration has been to encourage programs that enable individuals to make their own decisions. Thus, by evaluating programs by this criterion, we inform TDA whether the proposed policy is consistent with a currently adopted policy.

7. *Accountability*--does the program clearly define responsibility for actions? A program that clearly defines who is responsible for actions enhances the ease of administering the program. Assessing programs by this criterion also provides a measure of administrative feasibility.

8. *Checks and Balances*--procedural safeguards to ensure that affected interests are represented in the decision making. There are two reasons why it is important to assess the checks and balances provided by a policy. The first is that if affected interests have a say in the decision making, the policy is likely to satisfy more people and thus will be more politically feasible. Second, by enabling affected interests to participate in the decision making, better decisions can be made because various perspectives will be represented in the final decision.

9. *Measurability*--the extent to which the performance of the policy or program can be evaluated. The easier it is to evaluate the program, the easier it is to correct the problems the program may have. Thus, measurability provides an indicator of administrative feasibility.

10. *Enforceability*--the ability of the agency to ensure that program requirements are being met. Since environmental policies generally have social rather than individual benefits, people have little incentive to comply with them. Therefore, if a policy is unenforceable, it is unlikely that people will comply with it.

Using the goals described above and these administrative criteria as the basis for evaluation, the following chapters consider seven aspects of Texas pesticide policy.

2. SPECIAL REGISTRATIONS

2.1 INTRODUCTION

In chapter 1 we noted that the federal pesticide registration process was not designed to ensure that all registration conditions were appropriate to local requirements. Therefore, FIFRA provides for several types of special registrations. Section 24(c) permits registration of a pesticide for uses in addition to those allowed under the regular federal section 3 registration to meet "special local needs." Section 18 registrations are temporary registrations of a product which is needed to meet an emergency.[46] Because they are intended to allow pesticide policy to be responsive to local conditions, both section 18s and 24(c)s delegate to the states extensive authority over the two processes. While EPA retains final approval over the registrations, the states play a major role in the screening process in the day-to-day implementation of the programs.

Special local need registrations and emergency exemptions represent a strengthening of state authority vis-a-vis federal authority. As noted in chapter 1, the two provisions were incorporated in the 1972 amendments to FIFRA. Prior to 1972, states were authorized to issue state registrations for products used solely within that state. These products were then exempt from federal requirements. When this authority was taken from the states, provisions to grant special local needs registrations and emergency exemptions were delegated to replace some of the broad registration authority the states had lost. Until the 1978 FIFRA amendments, EPA retained substantial authority over the two programs. The 1978 amendments limited EPA's ability both to disapprove specific registrations and to oversee the state process.[47] In particular, the 1978 amendments removed essentiality from the definition of

special local needs and added economic cost of feasibility as a potential basis. Unfortunately, the extensive information that must be produced before a pesticide registration can be granted inhibit the states' abilities to oversee these special registrations.

This chapter describes special registrations. First, the federal and state procedures and Texas' own experience with 18s and 24(c)s are considered. Although the state portion of the procedure actually precedes the federal review process, in this chapter the federal procedures are discussed first because they constrain and define what the states must do. Then other states' programs are briefly described, and finally options to improve the Texas programs are discussed.

2.2 SECTION 18

Section 18 of FIFRA allows the states to grant emergency exemptions. There are three types of emergency exemptions described in the Section 18 regulations: specific, quarantine-public health, and crisis.[48] *Specific exemptions* are by far the most common. These are issued by EPA upon written request of the head of the federal agency, governor, or delegated official of the state where the use is proposed. Specific exemptions are intended to permit the use of a pesticide for a specific pest or site emergency where no registered alternative is available. It is the requesting agency's responsibiility to demonstrate that an emergency exists or is anticipated and that no registered alternative is available. The anticipated duration of the emergency must be specified; exemptions may not exceed one year.

Emergencies are determined on a case-by-case basis with information from the written requests for exemption. EPA requires that the requests include: (1)

information on the nature, scope, and frequency of the emergency; (2) a description of the pest and when and where it is likely to occur; (3) the registered alternatives, other available controlling methods and why they are inadequate; (4) a thorough description of the proposed exempted program; (5) a statement of economic costs and benefits with and without the specific exemption; (6) an analysis of potential adverse effects upon humans and the environment; and (7) a follow-up report.

Quarantine/public health exemptions are issued to prevent the introduction of a foreign pest into the United States. The procedures for application for this exemption are similar to the requirements for a specific exemption.

After EPA receives a request for either of these two types of emergency registration, it conducts a review of the request. EPA assesses human and environmental risks and economic costs and benefits and determines whether an emergency situation exists and whether alternatives are available. If an exemption is granted, a notice is published in the Federal Register. There is no provision for review and comment by interested persons at any time during the process. EPA targets the completion of this review process in fifty days. In 1982, the average processing time was thirty-eight days.[49]

The third type of emergency exemption, a *crisis exemption*, is intended to provide for those situations where time is a critical factor. The responsible state or federal official may authorize the exemption if it is determined that there is an emergency, that there is no registered alternative readily available, and that the time element is so critical that application for a specific or quarantine/public health exemption is impossible.

The agency must notify EPA by telegram of the situation within thirty-six hours and provide detailed information (amounting to that required for regular emergency exemption applications) within ten days. If treatment exceeds fifteen days. a specific emergency application must be submitted. EPA may notify the agency that treatment must be discontinued, withdraw the use of a specific pesticide for crisis exemption, or withdraw the right to resort to crisis exemptions from any agency which has abused the privilege. No pesticide which has been suspended or finally canceled may be used under a crisis exemption for any use prohibited under the suspension or cancellation.

Between 1978 and 1982, 1334 emergency exemptions were granted nationally 159 requests were denied: 47 percent of all denials during this period were in 1980 alone.[50] The number of requests for emergency exemptions has increased sharply each year, from 17 in 1978 to 402 in 1982. The EPA Internal Audit of March 1983 suggested a number of reasons for the increases, but did not identify misuse of the provision by the states as one of them.[51]

Texas ranked in the top ten for recipients of emergency exemptions during the period; this is consistent with Texas' position as one of the largest users of pesticides nationally and hence does not necessarily indicate misuse of the process by Texas.

Emergency registrations constitute a possible source of abuse because they provide a way around the normal registration process. The procedures that allow states to permit pesticide use in accord with special local conditions are by definition ways of circumventing full federal control. For example, EPA does not require a tolerance level for products used only under emergency

exemptions. (A tolerance indicates an acceptable level of pesticide residue on a product.) Many pesticide products are lacking only a tolerance level to complete the normal registration process. The expensive process of setting a tolerance level can be avoided by repeatedly requesting an emergency exemption.

FIFRA has attempted to prevent abuse of emergency registrations by limiting the periods within which they are effective. Both specific and public-health registrations are valid for the period of time in which the emergency exists, as specified in the request, but may not exceed one year. An exemption may be renewed annually by the EPA administrator upon reapplication. In Texas, approximately 35 percent of the 82 section 18 exemptions were repeat applications of at least three consecutive years during the first five years of the program's existence.[52] A review of the requests revealed that these repeat applications are generally made for products that are experiencing long delays in the normal registration process, usually because of the difficulty of setting tolerances. It has been EPA's policy to review emergency exemption requests on a case-by-case basis regardless of reapplications as long as good-faith efforts are being made to register the products.[53] In fact, reapplication requests should signal EPA to give these products and uses priority in the regular registration process. In 1983, four emergency exemption requests in Texas (about 20 percent) were reapplications.[54]

There was a 216 percent increase in the use of the crisis exemption provision between 1981 and 1982, from 67 to 145 nationwide. This accounted for the most substantial increase over the five-year history of the program. The increase in use of the crisis exemption is disproportionately larger than

the increase in the use of the specific exemption provisions. The March 1983 EPA audit noted that there was probably overuse of this provison by state and federal agencies.[55]

2.2.1 Texas Section 18s

Texas pesticide laws and regulations do not specifically provide for emergency exemptions. TDA, as the state agency representing agriculture, handles section 18 requests.[56] When it is determined by a concerned party (usually an extension agent or producer) that a pest outbreak is threatening (or will threaten) people, crops, livestock, or an endangered species, application is made to TDA for a section 18 exemption. Two people at TDA are responsible for the review process for all section 18 applications. An agronomist gathers all information necessary to validate the existence of an emergency and prepares justification for an emergency exemption for the proposed use.

TDA's first step is to confirm the site, crop, and pest in question. Next TDA's agronomist makes a comparison of the potential loss with and without the requested treatment. The staff person validates the existence of the emergency and estimates the time involved. The agency gathers additional information from private and public sources; different products and application methods are compared, and a review of the literature is conducted in a few instances.

The pesticide registrant must provide data related to efficiency, toxicity, residue, and environmental effects of the product.[57] TDA personnel consult other state agencies for comments and information in some cases. Finally, a review process of the completed application involving both the agronomist who

supervised the collection of the information and the direction of the Agricultural and Environmental Sciences Division ends in approval or denial of the proposed exemption. If the exemption is approved, the application is forwarded to EPA for review. No risk assessment is performed at TDA for either section 18s or section 24(c)s for two reasons: 1. lack of staff; 2. TDA views this as an appropriate function for EPA.[58]

The procedures for considering section 18 requests are not as clearly defined as those for section 24(c)s within the agency. More specific requirements might increase the amount of information available in each case. For example, a final report is required by EPA for each section 18 exemption granted. TDA could make this report more useful by expanding it and using the reports as a review tool.

2.3 SECTION 24(c)

Section 24(c) even more clearly than section 18 is intended to allow states to obtain the use of pesticides for special local needs. For this reason, EPA plays "a very limited role in evaluating Special Local Needs registrations approved by the States."[59] The EPA administrator has ninety days from the issuance of a special local needs registration to disapprove the registration. While the administrator can disapprove on numerous grounds, he or she must generally do so through a process which requires ten days' notice to the affected state and a discussion with the state officials.[60] Moreover, the administrator may not disapprove solely on the grounds of a lack of essentiality. Lack of tolerance data is the primary reason for disapproval of section 24(c)s.[61]

The consultation requirements and the immediate effect of a section 24(c)

Table 1: Ten Most Active State/Federal Agencies Utilizing the Crisis Provisions of Section 18 from FY 1978 to FY 1982

STATE/FEDERAL AGENCY	TOTAL (FY 1978 to FY 1982)
1. California	81
2. Texas	*25*
3. USDA	22
4. Oklahoma	15
5. Hawaii	11
6. Arizona	9
6. Massachusetts	9
8. New Jersey	8
9. Florida	7
10. North Carolina	7
Total for top ten	185
National total	308
% of top ten compared to national total	60.1

Source: EPA Audit, p. 51.

Table 2: Ten Most Active State/Federal Agencies in Emergency Exemption Program From FY 1978 to FY 1982

STATE/FEDERAL AGENCY	TOTAL (FY 1978 to FY 1982)
1. California	279
2. USDA	175
3. Florida	133
4. Oregon	111
5. Washington	103
6. Texas	*82*
6. New Jersey	82
8. New York	64
9. Idaho	63
10. Michigan	42
Total for top ten	1,134
National total	2,076
% of top ten compared to national total	54.6

Source: EPA Audit, p. 52.

mean that a special local needs registration issued by a state can potentially be in effect for a lengthy period, even if EPA ultimately disapproves it. At a minimum, the SLN would be in effect from the time it is issued through the ten day notification period. In fact, a much longer period generally passes before EPA can make a decision. EPA does not, and has not in the past, checked to see if section 24(c) registrations are granted on a widespread basis for the same crop/pest combinations, thereby indicating a need that is neither special nor local.[62] Rather, EPA relies on the states to use their discretion to prevent these situations.[63]

EPA's reliance on the states is clear from the following figures. Of the 3,200 special local need (SLN) registrations issued nationwide between 1978 and May 1981 only 27 were disapproved by EPA.[64] A March 1983 EPA internal audit found a disapproval rate of less than 1 percent at the federal level. Although no exact figures are available, Texas experienced a comparable disapproval rate.[65]

EPA's limited role in the section 24(c) registration process presents a potential for abuse. In fact, SLN applications have increased sharply, since the 1978 FIFRA amendments restricted EPA's grounds for rejection. Over 8,650 SLN registrations were granted through the end of fiscal 1982 and over 1,000 more were estimated for fiscal 1983 nationwide.[66] Texas ranked in the top ten recipients of SLNs for this period, again consistent with its position as a major pesticide user. It is beyond the scope of this chapter to consider EPA's procedures, but the fact that it does not even consider whether a product has been given a 24(c) registration in another state does suggest some failure to fulfill minimum oversight duties.

Table 3: Ten States with Most SLN Registrations

	STATE	Number of 24(c) Registrations*
1.	California	1,518
2.	Washington	462
3.	Oregon	410
4.	Florida	268
5.	*Texas*	*236*
6.	Mississippi	202
7.	Idaho	199
8.	Arkansas	181
9.	Georgia	164
10.	North Carolina	157

Source: House, *Hearing*, table 3.9, p. 128.
*Through July 7, 1982.

Section 24(c) registrations may be issued, at the discretion of the states, for up to five years. After that time, they continue to be valid federal registrations in the absence of state or federal action, until notification is given by EPA that reregistration is required. The reregistration process is the same as for normal registrations.[67] Thus, "it is not necessary for section 24(c) registrants, or the States, to take any action to reregister their products under FIFRA unless notified by EPA to do so."[68] States remain free to impose their own reregistration requirements on 24(c) registrants.

A special local needs registration is valid only within the state of issuance. Section 24(c) may, however, be granted in a number of states, leading to an effectively "national" registration while avoiding normal registration requirements. There is concern that some producers are using section 24(c) to make such an "end run" around the normal registration process.

2.3.1 Texas Section 24(c)s

The section 24(c) process begins when a farmer, rancher, pesticide producer, or extension service employee determines that a need exists for an unregistered use of a registered product. He or she then applies to the state for a section 24(c) registration. The interested party must submit to TDA the following:

1. A completed section 24(c) application form;
2. Ten copies of the product label;
3. Ten copies of the proposed section 24(c) supplemental label;
4. A copy of the tolerance level, or exemption from tolerance requirements from the Code of Federal Regulations;
5. Documentation of need for the 24(c) registration;
6. Research and/or test data supporting the efficacy of the product for the requested use and data documenting the expected residue levels for any food or feed crops involved.[69]

For each section 24(c) application received, EPA requires TDA to take four steps. First, TDA must determine if there is a special local need. "Special local need" has a broader definition than its literal meaning. It is defined by the regulations to mean "an existing or imminent pest problem within a State for which the State lead agency, based on satisfactory supporting information, has determined that an appropriate federally registered product is not sufficiently available."[70] It is also defined not to include "applications for registrations to control a pest problem present on a nationwide basis, or for use of a pesticide product registered by other States on an interregional or nationwide basis."[71] It does include economic needs of users.[72]

A "special local need" is not defined with precision in either FIFRA or the implementing regulations. EPA deliberately defined the term so as to leave "to the States the ultimate discretion to make this determination."[73] TDA also has no formal procedures for defining a "special local need." Rather, the State relies on a case-by-case determination of whether a need exists, with each approved 24(c) registration containing some factor which is local in nature. Since requests vary greatly, the agency has not developed a specific checklist of criteria on this point.

The second step required by EPA is a determination by TDA that the proposed labeling for the product meets criteria set out by EPA in the regulations. For products already registered under FIFRA for other uses, TDA assumes that inclusion of additional instructions for the new use is all that is necessary. For those products not registered under the usual procedures, TDA compares the label to similar products that are registered.[74] In addition, EPA labeling criteria are applied to the proposed label.

Third, EPA requires that TDA determine that the product meets EPA requirements for packaging and coloration. TDA procedures for this step are essentially identical to those for step 2.

Finally, EPA requires the State to classify the product for restricted use if it meets the general restricted-use criteria, is identical or similar to a federally registered product for which all federal uses are classified as restricted, or is used similarly to one classified for restricted use by EPA. Generally, more insecticides are classified as restricted-use since insect resistance builds up more quickly than plant resistance and hence requires

more potent pesticides.

EPA regulations include some additional requirements for state review of section 24(c) registration requests.[75] TDA must determine that the use for which registration is sought will not cause "unreasonable adverse effects on man or the environment, when used in accord with labeling directions or widespread and commonly recognized practices." This requirement applies only to: 1. products not similar to other federally registered products; 2. products not involving similar use patterns similar to current federally registered products; and 3. products for which registration has been canceled, disapproved, suspended, or turned down by EPA. The majority of Texas 24(c) registrations do not deal with unregistered products, but rather with new uses for products already registered.

In all other cases TDA in effect assumes that adverse effects exist unless the agency has received and confirmed a complaint about a similar formulation of the same product or a similar product, documenting harm to humans, wildlife, or the environment generally. Unfortunately, until recently, TDA complaint files were haphazard, so that it was difficult to determine whether a complaint had been made. Moreover, many pesticide incidents, especially those having to do with human health (see chapter 8), do not reach the complaint stage at all, or are resolved before TDA completes its investigation. Thus, no verified complaint exists for the incident. With over 300 complaints a year and no indexing system until now, it would be very easy to miss a complaint. Furthermore, TDA does not attempt to discover whether a product has received complaints in other states, even though many products are registered for the same additional use in many states under section 24(c). To

ease the burden on Texas of gathering this information, TDA could require that a complete list of all states where section 24(c) and 18 registrations exist or are pending accompany a section 24(c) request. The other states could then be contacted by phone for any available information.

EPA requires an efficacy review for public health-related 24(c) registrations because "lack of efficacy could have a direct and serious adverse impact on the health of persons who rely on such products for control of disease causing pests. This is generally not the case for registration of other (e.g., agricultural) uses."[76] Again, few 24(c)s have been issued for this purpose in Texas. EPA has downgraded its efforts to monitor efficacy in general since the 1978 FIFRA amendments.[77] Thus the agency does not pursue efficacy for special local need registrations other than human health-related products.

Whenever a state agency issues a 24(c) registration for a product that has been canceled for other uses, the lead agency must first consult with EPA.[78]

> This prior consultation will allow EPA an opportunity to discuss controversial applications with a State, and, where necessary, provide EPA with an opportunity to dissuade the State from issuing a potentially hazardous registration. In those cases where the State nevertheless issues a registration, EPA will at least have had sufficient prior notice of the State action to take whatever steps might be necessary and appropriate to prevent unreasonable adverse effects from occurring.[79]

TDA does little to follow up on 24(c) applications. No special inspections are made or special data on use collected. The lack of effort is primarily a person-power problem--there are simply not enough staff to perform these tasks.

2.3.2 Summary

FIFRA gives states the power to register pesticides to meet special local conditions and emergencies. EPA's oversight of these registrations is minimal, especially in the case of special local needs registrations. In Texas, procedures for obtaining these special registrations require that applicants document the existence of an emergency or special local need, but do not go much beyond that. The agency asks for virtually no additional data concerning the action of the pesticide under unusual local conditions. Table 4 summarizes the requirements of the two special registration procedures.

The special registration provisions offer an opportunity for circumventing the normal registration procedure by registering a product in many states but not through EPA. It is difficult for states to monitor the status of a pesticide in other states, although, as noted, Texas could require that companies submit information on pending and active special registrations in other states. Central monitoring of special registrations would be the most effective means of ensuring that these provisions are not abused. The state role should focus on obtaining and assessing information that is pertinent to the unusual local conditions to which special registrations are intended to respond.

2.4 OTHER STATES' EXPERIENCES

Texas' four neighboring states, New Jersey, and Florida were selected for review. All of the states had some form of committee review for one or both types of registration, but the use of those committees varied widely. Table 5 outlines the various procedures.

Table 4: Comparison of Section 18 and 24(c) Provisions

	Section 18 (emerg.specific/quat./crisis)	Section 24(c)
Tolerance or exemption from tolerance needed	no*	yes
Valid for	<1 yr./<1 yr./<15 days	up to 5 yrs.
Renewable	yes	yes
Registration permitted if same use previously		
(a) denied registration	no	no
(b) disapproved	no	no
(c) canceled	no	no
(d) suspended	no	no
Registration permitted if different use previously		
(a) denied registration	Y/?/Y	yes
(b) disapproved	Y/?/Y	yes
(c) canceled	Y/?/N	yes
(d) suspended	Y/N/N	yes
Unreg. active ingredient allowed	yes	no
Effective immediately upon state issuance	N/N/Y **	yes ***

? Not addressed in regulations or statute.
*EPA develops a temporary tolerance if section 18 request approved.
**EPA can disapprove during 15 day effective period.
***EPA can disapprove for up to 90 days after issuance.

Source: Compiled by authors from FIFRA.

Table 5. Comparison of Selected State Programs

	N.M.	LA.	ARK.	OKLA.	N.J.	FLA.	TX.
SECTION 24(C)							
Review process							
Internal					X		X
Committee							
ad hoc	X	X		X		X	
appointed			X				
Information required							
support letter	X	X	X	X	X		X
efficacy data	X		X	X	X	X	
Final approval							
appointed board or committee			X			X	
agriculture commissioner		X					
designated official	X			X			X
governor							
SECTION 18							
Review process							X
Internal							
Committee							
ad hoc	X			X		X	
appointed		X			X		
Information required							
support letter	X	X	X	X	X	X	X
efficacy data	X		X	X			

Table 5. Comparison of Selected State Programs (continued)

	N.M.	LA.	ARK.	OKLA.	N.J.	FLA.	TX.
Final approval							
appointed board			X				
agriculture commissioner	X	X				X	
designated official					X		X
governor				X			

Source: Telephone interviews with Tom Kaczoroski, Principal Environmental Technician, Bureau of Pesticide Con New Jersey Department of Environmental Protection, March 12, 1984; Bob Chada, Program Administrator, Pest Management Section, Plant Industry Division, Oklahoma Department of Agriculture, March 12, 1984; Raymond Hefner, Division of Feed, Fertilizers, and Pesticides, Arkansas State Plant Board, March 12, 1984; H. F. Calhoun, Director, Division of Environmental and Pest Services, Louisiana Department of Agriculture, March 12, 1984; and Lonnie Mathews, Bureau Chief, Bureau of Pesticide Management, Division of Pesticide Management, New Mexico Department of Agriculture, March 12, 1984.

2.4.1 New Mexico

The New Mexico Department of Agriculture (NMDA) has a Bureau of Pesticide Management responsible for Section 18s and 24(c)s.[80] The requests for a special local needs registration must come from a pesticide company together with all available data. Efficacy data is required by NMDA. The bureau chief reviews the request and then forwards the package to the appropriate member of an ad hoc committee of experts. The committee consists of fifteen members. Most of them are experts from New Mexico State University, cooperative extension service, or agricultural experiment station. The appointed reviewer makes a recommendation and gives a brief explanation. The chief of the pesticide management bureau again reviews the package and, if appropriate, forwards it to EPA.

New Mexico tends to be conservative regarding emergency exemptions. A comparatively large amount of data is required before a request is considered, including efficacy data, a temporary tolerance if available, and experimental results regarding the specific use for which the exemption is requested. A brand new chemical is automatically refused this type of exemption.

After this information has been submitted, the procedure is the same for the review process as in the case of section 24(c)s, except that the director of the Department of Agriculture has final approval.

2.4.2 Louisiana

In Louisiana, requests for special local needs registrations are channeled through a five-member committee appointed by the director of the Division of Environment and Pest Services of the Louisiana Department of Agriculture (LDA).[81] The committee is appointed on a case-by-case basis, but typically

includes the LDA official, an extension service representative, an expert from Louisiana State university, an agricultural consultant, and a farmer. The committee makes a recommendation to the commissioner of agriculture, but the division director's input has greater weight when the decision is not a clear-cut one.

Until two years ago, the committee had only three members. The larger committee requires more time, since committee members are scattered throughout the state, but increases the participation of other groups and the accountability of the process.

The emergency exemption process is an internal review with the input of extension and university specialists. The commissioner of agriculture has the authority to declare an emergency.

2.4.3 Arkansas

The Arkansas State Plant Board has the authority to regulate section 18 and 24(c) requests within the state.[82] The board consists of sixteen members representing agriculture; many are from the University of Arkansas. The members of the board are appointed, some by the governor.

A pesticide company submits its request for a special local needs registration to a pesticides committee of the Plant Board. The five committee members are appointed by the chairman of the Plant Board. The director of the pesticides committee forwards the request package to an appropriate reviewer. Next, the University of Arkansas staff review the proposal. Finally, the request goes before the pesticide committee for a formal recommendation. Then the full Plant Board votes; the final vote is binding.

Section 18s follow the same procedure, except the request generally comes from an extension agent or from within the Plant Board rather than from a pesticide producer.

2.4.4 Oklahoma

Oklahoma requires two sets of specific kinds of information to accompany special local needs registration requests.[83] The Oklahoma Department of Agriculture (ODA) requires the proposed label, existing federal label, efficacy data, and a letter of support. One set of data is forwarded to the pesticide coordinator at the University of Oklahoma. An ad hoc review committee of three or four is formed; based upon their recommendation, the ODA rejects or approves the request.

The procedures for section 18 requests are similar except that a formal recommendation is made to the commissioner, who must then go to the governor. The governor's office then approaches EPA with the final request. The program administrator sees problems with the final steps in this procedure, and there is currently a proposal for the governor to delegate to the commissioner of agriculture the authority to declare emergencies.[84]

2.4.5 New Jersey

In New Jersey the review process for section 18s actively involves experts and extension personnel from Rutgers University.[85] In 1978, this process was formalized to include a thirteen member review committee composed of research and extension personnel from Rutgers, appointed by the dean of the College of Agriculture. The committee reviews each request and makes a recommendation to the chief of the Bureau of Pesticide Control, New Jersey Department of Environmental Protection (NJDEP). The request is finally approved or denied by

the bureau chief. NJDEP reports excellent results with the new procedures. The department also reports a decline in the number of section 18 requests -- suggesting the new procedures have prompted increased self-screening.

No committee review is required for section 24(c) requests. NJDEP officials felt that a procedure like the section 18 procedure would be too cumbersome. Chemical companies apply to the Bureau of Pesticide Control for an SLN registration with the usual information and data. A proposal will not be considered without a letter or letters of support from experts at Rutgers, but the rest of the process is internal to the agency.

2.4.6 Florida

The Bureau of Product Data Evaluation of the Florida Department of Agriculture (FDA) is responsible for regulating section 18 and 24(c) registrations within the state. A registration committee composed of eight staff members convenes on a weekly basis to review special registration requests. The committee includes among others a toxicologist, a hydrologist, a chemist, and a permit specialist.

In the case of requests for section 24(c) registrations, the committee first decides if the SLN request meets "justification of need" criteria. Upon approval, the application package is forwarded to the University of Florida's Institute of Food and Agricultural Sciences. Experts at the university specifically test the efficacy of the product for the proposed use as required by Florida statute. The experts make a formal recommendation to the FDA registration committee. For this reason, formal letters of support are not required by FDA in the application package. The registration committee has final approval and forwards affirmative recommendations to EPA.

The section 18 review procedure is comaratively informal. The registration committee discusses the proposal and consults with University of Florida experts, but the request is not formally presented to the university staff. Consequently, letters of support from experts are an integral part of the request for emergency exemptions. No efficacy data are required for section 24(c) requests. The committee makes a recommendation to the commissioner of agriculture, who retains the authority to declare an emergency under section 18.

2.4.7 Summary

These cases illustrate the diversity of approaches to section 18 and 24(c) requests. Each of the states employs some form of committee review and relies heavily on the state university systems and extension services for expertise. Some states have taken steps to formalize this relationship, the most structured being New Jersey, where the university appoints the review committee. Even an ad hoc review team lends itself to increased accountability and expanded expertise.

2.5 PROGRAM EVALUATION AND OPTIONS

Problems with the 18 and 24(c) processes fall into four general categories. These are a lack of:

1. information;
2. sufficent expertise;
3. public input;
4. clearly defined goals.

Each category is briefly described and policy options to address the problems are then listed. Where policy options address more than one problem area they

are listed under each. A more extensive discussion is provided in the first listing.

2.5.1 Lack of Information

Lack of information to facilitate decisionmaking is the most obvious shortcoming of the Texas program. Information is needed about both individual applications and the program as a whole as a basis for better decisionmaking and evaluation. Texas could:

1. *Require yearly review of 24(c)s, based upon compilation of status reports from registrants including status of pending section 3 action.* This would greatly increase the amount of information available and would generate pressure for section 3 procedures to be followed. It would also focus attention on those cases of long duration, ideally prompting critical discussion.

2. *Require minimum exposure application techniques where health data are lacking.* This would minimize the danger to workers and encourage the development of health data by applicants. Workers in particular should be informed about possible health hazards when handling canceled or suspended pesticides applied under section 18 exemptions.

3. *Review other states' files before issuing 24(c) or 18 registrations.* By consulting with other states prior to issuance, potential "end runs" around the section 3 process can be spotted. Additional or updated information might be uncovered that was not considered or was overlooked. For example, although some states require efficacy data for section 18 requests, Texas does not. TDA could benefit from new information with minimum cost.

4. *Include previous cancellations on modified labels.* Those section 18s issued for canceled or suspended substances should have labels reflecting the concerns that prompted the cancellation or suspension.

5. *Include in routine procedures review of potential adverse health effects to exposed workers.* Before granting a special registration, TDA should examine the health consequences for any workers likely to be exposed during application. A literature search and consultation with other states would provide adequate information in most cases.

6. *Develop stricter criteria for exempting uses which have previously been suspended or canceled.* Products are suspended or canceled only after thorough review. Unless substantial new evidence regarding the risk and benefits of the product is presented, the request

could automatically be denied.

7. *Increase the number of onsite inspections of pesticides applied under special registrations.* Increased onsite inspections will both provide a better data base for judging the effectiveness of the product and call attention to problems for future applications. This option need not require additional TDA personnel. Extension personnel who already spend much of their time in the field could assist with this task.

8. *Develop a monitoring plan for section 18 and 24(c) registrations.* Such a plan would enable targeting of potential problem areas and would encourage more efficent use of inspection and lab resources.

9. *Develop special registration procedures.* Formal procedures should be prepared to improve accountability. Those requesting section 18s and 24(c)s would benefit from a more clearly articulated procedure in both cases.

10. *Require a literature search, with costs borne by registrant.* A literature search of relevant toxicological and chemical data bases would provide a greater chance of discovering relevant data than current methods. By shifting the costs to the requesting party, there would be minimal cost to the State, although the results might be more credible if the search were done by TDA.

11. *Evaluate the origin of the special local need or emergency.* It is important to clarify why the need for a special registration has arisen--has a new pest been discovered? is there a pest outbreak? is a traditional pesticide no longer effective? Some special local needs and emergencies may arise because improper use of pesticides in the past has caused increased resistance, and so forth. By monitoring these data TDA can help minimize future special registrations.

12. *Include discussions of pending 24(c)s and 18s in regular public meetings at district offices.* By stimulating discussion of processes and pending applications, TDA can both stimulate outside analysis and raise awareness among potential users of the availability of the registration options.

13. *Increase the amount of information in the final reports.* These reports can serve as a means of analysis of both the specific exemption or registration and the process itself. Comments regarding recommended changes, problems, and successes should be solicited from a variety of groups and included in the final report.

14. *Provide easier access to information about TDA's actions on special registrations, including those requested, granted, and denied.* This would encourage outside groups to undertake independent analyses of the processes and provide TDA with fresh viewpoints. A more extensive and public final report would serve this purpose.

15. *Make section 18 final reports available.* Keeping the final reports on file in the TDA library or in the district offices will better enable both users and public interest groups to assess the benefits of section 18s. Publicizing the availability of this information is also important.

16. *Issue final reports for section 24(c)s; and make these available.* Providing a formal review process after the expiration of a 24(c) would provide feedback on the success of the process in light of TDA's goals.

17. *Consult regularly with EPA and other states on procedures and results.* By increasing contacts with other states and with EPA, Texas can both influence their processes and keep abreast of current regulatory developments.[86]

2.5.2 Lack of Sufficent Expertise

With increased information comes a need for an increased level of technical skills to evaluate the information. In particular, a toxicologist and a chemist would be of value in assisting the agronomist presently employed. Access to an agricultural economist capable of evaluating the economic needs claims would also be helpful. Nevertheless, hiring a few additional staff will not solve many of the problems with the two processes. Only increased attention by EPA, which has the staff and expertise to judge the applications, will ensure the integrity of the processes. Such a resource commitment is beyond even Texas' ability to procure, and seems unlikely in the present environment in Washington. Hence little is likely to be done at the federal level and little can be done at the state level. Several of the recommendations listed here overlap those above. For example, Texas could:

1. *Develop stricter criteria for exempting uses which have been previously suspended or canceled.* As above.

2. *Include on label use instructions modified to take into account a previous cancellation.* As above.

3. *Hire technical staff to assist.* Toxicologists, agricultural economists, and others could improve the process by supporting requests with more detailed information and documentation of need.

4. *Form and confer with a Pesticide Advisory Board.* This kind of board, used in all five states whose programs we reviewed, would be able to provide a check on TDA procedures and would enable the public to have more confidence in agency decisions.

5. *Upgrade laboratory facilities.* Better laboratory facilities and equipment will provide TDA with the ability to perform more sophisticated analyses as well as increase the amount of testing.

6. *Upgrade computer equipment.* Better computer equipment will reduce the burden of clerical work and allow staff resources to be concentrated in analysis positions.

7. *Consult regularly with EPA and other states on procedures and results.* As above.

2.5.3 Lack of Public Input

Individuals and groups outside the requesting parties have no means of being kept informed on a regular basis of pending applications. Departmental decisions are also not subject to outside review. Texas could:

1. *Assist producers in getting special registrations where needed.* By assisting producers, TDA can help diversify the farm economy and increase production.

2. *Assist pesticide manufacturers in obtaining normal federal registrations.* By helping with the normal process, where warranted, TDA can help reduce the need for the special registrations and thus help prevent abuse of the system.

3. *Include discussions of pending 24(c)s and 18s in regular public meetings in district offices.* By stimulating discussion of both processes and pending applications, TDA can both stimulate outside analysis and raise awareness among potential users of the availability of the options.

4. *Increase the amount of information in the final reports.* These reports can serve as a means of analysis of both the specific exemption or registration and the process itself.

5. *Establish a mailing list of interested persons who will receive notification of section 18 and 24(c) requests.* This would provide an informal means of soliciting comments from people and organizations regularly interested in these requests. Interested press should be included, as well as individuals who to be included.

6. *Post requests for section 18s and 24(c)s in public places to provide notice (e.g., TDA district offices).* This would not only

provide notice of the request to people concerned about pesticide use, but would also allow better dissemination of information on availability of pesticide tools to potential users.

7. *Post requests on NPIRS or similar national agricultural/pesticide computer networks.* Such posting would provide rapid communication with other organizations nationwide. The instantaneous nature of the posting would be particularly useful in the case of section 18s. Comments would be received while they could still influence the decision rather than after a preliminary determination had been made.

8. *Provide a toll-free number that would, among other things, play a recording of current section 18 and 24(c) requests.* The toll-free line would allow groups and individuals outside the agency to get up-to-date information on these items. This would be a less expensive and demanding alternative to a mailing list.

9. *Establish written procedures to guide decisionmaking and publish the procedures in the Texas Register.* Written procedures will help ensure that reforms remain after Hightower leaves TDA. They also provide a means so that TDA clientele can better understand TDA actions.

10. *Provide easier access to information on TDA's section 18s and 24(c)s, those requested, granted, and denied.* This would encourage outside groups to undertake independent analyses of the processes and provide TDA with fresh viewpoints.

11. *Involve more people in rulemaking.*

12. *Make final reports available on section 18s.* As above.

13. *Issue final reports for section 24(c)s; and make these available.* As above.

2.5.4 Lack of Clearly Defined Goals

The vagueness of both sections 18 and 24(c) results in limited guidance to the state agencies and state personnel in the implementation of the programs. This vagueness in the federal statutes and regulations can be turned to TDA's advantage, since it allows TDA to define the goals of the programs. By linking both programs to specific policy goals, TDA can provide direction and make the program more accountable both within the agency and to the public. Again, several programs already suggested can serve additional purposes.

1. *Issue final reports for section 24(c)s; and make these available.*

2. *Assist producers in getting special registrations where needed.* By assisting producers, TDA can help diversify the farm economy and increase production.

3. *Assist pesticide manufacturers in obtaining normal registrations.*

4. *Evaluate the background of the special local need and emergency.*

5. *Establish written procedures to guide decisionmaking and publish the procedures in the Texas Register.* Written procedures will help ensure that reforms remain after Hightower leaves TDA. They also provide a means so that TDA clientele can better understand TDA actions.

6. *Participate in the federal hearing and regulation drafting process.* Texas, because of its size and influence, can play a major role in restructuring the federal 18 and 24(c) processes; by doing so, Texas may be able to obtain changes favorable to the type of program it wishes to see implemented.

7. *Issue 24(c)s for limited time periods rather than the full five years.* Several states issue only one-year 24(c)s and their programs seem to work quite well. One-year SLNs would decrease the potential for abuse of the process.

8. *Develop special registration procedures for 18 and 24(c).* Formal procedures should be prepared to improve accountability.

9. *Draft and issue regulations for 18 and 24(c).* Currently there are no regulations for 18; 24(c) could be expanded. Specifically implement section 74.046 by revising section 7.6.

10. *Establish a rulemaking process for pesticide regulations so 18 and 24(c) regulations can be issued.*

11. *Encourage alternative pest control technologies.* The need for special registrations can be reduced through provision of alternatives.

12. *Develop stricter criteria for exempting uses which have previously been suspended or canceled.* These stricter criteria would help prevent problems from developing with these pesticides.

13. *Limit duration of 24(c)s.* One possible scheme is as follows: pending section 3--two one-year 24(c)s allowed; no pending section 3--one year 24(c), no renewal; section 3 applied for after 24(c) granted--maximum six months extension to one year 24(c). This would reduce the temptation to use 24(c)s as a substitute for section 3 registrations.

14. *Voluntary withdrawal of inactive 24(c) registrations. Encourage or mandate. Voluntary withdrawal would clarify the real extent of use*

of the 24(c) process.

2.5.5 Analysis of Steps, Goals, and Criteria

The following two tables present the steps outlined above in a matrix format with the goals (table 6) and criteria (table 7) the group has selected to evaluate the program. A "+" indicates that the step serves the goal or is related positively to the criterion, a "0" indicates a neutral relationship, and a "-" indicates that the step works against the goal or does not meet the criterion. No attempt was made to quantify the extent to which steps met or did not meet particular goals or criteria.

Table 6: Comparison of Steps and Goals

Step									
Establish a mailing list	+	+	+	0	0	+	0	0	0
Post requests in public places	+	+	+	0	0	+	0	0	0
Post requests on NPIRS	+	+	+	0	0	+	0	0	0
Provide a toll free number	+	+	+	0	0	+	0	0	0
Provide easier access to info.	+	+	+	0	0	+	0	0	0
Establish written procedures	0	+	0	+	0	+	+	0	0
Make final reports available	+	+	+	+	0	+	0	0	+
Issue final reports for 24(c)s	+	+	+	+	+	+	0	0	+
Evaluate background of requests	0	+	0	+	0	0	0	+	+
Hold public meetings in district	+	0	+	+	+	+	0	+	+
Increase information in final rpts.	0	+	+	+	+	+	0	0	+
Participate in federal hearings and regulation drafting	0	0	0	+	+	0	0	0	0
Regularly consult with EPA/states	0	0	0	+	+	0	0	0	0
Issue 24(c)s for limited time	0	0	0	0	0	0	0	0	+
Require literature search	0	0	0	0	0	+	+	0	+
Draft and issue regulations	0	+	0	+	0	+	+	0	0
Establish rulemaking process	0	+	0	+	0	+	+	0	0
Involve more people in rulemaking	+	+	+	+	+	+	0	0	0
Develop formal procedures	0	+	0	+	0	+	+	0	0
Form Pesticide Advisory Board	0	+	+	0	+	+	0	0	0
Hire technical staff	0	0	+	+	+	+	+	+	+
Upgrade laboratories	0	0	+	+	0	0	+	+	+
Upgrade computer equipment	0	0	+	+	0	0	0	0	0
Provide more onsite inspec	0	+	+	0	0	0	+	0	+
Develop a monitoring plan	0	+	+	+	+	+	+	0	+
Assist producers with special reg.	+	0	+	+	+	0	0	+	0
Assist pesticide manufacturers with section 3 process	+	0	+	+	+	0	0	+	0
Encourage alternative technologies	0	0	+	+	0	0	0	+	+
Develop stricter criteria for uses previously suspended/canceled	0	+	0	+	0	0	0	0	+
Include modified instructions	0	0	0	+	0	0	+	0	+
Review health effects	+	+	+	+	+	+	0	0	+
Use minimum exposure technique	+	0	0	+	0	0	0	0	+
Review other states' files	0	0	0	+	+	+	0	0	+
Limit 24(c) times	0	+	0	0	0	0	+	0	+
Mandate voluntary withdrawal of inactive 24(c) registrations	0	0	0	0	0	+	0	0	0
Require yearly review of 24(c)s	0	+	0	0	0	+	+	0	+

Table 7: Comparison of Steps and Criteria

Step									
Establish a mailing list	+	0	0	0	0	+	+	0	+
Post requests in public places	+	0	0	0	0	+	+	0	+
Post requests on NPIRS	+	0	0	0	0	+	+	0	+
Provide a toll free number	+	0	0	0	0	+	+	0	+
Provide easier access to info.	+	0	0	-	0	+	+	0	+
Establish written procedures	-	+	-	+	0	+	+	0	+
Make final reports available	+	0	0	-	0	+	+	0	+
Issue final reports for 24(c)s	-	0	0	-	0	+	+	0	+
Evaluate background of requests	-	+	+	+	0	+	+	0	+
Hold public meetings in districts	+	0	+	-	+	+	+	0	+
Increase information in final rpts.	-	+	0	0	0	+	+	0	+
Participate in federal hearings and regulation drafting	-	0	+	+	+	+	0	0	+
Regularly consult with EPA/states	0	0	+	+	+	+	0	0	+
Issue 24(c)s for limited time	0	+	+	0	0	0	0	0	0
Require literature search	+	+	+	0	0	+	+	+	+
Draft and issue regulations	-	+	-	+	0	+	+	0	+
Establish rulemaking process	-	+	-	+	0	+	+	0	+
Involve more people in rulemaking	-	0	+	-	0	+	+	0	+
Develop formal procedures	-	0	-	+	0	-	+	0	-
Form Pesticide Advisory Board	-	+	+	0	0	+	+	0	+
Hire technical staff	-	+	+	+	+	+	0	+	+
Upgrade laboratories	-	+	+	+	+	+	0	+	+
Upgrade computer equipment	+	+	+	+	+	+	+	+	+
Provide more onsite inspection	-	0	+	0	0	+	+	+	+
Develop a monitoring plan	0	+	+	+	+	+	+	+	+
Assist producers with special reg.	0	0	0	0	+	+	0	0	+
Assist pesticide manufacturers with section 3 process	-	0	0	0	+	+	0	0	+
Encourage alternative technologies	-	0	+	0	+	+	0	0	+
Develop stricter criteria for uses previously suspended/canceled	0	0	0	+	0	+	+	0	+
Include modified instructions	0	0	0	0	0	+	+	+	+
Review health effects	-	+	+	+	0	+	+	0	+
Use minimum exposure techniques	0	0	0	0	0	+	0	+	+
Review other states' files	+	+	+	0	+	+	0	0	+
Limit 24(c) times	0	0	+	0	0	+	+	+	+
Mandate voluntary withdrawal of inactive 24(c) registrations	-	0	0	0	+	+	0	+	+
Require yearly review of 24(c)s	-	+	+	0	0	+	+	+	+

2.5.6 Goals

Not surprisingly, each of the steps had a positive impact on several goals and none had a negative effect on any goal. This is because the goals were sufficiently broad to include a wide range of options.[87] It is also true because the existing programs are so limited that they leave ample room for improvement in each area.

The goals fell into two categories: those met by more than half the proposals and those met by less than half. Accountability, Extending Resources, National Policy, Fair and Open Government, and Safety fall into the latter category. This suggests that the former group are the areas most in need of improvement. Or it could indicate that constituency, legislation, enforcement, and diversity are of a lower priority or are more difficult to affect. Legislation and diversifying the farm economy are probably in the latter category. Enforcement and constituency building require more commitment of resources. The lack of conflict between goals suggests that the program can be easily taken in a new direction without conflict between these goals.

The possibility of developing a committee system for reviewing section 18 and 24(c) requests was not included in the listed steps because the variations in it are too numerous to address here. One option is to formalize the relationship with Texas A&M University as New Jersey has with Rutgers University. Every state surveyed reported satisfaction with its specific committee system, sometimes in comparison with a previous arrangement. Almost any kind of committee system would disperse some of the burden of the review process among more people. Relative to specific goals, any committee system would improve accountability, extend resources, promote a fair and open

government, and, ideally, improve safety.

2.5.7 Criteria

Only three criteria had an appreciable number of negative impacts--Adaptability (4), Stability (5), and Resources (18). The negative impacts for adaptability all relate to the use of formal procedures (rulemaking, hearings) rather than the current informal procedures. The negative impacts on stability come from opening the process to more inputs, and hence introducing more sources of possible variation. Both of these sets of "negative" impacts could be given less weight if the policy goals are rated as important.

The major negative impact is in resource requirements, and it emphasizes the need for commitment of a much larger budget to the two programs--additional staff, both professional and clerical, additional equipment, and additional administrative overhead. Even those options which were given "+" or "0" ratings will require *some* resources.[88] Table 7 shows that sixteen of the steps have five or more positive ratings for the nine criteria, indicating that benefits may outweigh costs. Four programs have six positive impacts, three have seven positive marks, and one option each recieves eight and nine pluses. A logical course for TDA to follow might be to begin with the options receiving the highest number of positive marks compared to costs. In order of decreasing benefits relative to costs these steps include:

1. upgrade computer equipment;
2. develop a monitoring plan;
3. require a literature search;
4. review other states' files;
5. hold public meetings;

6. limit duration of section 24(c)s.

To have a program which meets the goals and criteria used here will cost a great deal of money. It is unlikely that Texas will be willing to commit sufficent resources to develop a program like this--and it is an open question whether it should. Many of the steps, if not all, could be implemented by EPA or required of the states by EPA, with appropriate increases in state grants, more effectively than if they were adopted singly by a few states. Adoption of these steps at the federal level would require amending either EPA regulations or FIFRA in most cases and is as unlikely as Texas' adoption or more so.

The policy question facing Texas is this: How much are we willing to spend to improve these programs, given that EPA is unlikely to undertake these reforms? Pesticide regulation is historically a low priority for TDA and section 18 and 24(c)s are a low priority within that, for many other pesticide problems are more pressing.

Hampered by legislative disinterest, or even hostility, and a low priority within TDA,[89] it is unlikely that Texas will be able to make up for EPA's deficiencies completely. Use of the section 24(c) process has increased as producers become impatient with lengthy delays in normal EPA registration procedures. If EPA were able to process normal requests efficiently and effectively in a reasonable amount of time, use of section 24(c) would drop sharply.[90] Texas would probably benefit more from joining with other states to force EPA to improve federal procedures than from putting many additional resources into improving state procedures. However, adoption of the more highly rated options presented here can go a long way toward increasing the

effectiveness of these programs in responding to local needs and at the same time protecting human health and the environment.

3. APPLICATOR CERTIFICATION

3.1 INTRODUCTION

Applicator certification is a linchpin in pesticide regulation as it has been framed by FIFRA. If the goals of certification are not achieved, then pesticide regulation may become a useless administrative exercise. Yet the certification process in Texas is very complex and somewhat confusing. There are contradictions within both the law and its interpretation. Such confusion undermines the effectiveness of certification and consequently of pesticide regulation. This chapter evaluates the Texas certification program and suggests possible alternatives which may improve its effectiveness. This evaluation is a general one, cutting across applicator categories. More specific applicator issues are considered in other chapters.

3.2 THE LEGAL AND REGULATORY FRAMEWORK OF CERTIFICATION

FIFRA requires that all applicators of pesticides classified for restricted use be certified as "competent with respect to the use and handling of the pesticide or class of pesticides covered by such individuals' certification."[91] Application of restricted-use pesticides under both federal and Texas law can legally be undertaken only by or under the supervision of certified applicators. The certification requirement is one way to fulfill partially the goal of federal and state pesticide laws -- limiting the potential adverse effects of these chemicals on humans and the environment.

Under FIFRA, the label defines legal pesticide use. Enforcing universal compliance with label guidelines, however, would be an impossible task. Instead, FIFRA requires applicator certification as a means of ensuring that labels are obeyed. Certification ultimately serves as an enforcement

mechanism for labeling. In addition, certification, like licensing, is an excluding mechanism -- one which limits the population of pesticide applicators to those legally certified as competent. Certification, then, seeks to improve compliance with label requirements by improving applicator information on pesticides and by limiting certification to those who can demonstrate competence regarding this information.

A pesticide is classified under FIFRA for restricted use if the administrator of EPA determines that the pesticide "may generally cause, without additional regulatory restrictions, unreasonable adverse effects on the environment, including injury to the applicator."[92] As noted, under Texas law a pesticide may be classified for state-limited-use if TDA determines that it needs additional restrictions to prevent it from causing unreasonable risk to the environment.

The extent to which application of pesticides in the restricted-use and state-limited-use categories is a problem is obscured by lack of data on the amount used in Texas, by whom, and in what manner. Nevertheless, analysis of the current situation identifies several potential problems, taken up in this chapter.

3.2.1 Federal Law: FIFRA

Certification of pesticide applicators is a complex process involving both federal and state laws and regulations. FIFRA requires that pesticides classified for restricted use "shall be applied for any use for which the restricted classification applies only by or under the direct supervision of a certified applicator."[93] FIFRA calls for the development of plans for applicator certification by the states, or by the administrator of EPA, in

consultation with the governor, for states in which a plan has not be approved by the administrator. The plan "shall prescribe standards for t certification of applicators of pesticides" in order to assure competency their use.[94]

FIFRA requires the establishment of "separate standards for commercial a private applicators" and forbids any provision requiring "private applicato to take any examination to establish competency in the use of pesticides."[95] private applicator is defined as one who applies pesticides witho compensation--essentially a person who applies them on his or her o property.[96]

A commercial applicator is one who uses or supervises the use of restricte use pesticides other than as provided by the previous definition. E regulations prescribe general standards for commercial applicat certification, including understanding of labels, appropriate safe precautions, and possible environmental and health effects of misuse. T federal regulations require "satisfactory completion of a written examinati and, as appropriate, performance testing" for certification as a commerci applicator.[97]

3.2.2 Texas Law and Regulation

Texas law incorporates many of the provisions of FIFRA. In addition to t federal general-use and restricted-use categories, pesticides may classified under Texas law for "state-limited-use," a category wi restrictions on applicators which at present are essentially the same as tho for restricted-use pesticides. Both federal and state laws provide for t registration of pesticides for "special local needs" and for "experiment

uses," but the certification requirements under these categories are at the discretion of the heads of TDA and EPA.[98]

Texas law retains the federal categories of private and commercial applicators and "incorporates certification requirements of commercial applicators as required by federal law."[99] However, state law defines the commercial applicator category differently than does the federal law, and adds a third category, noncommercial applicators. The commercial and noncommercial categories under state law are subdivisions of the federal commercial applicator category. Both commercial and noncommercial applicators must meet the same certification standards. Under state law, a commercial applicator is one who operates a business that applies state-limited-use or restricted-use pesticides to the land of another person for hire or compensation. As of December 1983, there were approximately 2,000 certified commercial applicators licensed by TDA,[100] combined with the 4,500 commercial applicators licensed by the Structural Pest Control Board (SPCB),[101] this gives a rough total of 6,500 commercial applicators in Texas. The noncommercial category includes all persons applying restricted-use or state-limited-use pesticides who do not come under the commercial or private categories. Generally, these applicators are employees of a government entity. As of December 1983, there were approximately 3,000 noncommercial applicators licensed in Texas, including 2,500 licensed by TDA and 479 licensed by the Texas Department of Health.[102]

State law regarding certification of private applicators is somewhat puzzling. The law provides that the application of state-limited-use and restricted-use pesticides can be legally undertaken only by persons "licensed as certified commercial or non-commercial applicators" or those "under the

direct supervision" of a certified applicator.[103] This prescription is fairly explicit, yet private applicators are defined in Texas law[104] and in FIFRA[105] as persons who "use or supervise the use of restricted-use or state-limited-use pesticides." This section further states that "a private applicator is not required to be licensed or certified to use restricted-use or state-limited-use pesticides." There seems to be some internal conflict on private applicators both within the Texas statute and between the state and federal laws. This conflict can only confuse efforts to regulate pesticide use. Ideally, this confusion should be dispelled by amending the relevant sections of the state statute to make the law internally consistent. Other options are discussed in the analysis section. The statistics indicate that there were approximately 130,000 private applicators certified by TDA as of 1983, but a more realistic estimate may be around 80,000, as the files for this category of applicators have not been purged of outdated information.[106]

A key passage in interpreting the state law on private applicators states that "a private applicator is not required to be licensed or certified to use restricted-use or state-limited-use pesticides." This passage lends itself to at least two possible interpretations, each of which places different constraints on TDA. The difference depends on where the stress is placed in the key phrase: "a private applicator is not required to be *licensed or* certified to use..." or "a private applicator is not *required* to be licensed or certified to use..." If the stress is on *licensed or certified*, this implies that private applicators could use restricted-use or state-limited-use pesticides without being licensed or certified, thereby severely restricting TDA's options. Essentially, this interpretation would allow any person who met the loose criteria of the private applicator definition to apply these

chemicals. Texas law would contain a giant codified loophole through which any private applicator could avoid certification.

An alternative interpretation is advanced by TDA. This interpretation stresses the word *required* in the aforementioned passage, implying that neither licensing nor certification can be made a *general* requirement for *all* private applicators. However, this interpretation maintains that restricted-use and state-limited-use pesticides may only be applied by certified applicators. Therefore, programs are provided to allow private applicators to undertake voluntary certification.[107] This interpretation seems more compatible with the context of the passage, which goes on to mention a "voluntary program to certify private applicators who wish to apply restricted-use pesticides in compliance with federal law."[108] Actually, the process is voluntary only in that the training program is voluntary. Certification by some means is required for all applicators of restricted-use or state-limited-use pesticides.

The State of Texas Plan for Certification of Pesticide Applicators designates the Texas Department of Agriculture as the lead agency "responsible for coordinating activities of state agencies in the regulation of pesticide use and application."[109] TDA coordinates certification, but other agencies have jurisdiction over certain applicators, with "each agency responsible for developing and enforcing their own certification program."[110] Under state law, the Texas Department of Agriculture will certify pesticide applicators involved in the following license use categories:

1. Agricultural pest control, including animal pest control (7,426)
2. Forest pest control (538)

3. Ornamental and turf pest control, except as provided by the Texas Structural Pest Control Act, as amended (3,391)
4. Seed treatments (285)
5. Right of way pest control (695)
6. Regulatory pest control (465)
7. Aquatic pest control (652)
8. Demonstraton pest control (1,373).[111]

The numbers in parentheses indicate the number of applicators licensed in each category in 1983. Because there are probably many people licensed in more than one category, double counting makes the sum of applicators for all license-use categories a meaningless figure.

Through its regulatory powers, TDA has relinquished control over categories 6 and 8, specifying that

> applicators involved in Regulatory Pest Control or Demonstration and Research Pest Control will be licensed by the regulatory agency responsible for the category or subcategory of pest control for which the license is requested. [These licenses] . . . may be issued for any category or subcategory listed in this section.[112]

This regulation effectively transfers TDA authority in any license use category to any other regulatory agency wishing to license applicators for "regulatory" or "demonstration" pest control. Regulatory pest control is a government program conducted to "suppress, contain, or eradicate pests." It is usually initiated to prevent the importation of nonnative species of pests, such as the Mediterranean fruit fly.[113] Demonstration pest control involves application of pesticides in the process of their development prior to marketing.

The Texas Department of Health certifies "commercial and noncommercial applicators involved in Public Health Pest Control which . . .encompasses . . (1) Vector Control (2) Rodent Control (3) Sanitation."[114] The Texas Structural Pest Control Board (SPCB) certifies and licenses "commercial and non-commercial applicators involved in industrial, institutional, structural, health-related pest control," according to the Texas certification plan.[115] The Texas Structural Pest Control Act requires the board to certify and license persons "engaged in the business of structural pest control."[116] The statute defines "the business of structural pest control" to cover the areas mentioned in the certification plan, but it is clear that the SPCB limits the exercise of its regulatory authority to structural pest control businesses and their employees. In addition, a person "licensed under the provisions of the Texas Structural Pest Control Act and offering services only in the license categories of structural pest control is not subject to the [additional] certification and licensing requirements of the Texas Pest Control Act."[117] Other powers of the SPCB are discussed in chapter 5.

As the lead agency for the Texas certification plan, TDA retains residual authority for administration of all certification programs. Under this plan, the SPCB may design tests for certification of applicators under its jurisdiction. All other agencies use tests designed by TDA in consultation with these agencies. However, even the SPCB tests require approval by TDA.[118] In practice, certification exams are designed by certifying agencies using study manuals designed by the Texas Agricultural Extension Service for each applicator category. These manuals are closely followed as models for the certification tests.[119]

To the extent that other state regulatory agencies exercise authority in certifying pesticide applicators, such authority has been delegated by TDA. Notwithstanding the division of regulatory powers in Texas law between TDA and SPCB, FIFRA firmly places the final responsibility for certification with TDA. A coordinating council, consisting of representatives of each of the certifying agencies, can be called together for meetings at the request of TDA in the event of conflict over certification requirements.[120] Thus far, coordination has been relatively smooth, but TDA's past may not be an accurate guide to the future. Coordination may well become more difficult should TDA attempt to impose certification requirements on other agencies. Such changes may even require TDA to submit an amended state certification plan to EPA for approval, and may also necessitate a renegotiation of TDA's interagency agreement with the Extension Service under which the study manuals are provided.

3.2.3 The Texas Certification Process

This section describes what each agency requires of an applicant before certifying him or her as competent in the use of the relevant pesticide(s). Commercial and noncommercial applicators must fulfill the same general requirements for certification in Texas, regardless of the certifying agency. Each applicant must pass both a general and a specific written exam which cover "labeling and labeling comprehension, safety, environment, pests, pesticides, equipment, application techniques, laws and regulations, and information as may be unique and necessary as related to the specific category or subcategory of applicator."[121] The same general examination is used for all applicators, regardless of the certifying agency. The specific tests are broken down by license use categories (see above), but are the same within each category or subcategory, regardless of the certifying agency. The

redesign of the aerial applicator examination may make it an exception to this generalization.[122]

Training is not a part of the official certification process for commercial and noncommercial applicators. Both private and state training programs do exist, however, and should such programs be offered as an official part of the certification process, they would have to be approved by the commissioner.[123] The major emphasis in Texas applicator training is on self-study manuals prepared by the Agricultural Extension Service. Although studies have found that such methods can be effective in educating applicators, the quality of the training obviously depends on the quality of the material presented in the manuals. Currently, training manuals are undergoing some revision, but there is no system for their routine review or update, primarily because of a lack of resources to undertake such a project.[124]

Once certified, an applicator need not be recertified unless the director of an agency's certification program determines that retesting is necessary due to "changes in technology, pesticide related problems, or the performance of individual applicators."[125] The head of the agency may require either general or individual recertification. There is currently no requirement for performance testing in order to demonstrate competence under Texas law. A passing score on the required written examination is sufficient to certify an applicant as competent to apply a state-limited-use or restricted-use pesticide in the use category for which he or she is tested.

Texas law requires more than certification before an applicator can use these pesticides. State law also requires that commercial and noncommercial

applicators be *licensed* before they use restricted-use or state-limited-use pesticides. This is primarily an economic restriction and, unlike certification, requires annual renewal. Commercial applicators must show proof of financial responsibility and must not have been "convicted of a felony involving moral turpitude in the last five years" or have "had a license issued under this subchapter revoked within the last two years."[126] This section of the statute also gives the certifying agency the authority to deny a license if "the applicant for *any other reason* cannot be expected to be able to fulfill the provisions of this subchapter" (emphasis added).[127]

Proof of financial responsibility is satisfied by filing a bond or liability insurance policy of "not less than $5,000 nor more than $100,000 for property damage insurance and . . . not less than $5,000 for bodily injury insurance."[128] The commercial license application must be accompanied by a license fee of $75. A commercial applicator license may be issued in the name of a business provided that "the business . . . have a certified applicator employed at all times."[129] Noncommercial applicators are neither required to show proof of financial responsibility nor asked about their record of felony convictions as a condition for receiving a license. Nongovernmental applicants pay an annual license fee of $50, but no fee is charged to government-employed noncommercial applicators when application of pesticides is a part of their official duties. Private applicators are officially licensed, but the only requirement for licensing is successful completion of the certification form.

3.3 ANALYSIS OF CERTIFICATION

As the previous discussion illustrates, certification of pesticide applicators in Texas is quite complex. Such complexity may be justified if necessary to achieve the goals of pesticide regulation. The current system, therefore, must be compared to alternative methods of achieving these goals to determine whether such a justification exists. This section attempts such a comparison, utilizing program criteria to evaluate the Texas applicator certification program and alternatives. The analysis is broken down into the certification process and other regulations regarding application of pesticides. Certification is further subdivided into training and testing.

3.3.1 General Information Needs

A caveat should be added here on the limitations of this analysis. Evaluation of the relative importance of applicator certification within the broader scope of the pesticide program depends on information which is not currently available. Information on the amounts and kinds of pesticides by use classification which are applied in Texas is essential to identify potential problems with certification. This information need is not unique to the evaluation of certification, but exists for other programs as well. Additional necessary information includes total numbers of *active* licenses by applicator categories and by license use categories; turnover; a breakdown of active noncommercial applicator numbers by agencies; and total number of uncertified applicators employed under the direct supervision of certified applicators. Information needed about programs includes the real pass rate for certification examinations; the number of retakes for certification exams; the total number of training programs in the state, including those not required to get TDA approval; and the number of persons utilizing these training programs. This information could then be correlated to determine

where problems may exist and to evaluate the success of programs. Without it, we have been limited to comparative evaluations of the options. The key question is: To what extent does limiting the application of pesticides to people certified as competent actually contribute to the "safe" use of pesticides? Without additional information on restricted-use and state-limited-use pesticides in Texas, the answer to this question will remain inconclusive.

3.3.2 Training

The current certification process includes both training and testing. Training of commercial and private applicators, as previously mentioned, is entirely voluntary. Although formal training sessions have at times been offered by the extension service, most commercial and private applicator training is limited to self-study of manuals available from the service. An effective training program would ensure that applicator "competence" lasts longer than the time necessary to pass the certification examination. The question here is what type of training program best realizes this goal. There are several possible alternatives.

The first possibility is to retain the present reliance on self-initiated training using self-help manuals. This alternative has the advantage of minimal additional resource requirements, and it maximizes the individual autonomy of applicators. However, a voluntary program is unlikely to be enforceable, and its effects on safe pesticide use are virtually impossible to determine. Additional adaptability and responsiveness to different viewpoints could be obtained through a periodic, routine review of the study manuals and incorporation of changes that reflect new knowledge and technology as well as suggestions from affected interests. The agency could encourage public

participation in the review process by publishing notice of the fact that it was reviewing the study manuals and soliciting public comment. This review would entail minimal additional resources.

The effectiveness of self-study training as compared to other training methods is difficult to measure. A five-state study of *private* applicator training published by EPA in 1981 found "no significant difference in terms of the number of impacts reported since training, between respondents who were trained in the self-study method versus the training session method."[130] (An impact is a change in pesticide use behavior which is attributable to the training program.) However, the study also found that when demonstrations and practical exercises were a part of training, these methods "are generally reported to be more worthwhile than the written materials."[131] In Texas these elements are absent from self-study programs.

Further evidence that self-study may not be effective comes from the pass rate for the certification examinations. The pass rate for the general commercial applicator examination given by the Structural Pest Control Board is around 50 percent. On the more difficult category tests, the pass rate runs around 25 percent.[132] The pass/fail ratio on exams administered by TDA is currently about 77/22.[133] Since there is currently no limit on the number of times the examination may be taken, it is possible for someone to become so familiar with some exams after repeated testing that he or she finally passes; thus the low pass rates are especially strong indicators of the ineffectiveness of the self-study method.

Formal training has many advantages. It is probably more effective in

imparting information, its more centralized nature gives TDA better control over what portions to emphasize, and, with updating of materials, the program could be adaptable. In order to achieve full control over the content of all programs, TDA would have to amend pesticide regulation 7.10(b), to make the criteria for administrative approval more inclusive.[134] The disadvantages of formal training are that it is expensive and requires applicators to take time out to come to the sessions. However, the investment of resources by applicators will tend to make them take better advantage of the information provided.

With required applicator training sessions and agency control over the composition of all training, TDA could move to address two particularly thorny problems: private applicator certification and the "direct supervision" loophole. Under the current system, these two areas make it difficult to measure whether any problem exists with certification as an enforcement mechanism for pesticide safety. Significant numbers of applicators of restricted-use and state-limited-use pesticides may remain unregulated under these two provisions. Training is one program through which this can be addressed.

3.3.2.1 Private Applicators

Texas law provides that TDA may establish a "voluntary program to certify private applicators."[135] This appears to be the intent of the material currently presented in the "Private Applicator Manual" self-study booklet, provided through the Extension Service. This voluntary self-study training is the only method used to "ensure" private applicator competence. One major disadvantage of this approach is that it provides a possible mechanism to circumvent the requirements for commercial and noncommercial applicators,

thereby complicating enforcement efforts. FIFRA requires states to license private applicators by completion of a form, which may require proof of competency including completion of a training program, but forbids the use of "any examination to establish competency" in such a training program.[136] This prohibition need not make private applicator training worthless. Rigorous examination might very well be made an integral part of a formal training session program, so long as no final examination is required. Completion of the program would be one of the facts to include on the license form. Again, the resource requirements of this program would be high, but gains in competence by private applicators, who constitute a major set of pesticide users, would offset these expenditures. Fees for training sessions could cover some of the costs.

3.3.2.2 Direct Supervision

The "direct supervision" provision of the federal and state pesticide laws allows the application of restricted-use and state-limited-use pesticides by non-certified individuals acting under the "direct supervision" of a certified applicator. Both laws allow that "direct supervision" does not require the actual physical presence of the certified applicator, only his or her "availability" if and when needed. FIFRA does require that the actual applicator be a "competent person."[137] Such wording provides some support for a program to assure minimal competence of all persons applying pesticides.

SPCB statistics give some indication of the numbers of people involved in the "direct supervision" allowance. There are currently 10,000 uncertified applicators under the "direct supervision" of 4,500 certified applicators in the structural pest control businesses, a ratio of more than 2:1.[138] This large number of unlicensed applicators is cause for concern.

TDA could require that all applicators, whether certified or not, be registered. This would provide at least some measure of the extent of the practice in other areas of the state. This requirement could be similar to the requirement for employee identification cards for all structural pest control businesses under regulations promulgated by SPCB.[139] Resource requirements could be offset through registration fees.

Another way to make certain that all applications of restricted-use and state-limited-use pesticides are carried out in a safe and effective manner is to require training for everyone who applies them, especially those who are not certified. One method of accomplishing this is to set up an applicator apprentice program, similar to those existing in Oregon and Florida. At a minimum such a program would require training of all persons applying restricted pesticides under the direct supervision of a certified applicator. Requirements for this training could be set forth by TDA and provided either by the Extension Service or by the certified applicators, if their training programs had TDA approval. In either case, the cost of the training requirement could be allocated to the certified applicator as a cost of business, thereby reducing the drain on TDA and Extension Service resources.

An additional component of an apprentice program would make a training period under the direct supervision of a certified applicator a prerequisite for certification. This approach would shift some of the costs of training to those who benefit from such training, and would be very effective by providing hands-on training. Apprenticeship programs are widely accepted among professionals and retain a high degree of professional autonomy. To prevent apprenticeships from becoming another means of circumventing the need for

certification, TDA could limit a person to one year as an apprentice, forbidding further application of restricted-use and state-limited-use pesticides until the certification examination is passed.

3.3.3 Certification Examinations

The second component of applicator certification is the examination, which establishes whether an individual is competent and knowledgeable in areas related to the application of restricted-use and state-limited-use pesticides. As the lead agency in the state certification plan required by FIFRA, TDA has final approval over the form and content of these examinations. This gives the agency a great deal of ultimate discretion over what kind of testing program will exist in the future. Although this is true under federal law, state law allows the SPCB to develop certification requirements of its own for applicators in the business of structural pest control. This makes TDA's position more delicate regarding review of SPCB certification examinations, but final authority is defined by federal statute.

3.3.3.1 Test Design and Procedures

Potential problems in the testing program are very similar to those identified in the training program. As with the self-study manuals, certification examinations are not required to be periodically and systematically reviewed. In fact, most exams are designed from the study manuals developed by the Extension Service, so the lack of review of these manuals affects the validity of the certification exams.[140] Although the Texas Pesticide Act mentions the need for a system which is sensitive to new developments in the pesticide application field,[141] TDA currently has no program to monitor such developments. This prevents an effective updating of certification exams. A first step to assure that certification tests

accurately measure applicator competence is to establish a program to survey changes in the science of pesticide application, including the solicitation of suggestions from interested groups or persons. As this option is almost identical to an option in the training program, the same procedure could serve both training and testing. The advantages and drawbacks of this option are the same as those described in the training section.

Two other small changes in testing procedures have the potential to improve the effectiveness of certification. First, a limit on the number of times a person may take and fail the certification examinations would help to preserve the integrity of the tests as a real measure of competence. Second, the development of several versions of certification exams for each use category would serve the same purpose. More recently developed certification exams at TDA currently have only one version. Both changes measure positively against almost all the criteria, with the most notable contribution being increases in the reliability and effectiveness of certification.

3.3.3.2 Performance Testing

The changes mentioned so far in certification testing are essentially "fine tuning" of the existing method of establishing competence through the use of written examinations. Another way to test competence is through performance testing. This method receives explicit mention in federal regulations as a method of certification which may be used "as appropriate." Also, Texas statute divides examination into two areas: 1. a demonstration of qualification to "perform functions associated with pesticide application," and 2. a demonstration of "knowledge of the use and effects" of the pesticides.[142] This statutory division suggests the legal appropriateness of performance testing as a method of certification in Texas. While written

examinations serve a necessary purpose in establishing competency, a case can be made that performance testing is also necessary as a complementary but distinct way to guarantee that certification assures safe pesticide application.

Performance testing can be designed in several ways, but it basically entails a person actually applying the pesticide in a carefully monitored demonstration.[143] Setting up performance testing would require the identification and measurement of skills critical to applicator competence in pesticide use categories. To prevent undue subjectivity in evaluating the test, carefully defined performance criteria would be needed. The value of performance testing depends on the standardization of the tests. These characteristics could make the development and maintenance of performance testing quite costly given the large number of distinct use categories in which certification occurs. Yet such a practical measure of competence may more than repay its costs if there are critical pesticide applicator skills which cannot be accurately assessed by written tests.

3.3.3.3 Recertification

One final option under the certification program is periodic recertification. If certification is necessary to ensure that persons can not become applicators unless they demonstrate competence, a recertification requirement can help ensure that applicators continue to be competent. FIFRA does not speak to time limits on certification, but Texas law allows TDA and other certifying agencies to require general recertification.[144] The goal of recertification could be met by either retraining or retesting. The advantages and disadvantages of such a requirement would in large part mirror those of original training and testing for certification, with the exception

of an increase in resource requirements. (Retraining would require more resources than would retesting.) This may be partially offset by a possible reduction in the number of charges of misapplication which must be investigated. The main advantage of a general recertification requirement is that it would help make certain that the purpose and effects of certification are continued over time. Thus, such an option should be seen as a complement of the certification program.

For the options in the certification program heretofore outlined, a general comment may be made regarding political feasibility of changes. Changes which place further restrictions on the licensing of new pesticide applicators will garner support from environmental groups, probably will be supported by currently licensed commercial applicators, and probably will be opposed by private applicators and those who seek certification. Changes which increase requirements on persons already certified will also be supported by environmentalists, but may cause all licensed applicators to join with those seeking certification in united opposition to the change. The political calculation of these subtleties is difficult.

3.3.4 Other Regulatory Strategies for Application

The previous analysis focused on alternative ways of accomplishing certification. This section considers alternative ways of structuring the application process to achieve the same goals as certification. These goals, safety and minimizing the use of pesticides, can be furthered in several ways.

3.3.4.1 General Certification

One possibility is to establish greater control over the use of all pesticides, not just those for restricted use and state-limited-use. Although this option has logical merits in furthering the goals of pesticide regulations, the resource requirements and political constraints would probably make it very difficult to implement. Nevertheless, the concept has merits. Even general-use pesticides may become deadly if used in an improper manner. There are numerous cases which demonstrate the harm which results from misapplications of general-use pesticides, often in violation of the label. Such cases may argue the need for general training in pesticide application as a prerequisite to the use of any pesticide.

3.3.4.2 Institutional Use

A more convincing case may exist for establishing greater control over all pesticides used in institutional settings. Several cases of misapplications of general-use pesticides in schools, with serious consequences narrowly avoided, illustrate that the harm of incompetence is not limited to restricted pesticides.[145] One way to address this problem is to require training and possibly certification for the use of any pesticide in an institutional setting. This could be accomplished by expanding the noncommercial applicator category to cover the general-use category of pesticides. This would require a change in the Texas statute. It is unclear whether this would require significant additional resources for administration. Institutional use is discussed in more detail in chapter 6.

3.3.4.3 Permit Requirement

Another way of designing the pesticide application process to further the same goals as certification is similar to that used under the Texas herbicide law. Under this design, each application of restricted-use or state-limited-use pesticides would require a permit by TDA for authorization. The regulatory authority for this exists under section 76.104 of the Texas Pesticide Act, which allows the agency to adopt rules prescribing the "time, place, manner, method, amount, or concentration of pesticide application."[146] This broad authority empowers TDA to set up a program to evaluate requests for pesticide application on the basis of the "economic, social, and environmental costs and benefits of the use of the pesticide."[147] Permits, when granted, could set forth requirements for application beyond the label guidelines required by EPA. The statute grants most of the authority for this type of regulation for state-limited-use pesticides,[148] but no such restrictions are currently placed on those pesticides containing the active ingredients classified as state-limited-use. TDA could make use of this provision by expanding agency evaluation of pesticide use dangers and by placing appropriate restrictions on those pesticides found to warrant them. A similar program exists in California, where permit applications are evaluated in a manner theoretically similar to environmental impact statements.[149] Although the resource requirements of this type of program would be high, the gains would be significant. There is, however, some danger that administration would be so cumbersome as to undermine the effectiveness of such a program. Political feasibility seems very low.

3.3.5 Table of Comparison

Table 8 summarizes the evaluation of options for easy reference. A simple system of pluses and minuses is used to score the options against twelve criteria and one goal. The goals of safety and minimization of pesticide use were very relevant, but were omitted in the table because all options scored positively with regard to them. Caution should be exercised on the basis of the table only, since similar values in the same criteria for different options may imply different meanings.

Table 8. Evaluation of Certification Options

OPTION	CRITERIA												GOAL
Training													
Self-study manuals	+	+	+	+	+	+	+	-	+	o	+	+	+
Formal training sessions	-	+	+	+	o	+	-	+	o	o	+	o	-
Private applicator requirement	-	+	+	+	?	+	-	+	+	+	+	?	-
Direct supervision	o	+	+	+	+	+	-	+	+	+	+	+	-
Apprenticeship	-	+	+	+	-	+	-	+	o	+	+	+	+
Certification Exams													
Test updates	-	+	+	+	+	+	+	+	+	+	+	+	o
Retake limits	+	+	+	+	+	+	o	+	o	+	+	+	o
Alternative test versions	-	+	+	+	+	+	o	+	o	+	+	-	o
Performance testing	-	+	+	+	?	+	-	+	o	+	+	o	-
Recertification	-	+	+	+	-	+	-	o	+	+	+	+	o
Other Strategies													
General certification	-	+	+	+	-	+	-	+	o	+	+	-	-
Institutional use cert.	-	+	+	+	-	+	-	+	+	+	+	-	-
Permit system	-	+	+	+	-	+	-	+	+	+	+	-	-

4. ENFORCEMENT

4.1 DESCRIPTION OF CURRENT PROCEDURE

The purpose of enforcement for any policy is to provide incentives for the fulfillment of that policy. In the case of pesticides, the policy is set out at the federal level by FIFRA and in Texas by the Texas Pesticide Control and Herbicide Acts. This policy has been to allow the use of pesticides while at the same time protecting humans and the environment from adverse effects.

The enforcement of any policy can have two levels. The first level is the basic, discrete enforcement action, such as the resolution of an individual complaint. This level acts either through negative sanctions (e.g., suspension or loss of licenses, fines, jail terms) or through positive reinforcement (e.g., subsidies, education), or both. The second level requires looking at the enforcement actions as a whole. For example, the enforcement process can be an iterative one where information on persistent problems is gathered and used to formulate more effective laws, regulations and procedures. In either case, the major tool of enforcement for pesticide regulation is the inspection, which can be used to document violators, to educate, or to obtain additional information. The Texas Department of Agriculture (TDA), in enforcing the pesticide laws, has the authority to conduct several different types of inspections. The misuse inspection process is TDA's response to complaints of alleged pesticide misuse. Other inspections -- the establishment, use, books and records, and labeling review inspections -- have the intent of ensuring compliance through spot checks and education. Each of the inspections is discussed in turn.

4.1.1 Misuse Inspections

To date, TDA's primary vehicle for pesticide enforcement has been the misuse inspection process. Table 9 notes the objectives for this process.

Table 9. Complaint Investigation Objectives

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1. To protect health and the environment;
2. To determine use consequences to health and the environment;
3. To detect patterns of use/misuse;
4. To detect those products which cannot be labeled so as to be safe for use if labeling is complied with;
5. To determine if the causative agent involved was a pesticide;
6. To determine if there has been a violation of FIFRA and, if so, to gather evidence for use in any possible legal action;
7. To gather information for use in developing informational and educational programs to prevent future episodes; and
8. To gather information for use in reviewing and amending, when necessary, labeling requirements and restrictions.

Source: TDA, "Inspector's Pesticide Inspection Guide" (Austin: TDA, September 1981).

These objectives reflect the two levels of enforcement: objectives 5 and 6 relate to the resolution of individual complaints, while the remaining objectives reflect the iterative potential of enforcement. In order to fulfill the above objectives, the misuse inspection process must include certain elements. These are knowledgeable inspectors, an adequate complaint form, and the compilation and analysis of data from each inspection. Finally, if the misuse inspection confirms a violation of the law, TDA must have the

ability to impose effective and immediate sanctions.

To those using pesticides, the most obvious element of the enforcement process is the inspector, the policeman in the process. TDA is funded for seventeen "full-time equivalent" inspector positions. These inspectors are spread about the state in twelve districts. TDA inspectors are responsible not only for the pesticide programs, but also for the enforcement of a number of other programs. Inspectors are divided into three levels by seniority, with the most senior inspectors spending more of their time enforcing the pesticide laws. Summer is the peak season for complaints, while during the off-season the inspectors collect documentary samples, examine manufacturing plants, and check labels, as required by FIFRA.[150]

As important as inspectors are to the enforcement process, TDA inspectors received no consistent, specialized training in the past. In addition, their manual, the "Inspector's Pesticide Inspection Guide," made no reference to human health issues or even crop damage. Instead, most of the guide consisted of EPA instructions for sample collection, and establishment, use, and label instructions.[151]

It must be noted, however, that the current administration at TDA is making considerable changes in inspector training. Two training conferences were held in spring 1984. These sessions included workshops on careful inspections and proper testimony, and emphasized professionalism and responsiveness. TDA's objectives for these sessions are noted in table 10. At the same time, the agency wrote a new training manual and complaint form. Also, at least one specialist (e.g., agronomist, entomologist) now works in each district, as

opposed to the former arrangement under which specialists worked out of the Austin office.

Table 10. Objectives of Training

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1. Participants will understand TDA's interpretation of the law and administrative procedures:
   A. How to pursue pesticide cases on an administrative basis in lieu of criminal/civil cases
   B. Understand penalty structure (range of remedies), and
   C. Inspector's responsibility in the process.

2. Participants will be able to inform the public of:
   A. Administrative procedures
   B. Penalty range, and
   C. Hearing process.

3. Participants will be able to:
   A. Gather facts,
   B. Conduct a legal inspection,
   C. Collect and handle evidence to identify, and
   D. Meet legal requirements, provide adequate documentation of above.

Source: TDA, "Pesticide Training Draft Agenda," February 1984 (mimeo).

Because the form used by the inspectors guides their actions, it, too, is an integral part of the enforcement process. The complaint form, which is now being replaced, was perceived within TDA as being mainly a medium for gripes; the department did not actively pursue all of the complaints.[152] The form emphasized crop damage and monetary loss. The new form, however, is much more detailed and addresses human and animal, as well as crop, pesticide exposure.

To be most effective, enforcement must move beyond level 1 to level 2, where data from every inspection are gathered to help in the formulation of policy.

Unfortunately, the information from complaints has not, in the past, been collected or used as an analytical tool for setting priorities.[153] The new complaint form may make this possible. Though inspectors will complete only relevant sections of the form, the potential exists for tracing a variety of problems through water, transportation, aerial application, and health networks. TDA also now has a microcomputer system with the capacity to present complaint data swiftly for analysis to highlight problem areas and aid policy decisions.

Until this system has been in operation for a while, long enough to collect a data base, the only compilation of complaint data is a 1982 TDA survey. Unfortunately, this survey has been severely criticized within the department for not being random or complete. According to the study, most complaints were made by farmers and residents to the TDA office in their district. The overwhelming reason for complaints, in 67 percent of the cases, was drift.[154] This violation is most frequently the result of aerial application and is discussed further in chapter 5.

4.1.2 Sanctions

After the complaint form has been filed by the inspector, the complaint is reviewed for disposition by a "complaint committee" consisting of the administrator of the Enforcement Section, the director of the Agricultural and Environment Sciences Program, and two members of the Legal Department.

The available sanctions fall into three basic categories: administrative proceedings, civil sanctions, and criminal penalties. The sanctions are not mutually exclusive. TDA may, for example, attempt to resolve a complaint administratively while at the same time initiating criminal or civil

prosecution. Furthermore, affected individuals may file tort claims for damages following violations quite apart from any actions TDA may take. These individual sanctions are not discussed further here, nor are sanctions available to TDA against pesticides which are illegally marketed.

4.1.2.1 Administrative Sanctions

The Department of Agriculture can proceed against a violator of the herbicide or pesticide law with one of four basic administrative sanctions. The choices are:

1. Issue a warning letter. This is the weakest sanction. Current guidelines call for it to be applied in response to a "first offense of a minor nature. [The] letter should carefully set out violation and steps to avoid such violation in the future."[155]

2. Attempt to suspend, modify, or revoke a license of the pesticide applicator. Change in license status is allowed when a licensee has applied a pesticide in a manner inconsistent with the label or otherwise violated EPA or TDA pesticide regulations. TDA must give the person notice of noncompliance, and may then suspend the license for ten days. To suspend the license for a longer period, or modify or revoke it, TDA must hold a hearing under the Texas Administrative Procedures Act.

3. Levy a fine against the violator. The department may defer changes in the licensing status of a violator and instead levy a fine. This option also requires an administrative hearing.

4. Attempt to settle the case with the violator prior to an administrative hearing. This involves the violator admitting the violation, waiving the right to a hearing, and paying a fine.

Of the possible sanctions, changing license status is the least used, in part because the procedures required under the Texas Administrative Procedures Act are so much more time consuming, unwieldy, and resource-intensive.[156] The department's Penalty Guidelines indicate that TDA will use license suspension/modification/revision only as a last resort.[157]

Before September 1983, the only way TDA could impose a fine against a violator was through the courts. In that month, however, a new provision for deferred license suspension became effective. This amendment provides that where the department can suspend a license, the commissioner or an agent may defer the suspension and impose a fine. TDA hearing officers -- as opposed to justices of the peace or state district court judges -- are more familiar with pesticide issues and laws, so the agency can retain more control over the pesticide regulation process.

The most important option available to TDA is its ability to settle directly with violators. An important result of the agency's new power to levy fines is its strengthened ability to bargain.[158] To begin this process, TDA invites the alleged violator to a settlement conference, which can be much less formal than either court or administrative hearing procedures. Other interested parties are also able to participate in the settlement discussion.[159] A critical part of the settlement is that the respondent admits that he or she violated the law. TDA then suggests a fine. If the violator agrees to the proposed fine, he waives the right to a hearing as well as the right to challenge TDA's action in court. If the violator and TDA do not agree, they may either continue to negotiate or TDA may apply alternative sanctions.

TDA's current internal guidelines about recommended penalties are not very specific. The range of fines contemplated by TDA begins at $50 for a "first offense, second minor offense, or more than one offense on first occasion," and goes to $500 for a repeat serious offender.[160] These guidelines do not, however, make clear what constitutes a "serious" violation. Under current TDA philosophy, apparently, part of the definition is whether the violation caused

harm, a factor discussed in more detail below.

4.1.2.2 Civil and Criminal Remedies

In addition to the administrative sanctions noted above, TDA also has the authority to seek civil penalties against violators of the pesticide (but not herbicide) law. TDA may request that the appropriate county or district attorneys or the attorney general pursue civil remedies in the justice of the peace courts. The pesticide act authorizes civil penalties of $50 to $1,000 a day for violations of the pesticide law or regulations.[161] The herbicide law does not provide for civil penalties. Now that TDA can impose fines administratively, the agency is unlikely to use this authority very often for pesticides.[162]

TDA may also request the county or district attorney or the attorney general to seek an injunction against violations of the pesticide law.[163] TDA also does not propose to use this option very often; it will use it only "where Respondent violates Code on a continuous basis and civil and criminal penalties do not bring about compliance."[164] The herbicide law does not clearly provide this power.

The pesticide law also provides for criminal penalties. The following specific offenses are defined:

1. transportation of unauthorized pesticides;
2. mishandling of pesticides, including improper disposal of pesticides;
3. improperly disclosing trade secrets; and
4. violating any other provisions of the pesticide chapter (this includes general misuse of pesticides and use inconsistent with label).

pulling sanctions from one part of the law and applying them after following procedures outlined in another part of the law. Indeed, one of the criteria for deciding to impose a heftier fine is that the violation was a more "serious" one, that is, one defined as a criminal violation.

4.1.3 Use Inspections

In addition to the misuse inspection, TDA has four other inspections: the establishment, use, books and records, and labelling review inspections. Together, these inspections will be termed "use inspections" to delineate them from misuse inspections. In conducting use inspections, inspectors visit sites where pesticides are produced, marketed, or used, usually with prior notice, in an attempt to ensure that pesticides are being produced, labeled, marketed, and used in compliance with the law. Inspectors also take this opportunity to educate the producer, marketer and user in safe pesticide use. But, if a serious violation is noted, the inspection then becomes a misuse inspection and is pursued as if there had been a complaint.

Table 11 notes the objectives of each of these inspections. Many of these objectives relate directly to the specific purpose of each inspection. For example, during a producer establishment inspection, the inspector checks for compliance with the various requirements of the pesticide regulations. If a violation is found, the inspector collects the documentary evidence necessary to support potential legal action. Some of the objectives, however, relate to the second level of enforcement. This is most apparent in the description of use inspections. In addition to ensuring compliance with label directions, these inspections are to observe use consequences to human health and the environment, to determine whether label changes are needed, to detect patterns of use/misuse, and to find products whose registration must be reevaluated.

Table 11. Objectives of Establishment, Use, Books and Records, and Labeling Review Inspections

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I. Establishment Inspections

A. Producer Establishment Inspections

1. Assure industry compliance with product registration, formulation, packaging, and labeling requirements before they are distributed in the channels of trade.

2. Collect and develop evidence to support legal actions when violations are found.

3. Determine if books and records are being maintained.

4. Determine if procedures for the disposal and storage of pesticide-related wastes are being complied with.

B. Market Place Inspections

1. Detect and obtain samples of any unregistered pesticides being marketed.

2. Determine if "restricted-use" pesticides are being sold in accordance with the act.

3. Examine advertising material, accompanying literature, and other labeling that may not have been available for examination at the producer's to determine if any false claims are being made.

4. Obtain samples of those products that were unavailable for sampling at the producer's.

5. Follow up stop-sales and recalls.

6. Obtain samples of products subject to deterioration.

II. Use Inspections

A. Protect the health and the environment.

B. Assure compliance with label directions and other use provisions of the statute.

C. Determine use consequences to human health and environment.

D. Determine whether label changes are needed.

E. Detect patterns of use/misuse.

F. Detect those products whose registration must be reevaluated because the product cannot be labeled so as to be safe for use when the label is complied with.

III. Books and Records Inspections

A. Increase the completeness and effectiveness of recalls, seizures, and stop-sale or removal orders.

B. Identify areas of potential future harm to humans and the environment for purposes of possible suspension, cancellation, or enforcement action.

C. Identify and locate violative batches and shipments of pesticides.

D. Define the scope of a selected violation and focus the direction of enforcement activities.

E. Determine if books and records are being maintained.

IV. Label and Labeling Review

A. Review labels and labeling to prevent the distribution and sale of misbranded pesticides and devices.

Source: TDA, "Inspector's Pesticide Inspection Guide."

Although the use inspections have excellent prospects for serving as an educational and data collection tool, TDA has not used these opportunities extensively in the past. Instead, these inspections have mainly been conducted in fulfillment of EPA grant requirements.

TDA is now considering the opportunities presented by these types of inspections. The current procedure is as follows: the agency first generates an annual sampling plan. This plan lists those establishments producing, selling, or applying restricted-use pesticides. Several purposes are often combined in a single visit; for instance, an inspector may check the pesticide

factory, its books and records, and its labels at the same time.

Manufacturing establishments are inspected every five years, unless they produce restricted-use pesticides, in which case they are inspected every two years. If a violation is found, the plant will be inspected the next year. The information gathered at inspections is collected at the state office and, at the very least, used in the compilation of next year's sampling plan. The inspectors are made aware of statewide problems but are encouraged to concentrate on the unique problems of their areas.[168]

Forty to fifty use inspections are undertaken annually. Although pesticides are applied year round, the fewest number of complaints are filed during the winter, and it is then that the most use inspections are conducted.

4.2 ISSUES IN PESTICIDE ENFORCEMENT

Our analysis of TDA's enforcement of pesticide policy has identified a number of important issues. We consider twelve of them.

4.2.1 Issue 1: Positive Incentives

Enforcement can operate through positive incentives, sanctions, education, or some combination of all three. TDA's enforcement of pesticide laws uses all three of these methods, but the emphasis is on education and negative sanctions. One addition to the current system that might improve its effectiveness is specific provision of positive incentives. For example, if, during a use inspection, the inspector finds that the applicator is using pesticides in compliance with the law and with all due regard to safety, the inspector could issue a "safe pesticide use" ticket worth a nominal amount. A second option is to compile the names of applicators who passed use

inspections and publicize the names in the local media. Yet another option is for TDA to provide or sponsor seminars or study courses. The incentive to take such courses, and to pass the test, would be to allow applicators to advertise their special or second level certification.

These options all have the advantages of engendering goodwill and of educating the user that TDA is serious about safe pesticide use. But they would be relatively expensive. These options may also have the advantage of providing incentives for users to learn about safe pesticide application and have the disadvantage of cost. Although education and positive incentives may diminish unintentional misuse and may persuade some intentional violators that their actions are too dangerous or counterproductive, there will always be a resistant core of violators. Thus, there will always be a need for an arsenal of negative sanctions.

4.2.2 Issue 2: Citizen Suits

Another issue in the enforcement of pesticide policy is the allocation of the burden of enforcement. At present, TDA bears most of this burden. Under many other environmental laws, however, the burdens and opportunity of ensuring compliance are shared between the relevant agency and the public by allowing citizens to bring suits against violators.

To allow citizen suits, of which there are three kinds, the agency's statute would have to be amended. The first kind, bureaucracy forcing, depends upon a provision in the law which sets maximum time limits for certain agency actions. If the agency fails to act within the time limit, a citizen, or interest group, can sue to force action. For example, section 4(f) of the Toxic Substances Control Act[169] states that, within 180 days of receipt of

test data or other information indicating that a chemical may pose significant risk of cancer, birth defects, or gene mutations in humans, EPA must decide whether regulation of the chemical is warranted to reduce the risk. If EPA fails to do so, this section provides the opportunity for bureaucracy forcing by citizens, or a group of citizens, through the courts.

A second kind of citizen suit is citizen enforcement. Under this type of provision, if, for example, an individual sees a pesticide misuse, he or she then informs TDA and the violator. If the violation is not addressed by TDA, the individual may sue as a "private attorney general" to enjoin future violations. The only relief directly available to this individual is a court injunction against the violator. If the violator repeats the violation, he or she could then be fined for contempt of court.

Private right of action is the third type of citizen suit. This type of provision would expand the private remedies available to individuals by eliminating the requirement to prove negligence as necessary under common law. An individual who has been harmed by pesticide misuse need only prove damages and violation of the statute or regulations in the suit against the violator. Our legal system now provides relief through a tort claim for those harmed by the negligent actions of others. In addition to requiring plaintiffs to demonstrate negligent conduct, common law actions require a plaintiff to prove that the defendant's conduct "probably" caused the plaintiff's harm. For all but the most easily observable acute pesticide poisonings, this causation requirement presents an insuperable barrier to recovery. Pesticide misusers therefore are not deterred from their misdeeds by the common law tort system.

The legislature could address this failure of the tort system by providing for a private right of action with "liquidated damages." If the law is amended to include liquidated damages also, there would then be an assumption in the law that any violation causes a certain minimum damage. The law would set forth a value for this damage, for example, an automatic $500 fine. This fine would be awarded by the court to the plaintiff, not to the regulatory agency. Liquidated damages would therefore provide an incentive for plaintiffs to seek redress through the legal system. At the same time they would send a message to pesticide misusers that a violation of the law is not cost-free.

The particular advantage of this option is that it relieves the plaintiff of the burden of proving harm, thereby helping to fulfill one of the major objectives of the legislation, protection of human health and the environment. However, there are also disadvantages. Bureaucracy-forcing is most applicable in speeding up regulatory decisions rather than ensuring the enforcement of those decisions. As with any legal action, citizen suits are expensive and time consuming. Moreover, amending the laws in this way may be politically infeasible, because it so clearly implies that pesticides are an extremely important problem. Giving citizens a private right of action would also decentralize authority and decrease consistency in punishment.

4.2.3 Issue 3: Inspector Identification with TDA State Office

It is not uncommon for personnel in the field to become more closely identified with "clients" in that area than with headquarters' policy. For example, USDA provides inspectors for every slaughterhouse in the country, but it has been suggested that the person who works at the site eventually owes loyalty to the plant, not to the government. TDA's most recent response to

combat the possibility of cooption has been a series of training conferences One of the objectives of the sessions was to engender a sense of esprit de corps and loyalty among the inspectors. There are also other options, some more feasible than others, to encourage loyalty and provide incentives.

First, under a "bounty system," inspectors could be remunerated with bonuses based on number of violations reported. Although this may encourage vigorous enforcement, it must certainly lead to resentment both toward and among inspectors. Furthermore, since the emphasis is on quantity, not quality, monetary incentives could encourage cycles in enforcement. For example, under such a system, the end of the reporting period is often marked by very strict enforcement. Thus, the system leads to inconsistency in enforcement. Finally, the number of complaints processed at present may depend more on the amount and type of pesticide used in each district than on the aggressiveness of the inspector. If so, this option would not improve inspector morale, or the effectiveness of enforcement.

Second, as in many government agencies (the General Accounting Office, for example), inspectors could be given temporary assignments or rotated among districts. This would help ensure loyalty to the state office, but many inspectors would surely object to moving across Texas every few years. The loyalty would be expensive in terms of other agency resources, especially the time and money spent in moving and adjustment. One of the largest, though not easily measured, expenses would be the loss of inspectors' contacts and knowledge in the area.

Finally, TDA could continue the training conferences on a routine basis.

This does use large amounts of resources, but the expenditure of administrative staff time should decline over time. Unfortunately, this may also mean that the conferences will become routinized and, therefore, less effective. Another expense that will not decline is the opportunity cost of lost time in the field for the inspectors.

4.2.4 Issue 4: Discretion of Inspectors and Enforcers

The discussion above has noted several areas in which TDA can exercise discretion in enforcing the pesticide laws. Inspectors may choose whether to note a violation, record it, and have it pursued. The agency may choose among kinds of penalties and their severity. A system that embodies a lot of agency discretion is adaptable to changing conditions, flexible, and responsive. On the other hand, such a system may lead to a loss of accountability and reliability, may be capricious, and may actually impede change if individual autonomous actors continue to behave in their accustomed ways.

Since inspectors are out in the field, they must be accorded a considerable degree of discretion. One means the agency has for limiting the discretion of inspectors is providing them with guidelines or rules that outline agency policy. Education of inspectors through workshops can assist in building identification with the agency and ensuring that discretion is exercised in accord with general agency guidelines.

Another group of people upon whom TDA must often rely for enforcement are local prosecutors and judges. Not only do they exercise a great deal of discretion, but they also often lack understanding of pesticide issues. TDA can provide them with educational materials or even a training program to ensure that local enforcers understand the goals of pesticide regulation and

to provide some uniformity across Texas in local enforcement proceedings.

4.2.5 Issue 5: Discretion in Assessing Penalties

As we have seen, TDA also has considerable discretion in assessing penalties for violations of the pesticide act. The guidelines TDA currently uses in determining appropriate penalties are quite general, including whether the violation is a first offense or a repeat offense, whether the violation is "serious" and whether harm resulted from the violation, and whether the violation was punishable as a criminal offense under section 76.201. Since most penalties are assessed through a negotiation process, one implicit limitation on the agency's discretion is the violator's estimation of the penalty that would be assessed through the formal administrative or judicial hearing. TDA cannot propose a harsher penalty than is customary in court.

We have already noted that a wide range of discretion in assessment of penalties may lessen their effect in discouraging violators. If the agency has a more formal and specific set of penalty guidelines, violators will know exactly what to expect and courts asked to review an administratively imposed fine will be disinclined to disturb the agency's decision. Specific penalty guidelines based on sensible criteria show that the agency is not acting arbitrarily. In addition to consistency, predictability, and fairness, there is another advantage to having a specific penalty policy -- the decisionmaking process is easier, more reliable, and more efficient. Instead of having to ascertain the amount of a fine in every case, the negotiators or hearing officer need only fit the particular facts into the penalty policy. On the other hand, guidelines for imposing penalties must be sufficiently flexible to allow the agency to negotiate settlements that are appropriate to specific circumstances.

The following are some criteria for assessing penalties that could be incorporated into agency guidelines:

1. Whether this is a first or repeat violation. This is a common principle of enforcement. The sanction applied for a first violation should be sufficient to deter further violations but not overly punitive.

2. The seriousness of the violation. This is also a common principle of enforcement. It is not nearly so clear a guideline as criterion 1, however, since "seriousness" may be measured by potential for damage, actual damage, or other factors.

3. Whether harm resulted from the violation. The degree of harm is an appropriate determinant of the size of the penalty in many instances. In assessing harm, the agency may want to consider the number of people actually harmed, the severity of the harm, and the potential for harm. Since TDA's purpose in enforcing the pesticide act is in large part to prevent harm from occurring, however, heavy reliance on this criterion alone might lead to a situation in which only obvious damages are punished. But, by penalizing misuses of pesticides even when no harm results, TDA may deter future misuses of pesticides.

4. What the violator saved by not obeying the law. This is a very pragmatic standard, designed to make disobeying the law unprofitable. It was first used in the 1977 amendments to the Clean Air Act, which direct EPA to penalize polluters according to a determination of the economic benefit to the corporation of not complying with the law. This criterion has the very important advantage of providing a strong deterrent to potential violators while being very flexible. However, it has the serious disadvantage that it is virtually impossible to obtain the figures necessary to determine what the violator saved. This problem is compounded by the difficulties that may often arise in determining exactly what the violator did that caused the violation and who benefited from the violation. Furthermore, in contradistinction to air pollution control devices, which are applied at one place and continue working, pesticide use violations may occur at different places and times and the costs of any one violation may be insignificant to regular users. Finally, it is important to note that many pesticide violations, including overuse or use of the wrong substance, do not save the violator money.

5. Costs of enforcing the particular violation, including whether the violator cooperates with the agency. This criterion is not related to the deterrence function of penalties, but rather helps to ensure that the costs of enforcement fall at least partly on violators rather than on taxpayers at large.

TDA is presently formulating internal guidelines that will help it determine which penalties to impose under certain circumstances.[170]

4.2.6 Issue 6: Penalties

The present system has been described earlier in this chapter. The range of remedies currently available is fairly wide and allows for flexibility and some adaptability. There are checks and balances available within the system for the accused and the complainant; if there is harm, the complainant can always resort to civil remedies.

The use of administrative sanctions is usually less resource-intensive and more predictable then the attempted imposition of civil and/or criminal penalties where the agency must rely on the actions of outside agents, such as district attorneys and judges. However, TDA's power to impose administrative sanctions flows directly from its licensing power. If a violator is not licensed and is not operating under the supervision of a licensed individual, TDA cannot use administrative remedies.

There are several alternatives to the current system of administrative penalties. The law could be amended to require the licensing of companies, rather than individuals. Unfortunately, individuals may not fear sanctions if the company pays for violations. This has long been a problem in environmental and health and safety legislation. The solution has been to apply civil or administrative sanctions to the company and criminal penalties to the guilty individual. Alternatively, as suggested in chapter 3, the law could be amended to require the licensing of all applicators. This expansion of licensing responsibility on the part of TDA might be very resource-intensive. Finally, the law could be amended to grant TDA the authority to

impose administrative sanctions for all violations. Problems also exist with the currently available administrative sanctions, however, not just with the system.

The first, least severe, penalty is the warning letter. A letter alone may not discourage misbehavior; this sanction may be more effective if TDA publicizes the letters.

The second administrative penalty available to TDA is settlement in lieu of license suspension. Although it has the advantage of giving TDA close control over the outcome, one disadvantage is that the negotiations do not involve other affected parties. Since the negotiation is informal, however, it would be possible for other government agencies, neighbors, and relevant interest groups to participate to some extent in the settlement process.

This practice would greatly serve to promote the goals of public participation and awareness of TDA activities. It may be very useful, too, in designing a settlement that goes beyond mere levying of fines, to bring a wide variety of perspectives and kinds of expertise to the discussion table. Such a program always creates difficulties in determining who should participate. Once some affected people are allowed in, there may be difficulties deciding who else can be there. TDA may want to make the decision -- but if the alleged violator does not like the process or the use involved, he or she does not have to settle. In general, the more people participating in the talks and the more public the settlement process is, the more likely some respondents will be to withdraw from the discussion. Often the most effective negotiation takes place between small groups of people. Secrecy is often a

condition of negotiations. In fact, the ability to keep the whole case quiet is often one of the major incentives to compromise before a hearing or trial. Nondisclosure of the terms of a settlement is often itself a crucial point.

4.2.7 Issue 7: Misuse without Harm

A difficult issue arises during any type of inspection when an inspector sees a misuse of a pesticide, but no apparent harm or damage has occurred. Since the use of chemicals may pose long-term, chronic threats to health and to the environment, it is inevitable that many violations of the law will not result in immediately identifiable damage.

TDA's policy is not to attempt to prosecute these violations. If the violation is relatively serious, although not yielding identifiable harm, TDA may issue a warning or attempt to negotiate a settlement. But the department does not wish to pursue these violations aggressively. Although this decision conserves departmental resources and picks those cases which the judicial system handles best, there are numerous disadvantages to not enforcing the law strictly.

Departmental action serves as a potent public education tool and, of course, as a deterrent. Unless violations are prosecuted, many people may not take the law seriously. Prosecution of these cases may educate the public that the policy is that any misuse of a pesticide is potentially dangerous and, therefore, illegal.

As noted in the discussion of issue 9, many witnesses to violations may be unwilling to complain. If TDA were more aggressive in prosecuting violations of the law per se, the burden would not fall so heavily on the complainants.

Another advantage to enforcing the law, whether or not damage to crops or to human health can be documented for each violation, is that the law also exists to protect the environment, damage to which is also frequently undetectable immediately after the misuse.

Before TDA can prosecute these types of violations, however, regulations must be changed. The pesticide regulation dealing with complaints (7.20), part b(1) states: "a preliminary report may be given to the parties directly involved in the incident. In cases where no apparent adverse effects can be documented, the agency will give the information to the complaining party and cease the investigation." If TDA revises this rule to allow further investigation and prosecution where appropriate, it will obtain an additional degree of control over enforcement.

4.2.8 Issue 8: Legal Use with Harm

As noted, one function of investigations is to provide information about gaps in the laws. Unfortunately, TDA has unnecessarily diminished the impact of its enforcement activities by cutting short investigations when it determines that no violation of the law has taken place. For example, someone made a complaint on November 4, 1980, claiming that he or she became sick after working in the field. The inspector's report noted that there was no violation "because no re-entry time exists for Lannate." No action was taken on the complaint. The investigation could have gone further to note the time between application and entry, if the worker knew of the application, and if any other workers were affected.

It is at least theoretically possible that after further investigation TDA could have recommended corrective action -- even though no legal violation

actually occurred. The applicators or growers might voluntarily agree to su that a reasonable amount of time passed between application of Lannate and worker reentry.

In short, TDA could compile data on the complaints which cannot be acted upon because no violation occurred. This information can be used to determine, and remedy, gaps in the law. A system for gathering information on complaints by type of pesticide and by effects would provide material to share with EPA, health care providers, and the legislature. The disadvantage of this course is that the kind of detailed investigation necessary to prosecute a complaint (photographs, documenting residues, documenting health effects) is costly. If TDA is going to find a gap in the law and ask the legislature to address that gap, however, it will need proof that a problem exists.

4.2.9 Issue 9: Reluctance to Complain

Of all possible complainants, those who are most likely to be harmed -- farmworkers and neighbors -- may also be the least likely to complain. Farmworkers are particularly vulnerable; they are poorly paid, and many are not full-time or permanent workers. If they are labeled as troublemakers, they will not be hired each day. Many, if not most, farmworkers speak no English. Undocumented workers may not want to get involved with official government agencies. They certainly do not have time or funds to spend on pursuing legal matters. Neighbors may not want to complain about others' misuses of pesticides if these do not result in severe or immediate danger. The long run risks may be less important to a neighbor than the desire to keep peaceful and cooperative relations.

TDA's recently instituted policy addressing this issue allows anonymous

complaints. TDA could go further, however, and encourage farmworker advocates such as Rural Legal Aid or the Farmworkers' Union to act as intermediaries. Another option is to amend the pesticide and herbicide laws to include a nonretaliation clause similar to title 7 of the Civil Rights Act of 1966. Since many farmworkers are "day workers," however, retaliatory "not-hiring" would be very difficult to prove. In the case of neighbor complaints, TDA could instruct inspectors to approach these cases with the attitude that the adversarial relationship is with TDA, not with the initial complainant.

4.2.10 Issue 10: Awareness of Use

Under the herbicide law, applicators must post a notice of intent to spray, but no equivalent clause exists in the pesticide law. The accountability of TDA and pesticide applicators might be better secured, however, by public awareness of all pesticide use. This could be accomplished through posting or notices in the local media. (See chapter 8 for a more in-depth discussion of posting.)

4.2.11 Issue 11: Public Awareness of, and Participation in, TDA

At this time TDA can only be sure that those who must have regular contact with the agency, such as pesticide manufacturers, distributors, marketers, and applicators, are aware of TDA's pesticide regulation function. These groups also participate in decisionmaking, through lobbying and notice and comment on rules, as allowed by law, because they have a direct, immediate economic interest in TDA's activities. A major premise in our political system is that there should be openness and equal access in our government. TDA can help ensure this through public awareness programs. Currently, TDA has several activities that are intended to inform the public and public interest groups. These include cooperation with the agriculture extension service in education,

a weekly radio show, and, recently, cooperation with farmworker advocates.

In addition to these efforts, TDA should first conduct a scientific poll to ascertain if its current attempts are effective. A direct route for public participation would be a toll-free 800 telephone number which would allow people to ask questions about pesticides or to initiate a complaint. Resources necessary would be a fee for acquiring the 800 number, staff to answer incoming calls, and publicity to promote awareness of the service.

Another means for participation for a smaller number of people is an advisory committee. Members chosen from concerned groups -- private and industry -- could discuss current problems and offer alternatives for TDA's consideration. Committee representation of a wide range of ideas would enhance community awareness and understanding. This option provides access and education for a very small number of people.

Another option is to provide inspectors with pamphlets, explaining TDA's role in enforcement of the pesticide law, a brief explanation of the law, what to expect in the complaint process, and whom to contact for answers to questions or for an update on particular complaints. Inspectors could then distribute the pamphlets to complainants and other interested parties. Finally, TDA could conduct a public information campaign on the safe use of pesticides. This should conclude with a list of those to contact for further information. Yet another option for public participation is openness in the settlement process as discussed in issue 6.

Of course, all these options will have some resource cost. But all could

help ensure access and accountability. They may also aid in effectiveness of enforcement of the pesticide law.

4.2.12 Issue 12: Herbicide Law

We noted that the purpose of the herbicide law is to allow local authorities in counties with significant cash crops to ensure that those crops are not damaged by the misapplication of herbicides. It thus overlaps the pesticide act in its coverage but gives counties -- rather than the State -- power to regulate affected substances. It is the conflicting requirements and fragmented authority created by the herbicide act that make it a unique element in Texas pesticide regulation.

First, because the law regulates the use of herbicides which are also regulated by the pesticide law, the two laws may impose duplicative or even contradictory regulations on the use of the same chemical.

Second, since only county commissioners can decide whether the act will be in effect, there is no means of ensuring consistency in the state. Moreover, the counties covered by the herbicide law may appoint their own "herbicide inspectors."[171] Although the county herbicide inspector is to cooperate with and work under TDA in enforcing the law, TDA lacks the critical power to hire and fire. The law further specifies that "a county herbicide inspector has the powers of an employee of the department." Thus, TDA's ability to administer a consistent and coherent pesticide regulation program is undermined in counties where the herbicide law is effective to the extent that inspectors are not even directly under the agency's control.

Another difference between the pesticide and the herbicide laws lies in the

nature of the sanctions available. TDA may use administrative, civil, or criminal sanctions in enforcing the pesticide act. To penalize a violation of the herbicide law which is not also a violation of the pesticide law, however, TDA probably must seek a criminal conviction. This means that the agency is dependent upon the local district attorney to help prosecute a suit; under the pesticide act, the agency may seek assistance either from district attorneys or from the attorney general. District attorneys may be less familiar with pesticide law than attorneys in the state offices, and they may tend to side with their neighbors against TDA. Standards of proof are also more stringent in criminal cases.

A final difference between the two laws lies in the additional protections which the herbicide law provides. One of these is advance notice of spraying. Another is the provision for buffer zones; these are discussed in chapter 8. The former provision ensures that neighbors are apprised of spraying, while the latter is intended to ensure that herbicides are kept a safe distance from areas that might suffer unintended damage. Both kinds of protections are equally appropriate for all pesticides, and these clauses should be inserted into the pesticide act whether or not the special herbicide provisions are retained.

In chapter 1 we saw that one of the most important goals of a state pesticide program is to ensure that local conditions are taken into account. The Texas herbicide act might be interpreted as fulfilling that goal, by decentralizing decisionmaking even below the state level. The rationale for allowing local officials to regulate certain herbicides and not other pesticides does not seem to be based on a clear distinction between the two

kinds of substances, however. At the same time, our discussion suggests that the resulting program fails to meet other important administrative goals, including consistency and reliability. Furthermore, the herbicide act is designed solely to protect crops; it is not germane to other important goals of a general pesticide policy such as health of users and consumers or protection of the environment.[172] On balance, the disadvantages of a separate herbicide act seem to outweigh the advantages.

In light of this discussion, there would seem to be several policy options for TDA. Retaining the two laws in their present forms has the disadvantages noted. To overcome some of these disadvantages, at the same time retaining the benefits of closer local control, TDA could undertake a program of educating local communities, county commissioners' courts, and local prosecutors and judges, so that these groups will understand the need for effective enforcement of the herbicide law and cooperate with the agency in prosecuting violators. For example, county commissioners' courts and the public could be brought together in public meetings. TDA could also encourage exchange of information among affected counties. Such an educational effort is relatively low in cost and might have high returns in the form of increased enforcement. It would not, however, overcome the limitations of the herbicide act itself, especially its lack of concern for environmental and human health effects of herbicide use.

TDA could address these limitations of the herbicide act by promulgating additional regulations. For example, most applicators of herbicides must obtain permits from TDA; the agency could impose strong conditions on permits. However, since protection of human health or the environment is not a goal of

the herbicide law, it may be too time consuming and politically risky to attempt to manipulate the statute for these ends. It may be easier and more productive to attempt either to amend the herbicide law to address health and environmental issues or to amend the pesticide law to incorporate some of these desirable aspects of the herbicide law.

Another option is thus to seek legislative action combining the pesticide and herbicide laws into a single statute. This would reduce overlapping and conflicting rules and would therefore be more efficient, consistent, and fair. The entire state would be covered by the law, and herbicide abuse anywhere in Texas could be addressed by TDA. The agency would have a greater range of sanctions at its disposal for dealing with herbicide misuse. The single statute could more clearly be used to protect human health and the environment. Some of the unique aspects of the herbicide law -- such as requirements for advance notice of spraying, the ability of county commissioners temporarily to suspend the use of a chemical if necessary, and the authority to require buffer zones similar to those now specified in the herbicide regulations -- might be included in the unified law.

One risk of collapsing the herbicide and pesticide laws into a single statute is that these unique aspects of the herbicide law might get lost in the merger. An especially important issue is how to treat local discretion, which is an important feature of the herbicide law. Perhaps this element of the herbicide law could be incorporated in a unified law, retaining in county officials the power to appoint additional inspectors, to oversee advance notice of spraying, and generally to respond to special local conditions.

Alternatively, Texas could retain two separate statutes, but make changes in the herbicide law to address the problems identified earlier. The disadvantage of this approach is that there would still be two laws with overlapping jurisdictions and separate enforcement schemes. The advantage is that this change might be more politically feasible.

A combination of these options might provide TDA and Texas with the most unified pesticide regulatory mechanism. Under such a program, TDA would:

1. Work with local prosecutors to educate them about the herbicide law (no new regulations or legislation required).
2. Promulgate regulations specifying grounds for permit refusal and revocation, procedure for revocation, and appeal.
3. Promulgate regulation(s) defining "constructive refusal" of the district or county attorney to prosecute herbicide violation.
4. Seek legislative amendments to the herbicide law or seek to collapse the herbicide and pesticide laws into a single statute providing for statewide effectiveness, protection of human health and the environment, consistent sanctions against misusers of herbicides as well as pesticides, and the use of buffer zones and preuse notification of spraying.

5. AERIAL APPLICATION OF PESTICIDES IN TEXAS

5.1 THE PROBLEM OF DRIFT

Aerial application is a widely used method of dispensing pesticides in Texas. Not only is it useful for the numerous large farms within the state, but it is also important for maintaining pest control in situations where ground spraying is impossible (rice fields) or impractical (forests).

Unfortunately, while aerial application may be an efficient means of applying pesticides in many cases, it is also associated with several serious problems -- most notably drift. When pesticides are released from airplanes there is almost always be some drift. "Target drift" describes a situation in which pesticide formulations move beyond the exact spot where they were released, yet remain on the field being treated. Target drift in itself is not a problem. "Nontarget drift" may be defined as the movement of spray droplets or dust away from the spray site before depositing. Nontarget drift may land on the next field or on a community many miles away. It can land on farmworkers, livestock, in reservoirs, or in waterways. The unintended deposits can harm crops, make farmworkers or livestock sick, and pollute water supplies. In Texas it is a substantial problem. In fiscal year 1983, 429 pesticide-related complaints were registered with the Texas Department of Agriculture. Approximately 40 percent of these complaints were drift-related.[173] This suggests that minimizing nontarget drift should be a goal of pesticide regulation in Texas.

5.1.1 Factors Associated with Drift

Variables associated with pesticide drift can be categorized as pilot-related, product-related, equipment-related, and weather-related. With the exception of pilot-related drift, these variables influence drift primarily by their effects on droplet or particle size, which is negatively correlated with drift potential.

5.1.1.1 Pilot-Related Drift

It is possible for the pilot to conduct operations in such a way as to minimize drift. In rectangular fields the pilot should fly back and forth across the field in lines parallel to the long side of the rectangle in order to minimize the number of turns that need to be made. The pilot should start treatment on the downwind side of the field to avoid flying through pesticide spray. On the turnaround the pilot should shut off the dispersal equipment and pull out of the field before beginning a turn. The turns should be completed in time to permit necessary course corrections before dropping back down into the field.[174]

The swaths the pilot will be flying can be marked with flags set above crop height, or flagpeople can help the pilot line up on the field. Automatic flagmen in the form of weighted streamers attached to the plane and released by the pilot can also be used.[175]

Ag (agricultural) pilots should handle obstructions such as trees, powerlines, and buildings at either end of the field by turning on their dispersal equipment late or by turning it off early.[176] When the field is completed the pilot should fly a swath crosswise to other swaths and parallel to the obstruction to complete the work. Obstructions within the field should

be treated in the same way. Areas next to buildings, livestock, nontarge crops, and waterways should be treated carefully.[177] Precautions include flying parallel to the sensitive area, leaving a border of untreated crops (buffer zones), and avoiding turns over sensitive areas.

Some pilot-related factors that may cause off-target drift are a result of either carelessness or ignorance. Pilots may not have complete knowledge of the land and the boundaries between farms. Unless the pilot surveys the area, drift may result. In some cases pilots may also be careless about reading pesticide labels or following the directions on the labels.

Pilot-related pesticide drift may also occur because of the interdependence of applicators and farmers. A farmer worried about profits (and thus crop yields) may pressure an applicator to apply a pesticide right up to the edge of the field.[178] No pilot can be as accurate in spray deposition as a boundary line between properties.

5.1.1.2 Product-Related Drift

Product-related drift is due to the physical properties of the pesticide itself or of an additive. Primary considerations in this case are volatility and viscosity. The more dense a pesticide or additive is, the heavier the droplets are and the faster they fall to the ground, minimizing drift potential. Several thickeners are commercially available to increase the viscosity of spray mixtures. Texas Agricultural Extension Service applicator manuals state that thickeners should be added by the applicator and their effects on flow rates should be determined during calibration of the dispersal equipment.[179]

Volatility, or the potential to evaporate, also influences drift potential. Products are commonly characterized as high-volatile esters, low-volatile esters, and nonvolatile esters. The most vaporization occurs in the high-volatile ester category, although it should be noted that even nonvolatile ester compounds will vaporize on hot days.[180] Once a compound vaporizes, it can be carried miles from the target site by light breezes. Because there are no data available about the types and quantities of pesticides used in aerial operations, it is impossible to know what percentages of pesticides used fall into each of the three categories. Therefore, it is not possible to estimate the magnitude of this problem.

5.1.1.3 Equipment-Related Drift

Equipment for dispensing pesticides is very complex, including:

1. Tank -- to hold pesticide to be applied. Should be leakproof and corrosion-resistant with a mechanism for unloading its contents in an emergency.
2. Agitation System -- to keep dry materials from clumping and liquids properly mixed.
3. Pump -- to deliver mixtures at desired flow rates (pressures).
4. Nozzles -- to dispense the pesticide. They come in various sizes. Nozzle size is important in achieving proper calibration of the dispersal equipment.
5. Boom -- to support and supply nozzles. It is located to the rear of the wing.[181]

Equipment systems may affect dry formulations by breaking up the particles into smaller sizes as they move through the dispersal system. Smaller particles may also be produced by improper handling and storage. It is on the droplet size of liquid formulations however, that application equipment has the greatest effect. The size of the nozzles used, the angle of the nozzles,

spray pressure, and airspeed all influence droplet size.[182] While spray fro any nozzle consists of a spectrum of droplet sizes, certain factors influence the number of droplets at the large or small end of the spectrum. The percentage of smaller-sized particles generally decreases as the size of the nozzle opening increases. Slower airspeeds and lower pressures also reduce the percentage of small droplets released. Nozzle position on the boom is another equipment-related factor that influences droplet size. Because equipment is so complex and maintenance so difficult, it frequently does not operate as designed. Equipment problems are perhaps the most common source of drift.

5.1.1.4 Weather-Related Drift

Weather-related elements including horizontal and vertical air movements, air temperature, and relative humidity in the immediate application area all affect drift. While much is known about the extent of each individual factor's affect on drift, it has been much more difficult to make accurate predictions about pesticide movement under uncontrolled conditions where the interrelationships among various weather factors and between weather and equipment factors come into play.[183]

The weather factor most commonly associated with drift is horizontal wind speed. However, estimating drift is not a simple function of knowing wind speed. Wind speed, and thus drift, will increase with height because objects on the ground (particularly crops) have the effect of slowing down wind speed in the affected area. The effects of horizontal wind speed also depend on the type of ground surface in the area -- not just terrain but crops as well. For instance, when studying air movements over two fields, researchers found fairly regular increases in wind speed (with height) in a wheat field, but in

a beet field there was substantial turbulence.[184]

Generally, the further above the crop the pesticide is released, the higher the horizontal wind speed it is subjected to. Horizontal wind speed is also likely to follow daily and yearly cyclical patterns.[185] This makes it very difficult to calculate proper application rates.

5.2 FAA AND TDA REGULATION

5.2.1 Federal Aviation Administration Regulation

Both FAA and TDA regulate aerial applicators in Texas. The FAA sets standards for its own certification process, operating rules, and record keeping.[186] FAA licensing consists of three parts: 1. a private or commercial pilot's license, 2. an agricultural flight test (flying skills specific to the application of pesticides), and 3. a pesticide knowledge test which is supposed to cover steps to be taken before starting an agricultural spraying operation, including a survey of the area to be worked, safe handling and disposal of pesticides, precautions to be observed in handling and application of pesticides, and so forth.[187] FAA is also responsible for certifying that the plane is equipped for agricultural operations. FAA licenses are good until surrendered, suspended, or revoked.[188]

FAA does not provide any training for applicators, who must obtain the necessary information privately. Furthermore, in Texas FAA does not administer a knowledge test.[189] The FAA written exam does test some pesticide use knowledge, but the agency relies on TDA's certification tests to ensure that pilots meet their standards. This reliance by FAA on TDA has the potential for causing problems. FAA tests only the pilot of the planem while

TDA's certification exam is required only for the person who is to be "th applicator." It is possible for these to be different people; indeed, the certified applicator need not even accompany the pilot during spraying operations. While there are no data to show whether this has been a factor in the number of complaints made to TDA against aerial applicators, there is certainly the potential for trouble.

FAA operating rules cover safety precautions such as flight procedures near congested areas, the wearing of safety belts, and posting (by newspaper, leaflets, TV, or radio) when pesticides are to be sprayed in congested areas. They also prohibit the misuse of pesticides.[190] FAA requires that applicators keep accounts for twelve months and include the name and address of each person for whom services were provided, the date of the operation and the name and quantity of the pesticide dispensed.[191] While FAA has jurisdiction in all areas of agricultural aviation, in practice local regional offices limit themselves to flight-related matters and leave the rest for TDA to handle. This division of responsibilities eliminates the possibility of conflicts between TDA and FAA regulations and allows for regulatory efficiency, because each agency can specialize. However, the division does not appear to be useful in obtaining maximum safety in the use of pesticides. FAA operating procedures include many safety precautions (posting in congested areas, prespray land surveys, etc.) which are not required by TDA. Because local FAA offices do not enforce these aspects of the regulations, aerial applicators may easily ignore them. To overcome this problem, TDA would have to adopt these operating procedures in its own laws and regulations and then enforce them, or FAA would have to change its practices.

5.2.2 Texas Department of Agriculture Regulation

TDA's jurisdiction over aerial applicators arises from its responsibility for commercial applicator certification and for enforcing restrictions on pesticide use. TDA requires that aerial applicators seeking to be certified must take a minimum of three exams from TDA. Instruction for these exams is obtained by independent study of materials available from the Texas Agricultural Extension Service. These materials include a general commercial applicator manual which contains a section on aerial application, a manual specifically about aerial application, and a slide set.

The first exam that potential applicators must pass is the general one that tests ability to comprehend and follow label instructions. The general exam also includes a section that prospective aerial applicators must answer, with questions relating specifically to aerial application. This section covers nozzle positioning, calibration, safe flight patterns, use of flagpeople, vaporization, and so forth.

TDA also requires that all new applicators take the aerial recertification exam, which was introduced in 1981 for the purpose of educating all aerial applicators on new application technologies and research discoveries. The primary reason for introducing the exam was that for a few years prior to 1981 the majority of complaints received by TDA were against aerial applicators.[192] Many of these complaints involved 2,4,5-T and 2,4-D, whose effects are highly visible and whose physical properties are such that they have a greater drift potential relative to other pesticides. Concern was also registered by agricultural insurance companies, which were having to pay out more money in claims as a result of the increased number of complaints.[193]

TDA evaluated the data and determined that a sufficient amount of new information was available to require a recertification exam under subchapter E, section 76.113(c), of the Texas Pesticide Laws and Regulations, which states: "A licensee must undertake training, submit to retesting, or both before renewal of a license if the head of the agency determines that additional knowledge is required in the license use categories or subcategories in which the licensee applies for renewal." Examinees must answer 70 out of 100 questions on the exam correctly to pass.[194] TDA is in the process of consolidating the general and recertification exams to minimize the number of tests that aerial applicators have to take.

Applicators must pass at least one more exam that is directly related to the type of spraying that they will be doing. There are tests for field crop pest control, forest pest control, aquatic pest control, and others. All the tests are given at TDA district offices.

It is not yet possible to evaluate the success of the recertification exam in minimizing complaints against aerial applicators. However, the exam can be evaluated with respect to certain goals and criteria. The purpose of the exam is to reeducate aerial applicators about methods of application that can reduce drift and increase the safety of both people and the environment. In minimizing drift (and ensuring that more pesticide lands on the target) this program should lead to better control of pests on crops or other target areas.

The resource requirements of the recertification exam are not substantial. All of the personnel and other resources are already in place. The only real costs associated with this program are those involved in evaluating new

material and deciding if it does contain information that should be passed on to ag pilots and rewriting the general and recertification exams. At the same time, the recertification program greatly increases TDA's adaptability to changing conditions and technologies by allowing it to pass on useful information to those who can use it best. When TDA passes on information through the recertification process (as opposed to a newsletter) it is in effect stressing the importance of that information and guaranteeing that it will be read and learned so the applicator can pass the exam.

The recertification exam thus rests on the assumption that good information will increase the sound application of pesticides. Recertification is a good tool for ensuring the continuing education of aerial applicators; however, it should only be used when significant new advances are made in the field of aerial application of pesticides. Less significant advances should be communicated by other means. TDA does not take an active role in providing such information to aerial applicators, however, leaving that function to the Extension Service pursuant to an interagency agreement. TDA has limited its role to notifying applicators of changes in certification requirements. Those applicators who are members of the Texas Agricultural Aviation Association (TAAA) receive information from the association regarding research developments, safety tips, and new EPA or TDA regulations. However, out of approximately 700 aerial applicators in Texas only about half belong to TAAA.[195] Since TDA has the names of all licensed aerial applicators, it could provide them with additional information about new developments.

5.2.3 Enforcement and Penalties

Both the enforcement procedures followed by TDA and the penalties they assess are the same for aerial and general commercial applicators, and these are treated in chapter 3. FAA employs two types of inspectors for enforcing agency regulations. Maintenance inspectors are responsible for enforcing FAA regulations for planes, and operations inspectors enforce safe flight procedures for pilots.[196] Regional FAA offices do not employ the chemical or toxocological experts necessary to carry out or verify a pesticide misuse complaint. FAA investigations are mostly in response to complaints of low flying, noise, flying over congested areas, and so forth.[197] When a complaint involving pesticide misuse is made, it is turned over to TDA for investigation. Data on the exact number of complaints made to FAA regional offices in the state were not available.

FAA imposes several penalties, including temporary suspension of the pilot's license, permanent revocation of the license, and fines of up to $1,000. In assessing a penalty the FAA considers the pilot's previous record and the nature and seriousness of the complaint.[198] Apparently, regional FAA offices prefer not to revoke a pilot's license permanently, because they feel that it takes away the person's livelihood.[199] FAA penalties are usually the result of a process of negotiation between the pilot and the local FAA office. If no agreement is reached as to a proper penalty for the violation involved, the two parties go to court to settle the matter. Again, data were unavailable on the number or nature of penalties assessed in any given year.

FAA's resources are devoted to making sure that pilots are safe and that they fly safely. To the extent that the FAA acheives this goal, the agency is

serving the public interest. However, as noted, it is left up to TDA to enforce all rules that control pesticides; it cannot enforce FAA's pesticide regulations. If that agency would enforce all its rules, safer use of pesticides would be the result.

5.3 POLICY OPTIONS FOR REGULATING AERIAL APPLICATORS

Policy options for reducing off-target chemical drift resulting from aerial application of pesticides can be evaluated under the categories of education, certification, and enforcement. In fact, there is a logical connection among these categories. Education provides new and better knowledge; certification insures that knowledge is learned (so the applicant can pass the test); and enforcement provides incentives for implementing that information. Options presented all center on the pilot, because of all the factors causing drift, the pilot is the only one over which TDA has some control. It is impossible for this report to show that one category of options is substantially better than the others because it is impossible to know how much drift results from pilot ignorance, pilot forgetfulness, or pilot carelessness. Until this can be determined (if it can) TDA should consider pursuing options under all three categories.

5.3.1 Education

The assumption underlying education is that better-educated pilots are less likely to make the mistakes that lead to off-target drift. Pilots who understand exactly how each factor affects drift potential are better able to make compensating adjustments.

5.3.1.1 Private Sector Education Programs

Private sector operations to educate ag pilots are already in place in Texas. One possible option would be for TDA to encourage an expansion of these programs. Among the various pesticide manufacturers marketing products in Texas, Monsanto, Dow, and Nalco are leaders in educating users of their products. Each of these companies has found that education is a cost-effective means of minimizing problems with their products -- problems that can threaten registration status for substances that take many years and millions of dollars to develop.

For example, Dow has developed an education program for users of certain pesticides. For each of these products Dow develops an extensive manual which explains the pesticide's proper use and effects. The company has also developed a general manual for aerial applicators and has worked closely with TDA and the Extension Service in studying climatological effects on drift and in carrying out the literature search that was part of the 1981 recertification process.[200] Monsanto invites applicators to formal classes covering better ways to use their airplanes, factors influencing drift, and the characteristics of various Monsanto products. Monsanto provides these classes free of charge and has engaged in this and other education programs for almost twenty years.[201] TDA could encourage other agricultural chemical companies to provide similar programs. As noted, better-educated pilots are more likely to apply pesticides safely and efficiently.

However, this program would probably not minimize the use of chemical pesticides as opposed to other methods of pest control. On the contrary, since it is sponsored by chemical companies, it could possibly lead to even

greater (albeit safer) use of chemical pesticides. Since the existence of this program relies on the private sector, TDA has little control over the amount and quality of education provided. The agency might prefer to mount its own education programs or encourage the Extension Service to provide additional programs. The costs of such programs could be offset by the gains in safe pesticide use. Agency-sponsored programs have the additional advantage that they may reach more applicators.

5.3.1.2 Membership in TAAA

TDA could ensure that aerial applicators are provided with continuing education by requiring that they all join the Texas Agricultural Aviation Association as part of the certification process. TAAA is well connected to the pesticide manufacturers, to research organizations (mostly state universities), and to the national association. The association can provide continuing education to new members as it does for current members. This option would make the educational materials available to all ag pilots in Texas. As with all education options, however, there is no guarantee that information would be acted upon. Given TAAA's close relationship with the agricultural chemical manufacturers, this option would probably not lead to a reduction in the use of chemical pesticides relative to other methods of pest control, but by keeping applicators up to date with the most recent developments it could conceivably lead to better control of pests.

This option would again require few agency resources; TDA could easily enforce it by not certifying any aerial applicator who failed to join TAAA. Because there would be one primary source of information, TDA could have more influence on the type of material sent out than under the previous option, although it would still not have total control. With only one provider of

continuing education, accountability would be clearly defined. There are serious problems, however, with state support of a particular private organization. Moreover, forcing all aerial applicators to join a private organization would reduce their autonomy and could conceivably lead to anticompetitive practices that would harm farmers.

5.3.1.3 TDA Newsletter

Another option would be for TDA, by itself or in coordination with the Extension Service, to take on the major responsibility for continuing education. TDA subscribes to agricultural aviation magazines, and scientific journals and is well connected to the research community through Texas A&M. The staff at TDA (or the Extension Service) could review new information and publish a periodic newsletter to provide continuing education for aerial applicators.

As with other education options, if the information is read and utilized by applicator safety will be improved and better control of pests may be achieved. Because TDA has the potential to be a more neutral actor in the regulation process, it is more likely that pest control techniques not involving a greater use of chemicals would be brought to the attention of aerial applicators. This method of information provision would be both reliable and stable to the extent that it would be carried out by a professionally qualified staff with a minimum of institutional bias. Accountability would be clearly centered at TDA and/or the Extension Service. The option would entail the use of more state resources than the other options. For a modest newsletter perhaps one additional staff person would be needed as well as additional funds for printing and mailing. As with all the other education options, evaluation of the success of this program would be

very difficult.

5.3.2 Certification and Recertification

Both certification and recertification exams can ensure that aerial applicators read and learn the contents of educational materials provided to them in order to pass the test. In theory, any applicator who passes a certification and recertification exam knows all that he or she needs to in order to apply pesticides safely. Options evaluated in this section focus on changes that could make TDA, pesticide manufacturers, agricultural insurance companies, and the general public more certain that aerial applicators know all that they should to apply pesticides properly.

5.3.2.1 Performance Testing and Spray Deposit Analysis

This option would require that aerial applicators pass a performance test as well as a written exam. It is in some cases similar to state driving tests, where licensees are required to pass both driving and written tests.

Since FAA already tests proficiency in flying, the performance test that TDA could require is a spray deposit analysis. Spray deposit analysis generates a highly accurate description of a plane's swath under given weather conditions. If a pilot knows the characteristics of the swaths he or she can adjust flying patterns and equipment to lay down the pesticide more directly on the target area, which turn leads to less drift.

This option would have a number of benefits. By reducing drift it would increase the safety of people, animals, and other nontarget objects that might be in areas adjacent to the spraying. It would benefit the farmer economically because a more direct application would mean that more of the pesticide (that

the farmer is paying for) would be deposited on crops as opposed to othe areas. This would also lead to better control of pests; however, this option would do nothing to lessen the use of chemical pesticides as compared to other methods of pest control.

Currently, the Extension Service organizes twelve "fly-ins" (where spray deposit analysis is done) a year in various locations around the state. Should TDA decide to require this as part of the certification process, the agency might need to increase both the number and locations of these fly-ins. This would require additional resources in terms of both personnel and money for the Extension Service. Some of these funds might be obtained from TAAA or pesticide manufacturers currently co-sponsoring these fly-ins. Or TDA might prefer to increase the licensing fee to cover the cost. The program would be easy to enforce, since TDA could deny or cancel the license of any applicator who fails to participate.

5.3.2.2 Certifying all Ag Pilots

As noted, current Texas regulations do not require all agricultural pilots to be certified applicators. While it is also true that ground applicators must act only under the supervision of a licensed applicator, this loophole poses a more serious problem for aerial application, in which very large areas are sprayed in a short time and which is the major cause of drift. This option would probably face opposition from owners of large aerial operations, but agricultural insurance companies favor it.[202] It would also require additional resources from TDA, although gains in safety should offset the costs of implementing this option.

5.3.2.3 Periodic Recertification

At present, an aerial applicator's certification is good until TDA decides it is necessary to require a recertification or until it is otherwise canceled.[203] TDA could, however, require recertification at specific intervals such as every other year or three years out of a five-year period.

The information learned for certification exams is very technical and easy to forget if not used frequently. Periodic recertification would keep that information fresh in the applicator's mind, and could ensure that information is current. The option should lead to safer and more efficient pesticide use, although it would entail expenditure of additional resources on writing and grading exams. Even those resources would be minimized if TDA switched to computer-graded exams; enforcement would take no resources since examination would be a condition of licensing. The option is already supported by the agricultural insurance companies and TAAA, even though it imposes some additional costs on the pilots themselves in preparation and examination time.[204]

5.3.3 Enforcement

Present enforcement procedures are the same for all commercial applicators. It could be argued that, because of its potential for damage and because of the large numbers of complaints filed against aerial applicators, aerial spraying should be subject to special enforcement procedures. Several options are evaluated in this section.

5.3.3.1 Additional Enforcement Programs

In Texas, each applicant for a commercial applicator's license must file either a bond or a liability insurance policy with TDA to prove financial responsibility. This is required to protect people who might suffer damages as a result of the operations of the applicant. If a damage claim is won in court, the insurance companies must pay the injured party. Repeated irresponsible behavior on the part of an applicator will eventually lead to cancellation of the policy or bond and therefore to withdrawal of his or her commercial license by TDA. Thus, market forces may already be operating to ensure safe pesticide use.

In practice, market forces are not completely reliable regulators, because their effectiveness depends on people making claims against irresponsible applicators. The costs of filing claims and pursuing them through the courts, the difficulty of obtaining the data necessary to win such cases, and the time lost from more productive endeavors discourage many people from using the courts to obtain damages. The State, therefore, needs to supplement market forces with additional programs.

One very strong kind of state program is found in Maine. The Spruce Budworm Program was started in 1954 in response to an outbreak of these insects, which defoliate trees and can cause massive tree mortality. The Maine Department of Conservation's Bureau of Forestry was able to take action against the pest under legislation holding the Forestry Bureau responsible for protecting the forestland.

Initial programs covered about 170,000 acres/year, but were expanded to

cover 3.5 million acres in 1976 after the area of infestation increased.[205] Funds to finance the project were obtained primarily from the federal government and from a special tax on forest landowners until 1981, when the federal government dropped out of the program. Now it is funded primarily by the landowners, including small individual landholders and large industrial holders.

Since the area of infestation is in prime recreational land with many bodies of water, the State Board of Pesticide Control and the Forestry Bureau have developed a strong program to oversee aerial application of pesticides. In mid-May, aerial applicators converge on the staging base, where their planes are calibrated, they are instructed on project rules and procedures, and they take the state licensing exam.[206] Once this is done, applicators are divided into teams of three applicators (and their planes) accompanied by a guide plane which carries state personnel.

For the actual spraying operation the three applicators fly in echelon formation directly behind and below the guide plane. The state monitor (usually a forestry student from the University of Maine) flies in the guide plane and controls the spraying operation. The monitor is responsible for ensuring that the spraying meets state standards. The monitor does prespray surveys of the spray block and, with assistance from computer navigation units, tells the aerial applicators when to stop and start spraying.

The State makes a substantial effort through the use of strict buffer zones and extensive preposting to ensure that humans and other nontarget species are protected from pesticide exposure.[207] Since many people are camping and

hunting during the peak spraying period, the State has developed extensiv preposting regulations to warn people when and where spraying will take place so that they can stay away from affected areas. Key points of ingress to spray areas are posted at least one week prior to spraying. Landowners and appplicators share responsibility for posting and must have posters and written notices used for this purpose approved by the State Board of Pesticide Control.[208] Large-scale spray operations (more than one plane) must provide press releases to local news media specifying the application site and approximate dates of application, encouraging the general public to stay out of these areas. The press release must also include a special information telephone number operated by the State to receive additional information about the applications. Special notification is required for seasonal residences, commercial campgrounds, remote campgrounds, and apiaries.

Because of the diverse nature of Texas agriculture, this kind of closely controlled state-run aerial spraying program is probably not appropriate except for emergencies. The program clearly provides coordination of pesticide application over a large area along with careful adherence to complex safety and environmental regulations. Maine's program, which covers only one crop and one pest within a concentrated area, is costly; a Texas program would have to cover hundreds of crops and thousands of pests. However, certain aspects of the program, including the use of forestry students to oversee large-scale aerial spraying operations, preposting, and the coordination of spraying among many large landholders, might be of use in Texas.

5.3.3.2 Mandatory Buffer Zones

One option for lessening the effects of drift is for TDA to mandate buffer zones for all aerial spraying or for all herbicides. Buffer zones could be defined as areas not intended to receive direct application of pesticide, but within which some spray will probably be deposited.

Buffer zones can reduce the likelihood that nontarget crops, environmentally sensitive areas, or people will be exposed to drift from aerial application. However, use of buffers will probably mean that farmers cannot have all their land treated directly by the aerial applicator. The amount of the farmer's crop production may be reduced in the buffer zones. Furthermore, to implement such a program TDA would have to determine appropriate buffer zones for a host of different pesticides, crops, and neighbors; to enforce it would be even more difficult. Complaints, which are the centerpiece of TDA's current enforcement procedures, would be especially difficult to verify, since it would be difficult to prove that an applicator released spray in the buffer zone. Evidence of residue in off-target areas may not be a result of spraying in buffer zones. On the contrary, it may signify that the mandated buffer zone is too small to protect off-target areas completely.

5.3.3.3 Preposting

Preposting is another policy option for minimizing unwanted effects of off-target drift. Under this option, information about the time, place, and chemical to be used in an aerial spraying operation is made available to the public through TV, radio, newspaper, poster, leaflet, or any combination of the above. While preposting does not do anything to reduce the amount of drift, it can reduce the amount of human exposure by warning people to stay away from areas where spraying is going to occur. It can also put landowners

on notice to be on the lookout for instances of drift. The effectiveness o this program would depend on whether people received the information, which can be costly unless run as public service messages, preferably in both English and Spanish. Enforcement of the preposting option would probable have to rely on the complaint process. TDA inspectors could supplement the above by making occasional spot checks in areas where spraying is going to occur. Pesticides are applied aerially so frequently that inspectors alone could not enforce this program. Chapter 8 discusses problems with notification and posting more extensively.

6. URBAN USE OF PESTICIDES

6.1 INTRODUCTION

Because pesticides are usually associated with agriculture, people often fail to realize the major role they play in urban areas. Among these are maintenance of health, sanitation, preservation of buildings, clean water, and asthetic quality. However, as always, the benefits of pesticide use entail certain liabilities. These are especially severe in urban areas which possess characteristics entirely different from those of agricultural areas.

A main distinction is that in urban areas a substantial quantity of chemicals is used within a densely populated area. It is estimated that there are between five and ten pounds per acre of pesticide deposits in urban areas.[209] Primary users of pesticides include property owners, commercial applicators, government, nurseries, and landscaping businesses. Pesticides are commonly applied in homes, yards, restaurants, parks, schools, hospitals, libraries, pools, and various other public areas. This heavy use of pesticides presents a high probability of public exposure and potential risk to human health and the environment.

Another characteristic unique to urban areas is the need for persistent pesticides. Persistence is desirable because structures are permanent and need constant protection against pests and also because persistent pesticides mean less frequent visits by the exterminator and hence lower costs to consumers. Most organochlorine insecticides are quite stable and may persist in the environment for extended periods. Though this characteristic contributes to their value as pesticides, it has been found to have adverse effects on animals and the environment (see chapter 8). Among the persistent

pesticides commonly used in urban areas are methoxychlor, toxaphene, strobane, lindane, icofol, endosulfan, cholordane, heptacholor, and DDT.[210]

Furthermore, applying chemicals to small areas and structures requires application techniques different from those used for agriculture. Techniques used by urban applicators need to take particular account of the high potential for inhalation exposure when application takes place in small and/or closed areas.

Because of the differences just noted, urban use constitutes an area of special concern. This chapter explores various issues surrounding pesticide use in urban areas. This topic encompasses a wide range of issues; the following research focuses on those which seem most outstanding. The major characteristic of urban pesticide use is the multiplicity of users and functions. We begin with a discussion of the present process for regulation, and then turn to a description of the many users. Second, various programs set up by the Texas Department of Agriculture (TDA) to deal with these issues are examined. Finally, alternative ways to deal with these issues are explored.

6.2 HOW URBAN REGULATION IS ACCOMPLISHED

6.2.1 Public Agencies

In addition to EPA and TDA, which have roles in regulating all pesticide use in Texas, there is another state agency with special authority for urban pesticide use -- the Structural Pest Control Board (SPCB). Prior to 1971, the only control of pesticide use in urban areas was the registration of pest control companies requiredby some cities. Complaints were handled by the

Better Business Bureau, and cases involving deception or fraud were usually handled by local government authorities.[211] The Texas Structural Pest Control Act was enacted in 1971 for three major reasons. First, members of the Pest Control Association (TPCA) were interested in being recognized as professionals. TPCA wanted licensing and a board to set standards for operators because of a concern for protecting the industry and consumers from unqualified operators. Second, at that time amendments to FIFRA were being considered in Congress that would require the certification and licensing of applicators. In anticipation of the mandate, Texas passed the Structural Pest Control Act, which created the Structural Pest Control Board to meet and enforce federal standards. Third, Texas legislators saw the proposed pesticide act as a means of protecting public health, welfare, and the environment.

The primary responsibility of SPCB is to regulate people who are engaged in the structural pest control business. Among other responsibilities, the board develops standards and criteria for licensing persons engaged in the business of structural pest control. The board also promulgates rules and regulations governing the methods and practices of structural pest control when it determines that the public's health and welfare necessitates such regulation to prevent adverse effects on human life and the environment.[212]

The SPCB staff, composed of an executive director, seven investigators, and three secretaries, carries out the board's functional activities. The board itself is composed of nine members who serve its policymaking and quasi-judicial functions. Three ex-officio members of the board represent other participants in the urban use of pesticides -- the Texas Department of Health

and Texas A&M University.

Since SPCB's authority extends only to commercial applicators of pesticides for structures, a wide variety of urban users do not come under its jurisdiction. TDA certifies on a voluntary basis private applicators who wish to apply restricted-use pesticides and certifies and licenses commercial and noncommercial applicators; categories of urban use that are affected include ornamental and turf pest control and fly control.[213]

The Texas Department of Health certifies commercial and noncommercial applicators in the category of health-related pest control, which includes vector control, rodent control, and sanitation. The health department tends to focus on sanitation measures in pest control more than it does on pesticide use.

In 1971, the Texas Department of Agriculture entered into an intrastate service agreement designating Texas A&M University as the leading educational resource for the state. Texas A&M's Entomology Department does research concerning pests, pesticides and integrated pest management. One staff position was designated to focus specifically on urban pesticide use. This position has been vacant since January 1, 1984, and is not expected to be filled until September 1984. Research has consisted of getting background information on urban use in order to identify the issues. Special attention has been given to wood-destroying organisms and trying to develop alternatives to organophosphates.[214]

Through seminars, workshops and literature, A&M functions as a disseminator

of information. Information for certification tests comes primarily from manuals published by Texas A&M. Texas A&M, Texas Tech, and the Texas Pest Control Association jointly sponsor two information workshops annually. Problem areas determined by the pest control operators (PCOs) together with the SPCB are covered -- roach control, flea control and rodent control are traditional topics of concern as well as management practices, sales and marketing, and issues of profit and loss. Texas A&M usually hosts the workshop in January, with an average attendance of 300-600; Texas Tech hosts the workshop in September, with attendance of 250-350; out of a statewide total of approximately 4,500 certified applicators.[215]

6.2.2 Certification and Licensing

The owner or manager of a structural pest control business entity, including each primary business office and branch business or branch office engaged in structural pest control operations, must secure a business license and a certified applicator's license from the SPCB. Each business when applying for issuance or renewal of a license must submit proof of insurance, and each business entity must have a certified applicator who is not also serving as a certified applicator for another business entity.[216]

The SPCB rules, like TDA's, allow individuals under the direct supervision of a certified applicator to use restricted-use or state-limited-use pesticides. "Direct supervision" means that the pesticide is applied by an individual acting under the instructions and control of a certified applicator responsible for the actions of that individual and available if and when needed for consultation or assistance. The certified applicator need not be physically present at the time and place of the pesticide application.[217] In 1983, approximately 10,000 uncertified employees were working under the

supervision of approximately 4,500-5,000 certified structural pest contro applicators.[218]

The fact that supervisors do not have to be physically present may offer opportunities for misapplication. In fact, misapplication is the second most frequent type of complaint received by SPCB and was stated by several people in the field to be a growing concern, particularly in termite control. In 1983, approximately sixty-three complaints were filed with the SPCB involving misuse. About twenty were found not to be pesticide-related. Of the remaining two-thirds, most involve chemical misuses and improper application -- such as pesticide being placed in an area where it should not have been or improper exposure to the chemical.[219] A similar problem is found in the rule that exempts employees of government agencies and educational institutions from needing certification in order to apply restricted-use chemicals, which also creates conditions favorable to misapplication. These issues were discussed in chapter 3.

6.2.3 Enforcement

Enforcement of the laws is carried out by the two regulatory agencies. SPCB enforces complaints against those applicators it has licensed and carries out continuous checks for compliance with regulations. Investigations by SPCB are performed by the Board's seven investigators, each of whom serves a specific region of the state. In 1983, more than two thousand complaints were investigated, about sixty of which involved misuse complaints, and over two hundred samples were collected.[220]

SPCB offers no training for investigators. Four of the seven investigators come from backgrounds in law enforcement, two worked in the pest control

industry, and the seventh was hired out of college. The number of investigators has not increased in the past five years. Meanwhile, the number of misuse investigations has risen 110 percent; the number of licenses issued has gone up 40 percent; the number of total complaints has increased 50 percent; and the number of people taking the license exam has risen 40 percent.[221]

The most noticeable feature of regulation of pesticides in urban areas is the lack of specified procedures for applying dangerous chemicals. This absence also makes general enforcement very difficult. SPCB has not taken advantage of its authority to issue regulations in the interest of public health and the environment to promulgate general written standards and criteria for structural pest control procedures. Instead, the agency has determined that misuse is any use not in accordance with the label. This lack of positive guidelines puts each pest control operator in the position of self-monitored compliance and leaves each investigator without specified procedures to oversee actions other than compliance with the label.

Although there are no written procedures for use in investigations and the investigators are not required to have any specific training, they do have guidelines for finding violations of the Structural Pest Control Act. These guidelines are the grounds for the negative sanctions found in the law.[222] The board may revoke, suspend, or refuse to issue or renew a license, and it may reprimand or refuse to examine an applicant. Grounds for using a negative sanction include misrepresentation or fraud; failure to provide necessary information or records of pesticide use; dangerous practices or practices inconsistent with the label; and other violations of regulations laid out in

the act. The board may also seek to impose fines or to obtain injunctiv relief through court proceedings. In 1983, seventeen out of approximately sixty-three complaints involving misuse resulted in suspension or revocation of licenses. The remaining misuse complaints were handled by reprimand or verbal warning. Civil penalties are used two or three times a year.[223]

6.2.4 Education and Information Programs for Professional Applicators

Federal regulations require each state to submit to EPA a plan for educating certified applicators. Texas A&M functions as the state's leading resource for educating people interested in obtaining certification to apply restricted-use chemicals. Since certification is the means of demonstrating competence and knowledge of the safe use of pesticides, it is an important component of regulation.

As for other applicators, information for the certification test comes primarily from a manual published by Texas A&M and available from SPCB, TDA, or the County Extension Office.[224] To qualify for certification, individuals must score 70 percent or higher on an examination consisting of fifty questions. The general test for commercial applicators, which is regarded as one of the easier tests, has only about a 50 percent passing rate. Barely 35 percent pass the first time in the termite category, and only 20-30 percent pass the first time in the fumigation category.[225] If an individual fails the first time, he or she is allowed to retake the test the next time it is offered -- four times a year in most categories. These test scores suggest that there may be a need for additional training.

6.2.5 Summary

We have argued that the problems posed by urban pesticide use are especially difficult because of the multiplicity of users and uses. This has given rise to a complex institutional structure, which is characterized by the presence of a third regulatory agency beyond EPA and TDA -- the Structural Pest Control Board. This agency licenses applicators who apply pesticides to and inside structures. In order for SPCB to accomplish its objectives and exercise its authority fully, it must rely on help from other agencies -- particularly A&M for education and research and development related to urban pesticide use and TDA for testing of the samples taken during investigations. This interdependence creates the possibility of gaps in regulation. The limited size of SPCB's investigative staff and the agency's failure to issue regulations implementing its authorities create additional problems in urban pesticide regulation. In the following section, we continue discussing the complexity of urban pesticide regulation by describing the various users.

6.3 USERS OF URBAN PESTICIDES

Among the major users of pesticides in urban areas are institutions and households. We discuss each of these, with special attention to use in apartments, where the density of habitation both creates a special need for pest control and intensifies the possible problems of use.

6.3.1 Household Use

In 1980, the Environmental Protection Agency's Office of Pesticide Programs published a Nationwide Household Pesticide Usage Study involving interviews with 8525 respondents from throughout the nation. The conclusions of the study sparked great concern. Ninety percent of households surveyed used pesticides; 84 percent applied them in houses, 21 percent used them in

gardens, and a similar proportion applied pesticides in yards.[226] Eighty-four percent of those using pesticides did so without being concerned about possible side effects. Less than half read the product labels for application and misuse prevention measures.[227] This study also quoted results from a 1969 study done in South Carolina, where 88 percent of households using pesticides stored them in unlocked areas, with more than half within easy reach of children. For two-thirds of the households using pesticides, the users did not wear gloves or wash their hands after spraying.[228]

In 1980, a survey of Texas households was published by Texas A&M.[229] This survey found that professionals applied chemicals in about one-half of all households, while in about two-thirds of the households, consumers sprayed their own homes in addition to this professional pest control. The survey concluded that the attitudes of the public toward chemical safety needed improvement. It also stressed problems involving lack of professional consultation, poor storage practices, and lack of precaution when spraying. Another study of Texas residents conducted in 1978 found that most people were not knowledgeable about the toxicants being used in their homes, yards, and gardens and were generally unaware of the possible harmful side effects of human exposure to pesticides.[230]

One important characteristic of urban pesticide use is that there are many untrained users of small amounts of pesticides. These users are not regulated, and the primary means of ensuring that they apply pesticides safely is information. The main source of information is the product label, which tells users the purposes for which the product is suitable and what precautions to take in using it. Nonetheless, these studies indicate that

labels are inadequate in ensuring the safe handling of pesticides by the public. Those users who do turn to commercial applicators are also at a disadvantage. Although SPCB is required to establish a public information program to tell the public about the practice and regulation of structural pest control in Texas,[231] the only requirement that the agency has established is that each written contract in which an applicator licensed by the SPCB agrees to perform pest control services must include the board's mailing address and telephone number and the statement, "The Board has jurisdiction over individuals licensed under the Structural Pest Control Act."[232] Obviously, this statement does not provide the consumer with any means of assessing the skill or performance of the applicator, nor does it require the applicator to tell the consumer appropriate safety measures to take.

6.3.2 Apartment Use

One of the most important urban uses of pesticides is in apartments. The City of Austin Housing Code mandates biannual pest-control in rental units by landlords. A mail survey of apartment landlords was conducted in order to determine use patterns in apartments and the roles of tenants, landlords, and commercial applicators in the pest control

Questionnaires were mailed to the managers of the 439 apartment complexes listed in the Austin telephone directory. Over 48 percent of the managers surveyed responded. The 212 apartment complexes they manage account for 27,147 rental units. As of February 1984, there were approximately 97,500 rental units in Austin.[233] Therefore, this survey accounts for approximately 28 percent of all rental units in Austin.

In addition to questions on pesticide use, the survey ascertained the size

of apartment complexes and whether they are high- or low-rent. To determine pesticide use patterns by apartment complex size and by rent, the number of units, high rent, and low rent were divided into quartiles. Managers were also asked their zip code. A zip code map was matched to census tract maps to ascertain approximate income. Predominately high income, low income, and college student areas were identified, creating three sample areas for study.

Tables 12 through 19 present some of the survey's findings. Briefly, the survey shows that, though there is a wide variety of pesticide use behavior, most managers follow a general trend. Most landlords hire commercial applicators who spray on a monthly basis. Managers usually give written advance notification of spraying to tenants, including instructions on precautions for tenants to take. However, a large percentage of applicators still spray if tenants do not follow the instructions. A survey of tenants is needed to see if they do take the precautions. It is also important to see if tenants' perceptions regarding advance notification and the right to refuse spraying are the same as the managers' perceptions.

Apartment complexes with professional pest control showed more concern for tenant safety. They gave better advance notice, they were more likely to give instructions on precautions, and they gave more types of instructions. This is probably due to the pest control companies. Managers with professional sprayers allowed less tenant refusal, possibly because of their contracts for spraying the whole complex.

Rent and income areas generally followed the same trends. Higher-rent and high-income complexes used more professional sprayers. Despite this, lower-

Table 12. Professional and Nonprofessional Spraying by Rent and Size (percent)

	PROFESSIONAL	NONPROFESSIONAL
High Rent		
1.	77	23
2.	85	15
3.	81	19
4.	92	8
Low Rent		
1.	75	25
2.	81	19
3.	86	14
4.	93	7
Size		
1.	90	10
2.	74	26
3.	80	20
4.	89	11

Table 13. Chemicals Used for Pest Control

	% PROFESSIONAL	% NONPROFESSIONAL
Baygon	19	18
Dursban	36	47
Diazanon	58	50
Ficam-W	9	3
Boric Acid	18	24
Boric Acid, baygon, resmithrin	9	--
DDVP Emulsion	2	--
Orthene	2	--
Carbamates (class of chemicals)	2	--
Talon G (Rodenticide)	1	--
Pyrethrum	1	6
Precor (for fleas)	1	--
Majikil (baygon bait)	1	--
Whitmire process and DSBN	1	3
Boric Acid and diazanon	1	--
Malathion	--	3
Di-toxe	--	6
St 797A	--	3
F09	--	3

Note: Multiple responses are applicable, therefore the percentages are not cumulative.

Table 14. Frequency of Spraying (percent)

	FREQUENT	INFREQUENT
High Rent		
1.	81	19
2.	86	13
3.	84	14
4.	80	13
Low Rent		
1.	69	28
2.	89	8
3.	89	9
4.	82	14
Size		
1.	77	20
2.	95	5
3.	88	12
4.	75	17

Table 15. Advance Notification of Spraying

	%
1-2 days	44
3 days	3
1 week	23
2-3 weeks	1
Month	1
Monthly newsletter	5
Always posted	3
At move-in or when tenants sign lease	9
Tenants always know schedule	12

Table 16. Advance Notification by Rent, Size, and Type of Sprayer (percent)

	A	B
High Rent		
1.	73	20
2.	78	16
3.	66	22
4.	65	26
Low Rent		
1.	83	13
2.	74	21
3.	65	19
4.	64	29
Size		
1.	71	22
2.	82	12
3.	64	27
4.	64	29
Sprayer		
Professional	69	22
Nonprofessional	81	13
Overall	71	20

Note: A = notice within one week; B = tenants always know schedule or notice at move-in or when tenants sign lease.

Table 17. Option to Refuse Spraying

	OVERALL	PROFESSIONAL	NONPROFESSIONAL
Option	74%	71%	94%
No option	18	21	0
With excuse	8	8	6
	100%	100%	100%

Table 18. Type of Precautions

	OVERALL	PROFESSIONAL	NONPROFESSIONAL
Clear dishes	93	95	86
Rinse sink	21	21	21
Protect pregnant women, infants	31	29	41
Clear cabinets	10	12	3
Air apartment	1	0	3
Protect pets	10	10	10
Protect plants	3	3	3
Leave apartment	1	0	7

Table 19. Awareness of Alternatives

	CAULKING	BORIC ACID	SANITARY PRACTICES	DIATOMACEOUS EARTH
Size				
1.	51	65	59	12
2.	58	83	64	4
3.	63	92	75	8
4.	50	69	59	6
Professional	54	76	63	7
Nonprofessional	63	80	66	9
Overall	55	76	64	7

rent and lower-income complexes gave better advance notices and were more likely to give instructions on precautions. Higher-income apartments were sprayed more frequently, while the highest- and lowest-rent complexes were sprayed the most. This could be because low-rent buildings need more spraying. The student area apartments were sprayed the most, and these are older, lower-income areas.

One of the most worrisome features of urban pesticide application is the large number of users. Apartments contain a high number of potential users living in very close proximity to one another. Although our survey tells nothing about the tenants' use of pesticides, it does indicate that there are few managers who do the spraying themselves. The high use of professional pesticide applicators in apartments not only increases the likelihood of safety by decreasing the number of different users, it also increases the likelihood that certified applicators are ensuring that good safety practices are followed. The findings of the survey, therefore, suggest again the extreme importance of good oversight of certified applicators.

6.3.3 Institutional Use

The Texas Structural Pest Control Act exempts government personnel from regulation as commercial applicators.[234] Government employees using nonrestricted-use pesticides also do not have to be licensed. This means that SPCB does not have authority to regulate government personnel who apply pesticides, despite the large amount of pesticides used by government agencies. To obtain a better understanding of the ways in which government agencies use pesticides, we surveyed units of the City of Austin and the University of Texas.

One purpose of this study was to see how widespread and decentralized pesticide use and control is within the city. We found that there is no coordination of pesticide use. Table 20 lists eight different city authorities that independently decide what pesticides to use and when. These departments do not have to report their use to anyone, although the Office of Environmental Resource Management surveyed city departments in 1979 and in 1981 to see who was using what chemicals and for what purpose. These surveys were only for data collection and not for regulation, and they involved Parks and Recreation and the Health Department almost exclusively. A similar survey is planned for 1984.

There is no evidence of any major abuse of pesticides within the city government. Restricted pesticides are rarely used, and when they are, professionals do the spraying. However, awareness of health hazards and the degree of care taken in spraying vary greatly among city agencies. The airport authority evidences the clearest concern for human safety. Furthermore, there is no single agency coordinating or overlooking city use of pesticides, which means that it is possible for overlapping uses, poor timing of related applications, or other wasteful applications to occur. Some departments have indicated that they use unlicensed applicators; since SPCB has no jurisdiction, there is potential for error by unsupervised, untrained city employees. If Austin is typical of other cities, urban use by governmental authorities is poorly monitored.

Table 20. Pesticide Use by the City of Austin

DEPARTMENT	JURISDICTION	APPLICATOR	SAFETY MEASURES OR PROTECTIVE CLOTHING	PESTICIDES	FREQUENCY
Public Works/Building Maintenance Division	most city facilities	commercial		baygon, diazanon dursban	quarterly or Saturdays
Library	libraries	nonlicensed custodian	mask; 1-2 hours before library opens	Ficam-W cyanimid	1/week in problem areas
Airport	inside terminal	commercial	late night spraying	diazanon dursban	monthly
	outside terminal	airport personnel	rubber gloves, masks	amdro (for fire ants)	as needed
				primatol (for weeds)	spring
Auditorium/Coliseum	2 buildings	maintenance crew	mask, gloves spearmint oil to hide smell		2-3 days before events but up to day before
Police/jails	(only cracks & crevices)	commercial	prisoners out of cells during spraying; wait 5 minutes to re-enter	diazanon, dursban Ficam-W, baygon, pyrethrum	monthly
Parks & Recreation					
Golf Division	golf courses	licensed applicators	gloves, rain suit, respirator	MSMA, Roundup, Synchlor	
Parks Division	parks	licensed applicators sometimes crew if small amount	no posting	amdro, Roundup, diazanon	
Health	city facilities			Ficam-W for roaches diazanon	
	neighborhood (by request, for mosquitoes)			diesel oil on water dibon, malathion	

Source: Compiled by authors from interviews.

6.3.4 University of Texas

The University of Texas is another institution that uses a lot of chemicals for pest control. Pest control was under the responsibility of custodians until recently, when a professional applicator was hired as an environmental health specialist. He is responsible for pest control in all university buildings except cafeterias. This specialist works with two assistants who are not licensed.

Spraying pesticides is not easy, considering the heavy and constant use of the buildings. Dormitories are sprayed three to four times a year when the students are gone. Diazinon, pyrethrum, and Ficam-W are used. Other buildings are usually sprayed late at night. There is a large problem in spraying laboratories; great care is needed to protect lab animals. Cafeterias are sprayed by a professional company twice a month. They are sprayed at night with dursban, DDVP, and vapona.[235]

Grounds maintenance is responsible for pest control on university grounds. Spraying of herbicides is done by groundskeepers who have informal training from supervisors. They use rubber boots and a mask. Spraying is done in the spring and will be done more often in the future, as they hope to go to a granular form of herbicide. Diazinon and dursban are also used as needed for insects, especially ants and grub worms. All chemicals are stored in two locked storage buildings.[236]

Again, as in city use, there is no evidence of abuse of pesticides at UT. However, there is potential for misuse, due to lack of control, overuse, and inadequate safety practices.

6.3.5 Summary

Our overview of urban pesticide users has suggested that the multiplicity of uses and users does present some problems. When there are so many different users, direct regulation and licensing are inappropriate or impossible, so information provision becomes the most important means of ensuring that people use pesticides safely and efficiently. However, it is rather difficult for consumers, landlords and tenants, and employees of government and educational institutions who apply pesticides to obtain adequate information. Lack of pesticide knowledge may lead to problems of misuse and overuse, especially by those who do not or cannot read the label and do not understand the importance of using only the specified dose.

Another problem arising from the multiplicity of users is the lack of coordination among them. Overuse is especially likely when so many users, occupying essentially the same space, apply pesticides. When some of the major users are government agencies whose employees are not subject to any regulatory controls, this likelihood increases. The following section considers various programs that could alleviate some of these problems as well as the problems in regulation outlined in the previous section.

6.4 POLICY OPTIONS

Although characterized by several distinct features, including the density of users, the number of users, the variety of uses, and a complex regulatory structure, urban pesticide use is not often distinguished as a separate subject, and there are no pesticide programs specifically addressed to urban problems. This section discusses several policy options that are available to respond to the problems of pesticide use in urban areas that we have described. It focuses especially on regulation, information provision, and

other urban problems; within each of these areas, specific policy alternatives are compared with present TDA actions and assessed against the criteria presented in chapter 1.

6.4.1 Regulation

As we have seen, regulation of urban pesticide use is accomplished primarily through the enforcement and certification and licensing programs of the Structural Pest Control Board (SPCB). SPCB has no procedures or recommendations beyond the label for application of dangerous pesticides or for investigating the misapplication of dangerous pesticides. The board also has no requirements that potential investigators have training or knowledge in toxicology, health problems related to pesticides, biology, or epidemiology.

The absence of procedures and required expertise may cause the program of enforcement to be less than effective in protecting consumers and the environment. For instance, the complaint form used by investigators from SPCB does not require that any health-related problems be listed. Furthermore, the agency keeps no record on the kind or amounts of chemicals used by exterminators. Record keeping gives regulators the advantage of knowing what kinds of pesticides are being used and in what quantity. Attention can focus on the most commonly used chemicals and the most harmful chemicals. If necessary, this information could be used to set limits for the amounts of pesticides applied, particularly public places, such as day care centers and hospitals.

The reliability of the present enforcement program may be undermined by the rising demand on the seven investigators. The number of complaints filed and the number of persons applying for licenses have increased substantially over

the past five years, while the number of investigators has remained unchanged. Each investigator is responsible for regulating roughly 2,000 commercial applicators. Since there is no evaluation system for investigators, it is difficult to determine if each inspector is capable of enforcing the law effectively for this large number of applicators.

There are several policy options that might alleviate some of these problems. SPCB could:

1. Exercise its statutory powers to create specific procedures and/or guidelines for applicators of dangerous pesticides and for investigating the commercial misapplication of dangerous pesticides. These guidelines would improve the efficacy of the few investigators as well as providing better information for applicators about appropriate activities.

2. Create a training and evaluation program for investigators. This would complement the investigation guidelines. Part of this training could cover toxicology, health effects of pesticides, and other pertinent sciences.

3. Increase the number of investigators, thereby allowing each to cover a smaller region.

4. Require businesses to submit records of the types and quantity of pesticides used. This information would be helpful in understanding urban pesticide use and would aid in identifying areas where attention is needed.

Options 1 and 2 would increase both the reliability and the adaptability of present SPCB enforcement programs. Investigations would be more complex but more accurate. These first two options would require rulemaking by SPCB and additional resources for training. Option 3 would require legislation and increased funds. Additional recordkeeping would also increase the effectiveness of the overall enforcement effort, but would doubtless entail hiring at least one additional staff member.

The second component of regulation, certification and licensing, is also carried out by SPCB. We have identified three areas of concern in certification. One, the appropriateness and comprehensiveness of the certification test, is discussed in chapter 3. Another is the possible problem when noncertified applicators apply restricted-use pesticides under the supervision of the one certified applicator required by law to be employed by a licensed business. There are no data to support or refute a contention that these noncertified applicators are more likely to misapply pesticides; such data should be collected. The options mentioned in chapter 5 to relieve this problem apply here as well:

1. Requiring more direct supervision in the stricter sense of the word "direct." This could be accomplished by requiring noncertified applicators to serve as apprentices for a specific period of time. This option would create an evaluative measure where none currently exists.

2. Requiring that all applicators be certified. Both these options would require changes in legislation.

The third problem we identified is that employees of government agencies are not required to be certified at all, although government agencies are major users of pesticides in cities. Some possible options for alleviating this problem are:

1. Encourage each government agency to designate one or two employees within the agency to be certified and set up classes to teach and assist them. This is a relatively weak measure, useful only if participation is high. Since it is not enforceable, it is not very dependable.

2. Make it mandatory for agency users to be certified in order to apply restricted-use pesticides. This would treat government agency users of pesticides like all other commercial applicators.

3. Make it mandatory for agency users to be licensed in order to apply any pesticides. This would place more stringent restrictions on government users than on others. Since these users' decisions

affect such large numbers of people without their knowledge, it could be argued that such extra restriction is needed.

4. Mandate that cities spend some resources on coordinating citywide pesticide use on government property. Present uncoordinated programs have the strong potential for overuse of pesticides; money spent on coordination should be offset by the reduced amount of pesticides used.

6.4.2 Education and Information

Programs for education and information are provided both for the general public and for the commercial pest control industry. The public information and education programs of TDA and SPCB include information sources at Texas A&M and the county extension offices. The SPC law also mandates a public information program. The program itself is minimal, however, and the evidence suggests that the public has a poor understanding of the need to treat pesticides with care and use them only according to instructions.

A more effective public information program could be developed, using the media for public service announcements, compiling a mailing list for parties interested in new developments, and offering a toll-free telephone number to answer questions about pests and appropriate ameliorative measures. Such programs could also serve to improve public relations for SPCB and TDA.

The programs for educating commercial applicators consist primarily of the dissemination of manuals for studying for the certification examinations. The high failure rate on the certification test suggests that these manuals alone may not be sufficient. The infrequent workshops that are sponsored by the two agencies, the Texas Pest Control Association, and the chemical companies are effective only for the relatively few applicators willing to take the time to attend.

The SPC law does allow the board to require that applicators attend education programs. Enacting such a regulation could increase the knowledge of applicators, especially if the programs focused on the special problems of applying pesticides in densely populated areas. Extending the requirement to include yearly or biannual continuing education could be still more effective in increasing the safe use of pesticides and in reducing the number of complaints received by SPCB. Such a requirement would impose costs on applicators, but would not impose them directly on the agencies. Other programs, such as creating a toll-free line to an entomologist or an easily accessible library of pest control literature at TDA or SPCB would entail agency funding.

6.4.3 Coordination

A coordinated urban pesticide program holds promise for the effective, safe use of pesticides. All of the areas that have been analyzed -- regulation, education and information, and institutional use -- suffer in some way from a lack of coordination in the urban sector. This is especially true because of the lack of coordination between TDA and SPCB in licensing, certification, and enforcement.

Options available to increase coordination between the agencies are:

1. Designate an urban use liaison within TDA. This would in effect be little more than a clearinghouse for information inside the agency. It would require only one staff person.

2. Create an urban office within TDA. This office would serve as a research body as well as an information source. Its purpose would be to pinpoint areas in need of attention by the policymaking bodies (SPCB and TDA). This option would also require only a minimal staff. Implementation of this option should also include the library of information about pest control and alternatives to pesticides mentioned above. This office could work with city officials as well as with SPCB to help develop coordinated urban

pesticide use programs.

3. Put SPCB in TDA and expand its authority to include all functions of urban use. This would be similar to option 2, but SPCB would serve the functions outlined there as well as its current functions. Inside TDA, it would be more sure to coordinate its licensing and enforcement efforts with those of the parent agency.

Options 1 and 2 would entail hiring an additional staff member. Option 3 probably would not, but might be more difficult to achieve politically.

7. PESTICIDE RESIDUES IN FOOD

7.1 INTRODUCTION

Most food sold in the United States today contains small but detectable levels of pesticide residues. These residues are found in almost every type of food, from fruits, vegetables, and grain products to dairy products and meat. Tests indicate that several of the pesticide and herbicide active or inert ingredients approved for use on food crops may cause cancer or birth defects in experimental animals, and consequently may be suspected of causing those effects in humans.[237]

However, the number of the remaining ingredients that may cause cancer or birth defects is not precisely known. Many of the necessary scientific tests have never been run; some of the tests have been done, but EPA has not yet gotten around to evaluating the data. If there is a significant public health risk from any of these substances, it is most likely to come, for reasons discussed below, from lack of knowledge about some of these ingredients, and from delays in the process of removing suspected carcinogens from the market.

With our present level of scientific knowledge, we can tell whether a given pesticide may cause cancer in humans, but we cannot measure the amount of the cancer risk. The different theoretical models that exist in the field of "risk assessment" give widely different estimates of what "safe" levels of pesticide residue consumption are. The problem arises mainly because these models are expected to 1. guess a substance's ability to cause cancer in humans based on its ability to cause cancer in experimental animals; and 2. guess what will happen when humans consume very low doses of a substance over a very long period of time, based on what happened to experimental animals fed

a very high dose over a relatively short period of time.

The data that EPA has used to set tolerances (acceptable limits) of pesticide residues in food are inadequate for five reasons:

1. A large number of these tolerances were granted in the 1950s and early 1960s, before anyone required tests for carcinogenicity (cancer-causing capability), mutagenicity (mutation-causing ability), or teratogenicity (birth defect-causing ability). FDA, then the agency in charge of setting tolerances, did not begin requiring tests for carcinogenicity or sterility-causing capability until 1963. Tests for teratogenicity and mutagenicity were included in the requirement in 1970.[238]

2. Some pesticide active ingredients (a notable example is ethylene dibromide [EDB], recently banned because of its suspected ability to cause cancer in humans) were exempted from tolerance requirements in the 1950s, because the measurement technologies available at the time were not sensitive enough to detect their residues.

3. EPA has exempted all currently marketed pesticide inert ingredients (substances in pesticide formulations other than the active, "bug-killing" ingredients) from tolerances; many of these exemptions are also based on old data that may be in error. More recent information has shown that several of these ingredients, such as trichloroethylene, hexane, and benzene, are likely human carcinogens, and EPA will probably ban their use in the next few years. The reason that EPA has never set a tolerance for an inert ingredient is that those ingredients generally have convenient substitutes; consequently, whenever EPA's available data have indicated the need for a tolerance for an inert ingredient, the company seeking to register the pesticide has substituted a different ingredient.[239]

4. Many of the tolerances were set using data submitted by a private firm, Industrial Bio-Test, Inc., whose president and three other officials were later convicted of fraud for doctoring test data. During the 1970s, this firm was the largest private toxicological testing laboratory in the United States, performing an estimated 35 to 40 percent of all toxicology tests (tests of substances for carcinogenicity, mutagenicity, acute toxicity, and so on) in the country.[240]

5. Some of the tests done in the 1960s and 1970s used poor methodology, not because better methods weren't available, but because at the time EPA did not review the studies carefully enough and insist that they be redone.

In the late 1970s, partly as a result of prodding by the General Accounting Office and two Congressional subcommittees, EPA tightened up its registration requirements and began a systematic review of the aproximately 6,000 pesticide food tolerances that had been granted up to that time.[241] About 350 active ingredients are currently registered for use on food crops. The agency has updated its information on about one-eighth of the currently registered pesticide active ingredients, a process that, given the recent increase in EPA's funding, can perhaps be completed in ten years.[242] As part of the reassessment effort, many of the old studies are being redone, but EPA lacks enough trained toxicologists to review in a short period of time the newly generated data pouring into EPA "by the truckload."[243]

7.1.1 A Case History

Although there are many examples that illustrate these points, we will consider only one case -- that of EDB, which was much in the news during the course of our research.

In late 1983, traces of EDB, a pesticide used since the 1940s to kill insects in stored fruit and grain and nematodes (tiny worms) in the soil, were found in a wide variety of processed foods sold in supermarkets. The U.S. Food and Drug Administration, which before 1970 was the federal agency responsible for setting pesticide food tolerances, had exempted EDB in 1956 from tolerance requirements in the belief that all EDB residues evaporate from food before it is eaten.[244] This belief resulted from the fact that before the mid- to late 1970s, the available technology was not sophisticated enough to detect EDB residues in the small amounts, measured in parts per billion (ppb), in which those residues appear in food.

In 1977, EPA's Carcinogen Assessment Group labeled EDB as "likely to b carcinogenic to man,"[245] and the agency issued an RPAR on EDB.[246] In 1981, EPA found EDB residues ranging from .5 to 4,200 ppb in 21 out of 22 flour samples made from wheat fumigated with EDB, and discovered that an average of 35.7 ppb remained in biscuits baked from those 21 samples.[247]

However, it was not until the Florida Department of Health and Rehabilitative Services discovered EDB in groundwater in the summer of 1983 and in supermarket food samples that fall, and set its own tolerance for EDB food residues at an effective zero level, that the pesticide gained much public attention.[248] In the ensuing debate about what level of EDB in food, if any, is "safe," there was agreement on only one thing: we simply do not know for certain the extent of the potential cancer risk involved when humans are exposed to very low levels of EDB residues (measured in parts per billion) over very long periods of time (i.e., a human lifetime). There was also agreement that we cannot precisely estimate any health risk resulting from exposure to small EDB residues over a much shorter period of time.

Consequently, there was heated disagreement over what level of EDB residues, if any, should be cause for removing food from supermarket shelves. The central issue was how to weigh the unknown health risk from the residues against the economic costs of declaring food to be unsalable. This issue has arisen in the past when unintentional environmental contaminants have been discovered in food: the Food and Drug Administration has had to decide what to do about mercury-contaminated swordfish in several states, Kepone-contaminated fish in Virginia, and PBB-contaminated meat and dairy products in Michigan. In each case, setting a zero allowable level for detectable residues would have

resulted in shutting down an entire industry.[249]

7.2 REGULATORY RESPONSIBILITIES

Responsibility for protecting the public from potential health hazards created by pesticide residues in food is divided among five federal and state agencies, whose duties are described in turn.

The federal *Environmental Protection Agency (EPA)* determines which pesticides may legally be used in the United States, and sets standards (tolerance levels) for amounts of pesticide residues allowed in raw agricultural commodities (such as wheat) and in processed foods (such as bread or breakfast cereal). Food containing more than the allowable amount of any pesticide is treated as "adulterated" under the Federal Food, Drug, and Cosmetic Act (FFDCA), and may not be sold in interstate commerce.

Before 1970, this tolerance-setting power belonged to the Food and Drug Administration under a 1954 amendment to the FFDCA. The 1970 administrative reorganization that created the Environmental Protection Agency transferred this responsibility to EPA.

EPA may exempt a pesticide ingredient from all tolerance requirements if the agency determines that "such a tolerance is not necessary to protect the public health." This may occur if EPA decides (as the FDA did in 1956 concerning EDB) that the substance in question leaves no detectable residue in food, or if the substance is "generally recognized, among experts qualified by scientific training and experience to evaluate the safety of pesticide chemicals, as safe for use."[250]

The federal *Food and Drug Administration (FDA)* has responsibility fo enforcing the tolerances set by EPA, by preventing the sale of foods containing pesticide residues greater than the tolerance limit. However, FDA only has jurisdiction over food sold in interstate commerce. If FDA discovers a sample of contaminated food that it can prove has been shipped or is being prepared for shipment in interstate commerce, the agency must first obtain an order in federal district court before it can stop the sale of the food. By then, frequently, the food has already been sold. Alternatively, FDA can notify the state agency with jurisdiction over the matter (usually the state health department) and have it take enforcement action.[251]

FDA also has the power to set tolerances for food "additives." Pesticides, however, do not count as food additives unless the concentration of the pesticide increases as the food is processed, or unless the pesticide is introduced into the food deliberately, instead of being an unwanted but unavoidable by-product of pesticide use on food crops or in manufacturing establishments.[252]

When food is found to be contaminated by a harmful substance that does not have a tolerance (an environmental contaminant such as mercury, or a pesticide which was not issued a tolerance because it was not believed to leave any residues), FDA has the power to set an "action level" specifying the maximum level of the substance permitted in food sold in interstate commerce. Although "action levels" are technically not tolerances (because the contaminant 1. is not a pesticide; or 2. is a pesticide, but was not assigned a tolerance through the prescribed tolerance-setting process), they are treated the same for enforcement purposes.[253]

The U.S. Department of Agriculture (USDA) tests meat and poultry for the 143 pesticides and animal drugs known to leave detectable residues in those food products. This program takes samples from 1 in 8,000 livestock and 1 in 700,000 the poultry placed on the market. However, USDA does not test for a number of possible cancer-causing substances known to leave residues in meat.[254]

This leaves the *Texas Department of Health (TDH)* as the primary agency responsible for safeguarding Texans from pesticide residues in food produced and sold within the state. Under the Texas Food, Drug, and Cosmetic Act (TFDCA), whose provisions are similar to those of FFDCA, TDH has the authority to set pesticide residue tolerances for all food produced or sold in Texas. TDH also enforces TFDCA and has the power, under the "tagging" process, to stop immediately the sale of food items its inspectors find to be "adulterated" under the provisions of the Act. By a slightly more time-consuming process that operates through the courts, TDH may also require sellers to destroy the offending food and may compel food manufacturers to recall adulterated food from stores.

The fact that TDH sets pesticide residue tolerances in Texas means that it has the power to establish more stringent legal limits for those residues than those set by EPA. However, for reasons discussed below, TDH has not chosen to exercise that power.

By denying or canceling the registration of the offending pesticide, the *Texas Department of Agriculture (TDA)* has the power to safeguard consumers from hazardous residues of that pesticide on Texas-grown food. However, TDA

has no direct enforcement power to protect people from contamination of fo grown outside the state.

Although TDA has regulatory control over unharvested food crops, the exact jurisdictional boundary between TDA and TDH gets fuzzy once the food is harvested and removed from the location where it is grown. This is true especially for food crops, such as wheat, that are still in their raw (unprocessed) form, and which are not normally eaten in that form.[255]

7.3 FEDERAL LAW AND THE FEDERAL TOLERANCE SYSTEM

The FFDCA, as it has been interpreted by regulators and the courts over the past thirty years, divides potential dietary health risks into two groups: compounds that are a natural part of the food itself, such as oxalic acid in rhubarb or caffeine in coffee, tea, and chocolate; and substances that are "added" to food, either deliberately or accidentally, as a result of human activity. Naturally occurring compounds in food are treated as safe if they don't "ordinarily" render the food injurious to health. "Added" substances, on the other hand, are considered dangerous if they possibly "may" cause a health hazard. What these subtleties of wording mean in practice is that "added" substances, not surprisingly, are subject to a more stringent standard than naturally occurring substances.[256]

Within the class of "added" substances, the act in turn distinguishes between two categories:

1. purely optional added substances (food additives, such as artificial flavorings and colorings) which the seller may put in or leave out at his or her convenience;

2. substances that are "required in the production (of food) or cannot be avoided by good manufacturing practice . . ."; pesticide

residues and environmental contaminants (such as mercury and PCBs) both fit in this latter category of "unavoidable" food contaminants.

The act treats potentially carcinogenic substances in each of these two categories differently. For food additives, which fit into the former category, the law is clear: "No additive shall be deemed to be safe if it is found to induce cancer when ingested by man or animal, or if it is found, after tests which are appropriate for the evaluation of the safety of food additives, to induce cancer in man or animal." (This is the so-called Delaney Clause.)[257]

Thus, food with any detectable level of a possibly cancer-causing additive is automatically considered "adulterated" and may not be sold in interstate commerce.

An analogous rule for pesticides would ban the sale of food containing detectable residues of any pesticide that shows the ability to induce cancer in experimental animals at some dose level. That would in effect cancel the use of all those pesticides on food crops, an action Congress has not been willing to take.

Instead, the FFDCA empowers EPA to specify acceptable nonzero levels of pesticide residues in raw agricultural commodities (fresh-grown, unprocessed food). The act further states that food "shall not be deemed unsafe if such residue . . . has been removed to the extent possible in good manufacturing practice and the concentration of such residue in the processed food when ready to eat is not greater than the tolerance prescribed for the raw

agricultural commodity."[258]

If the residue level is higher in the processed food than in the raw commodity, EPA may still approve the higher level by classifying the pesticide residue as a food additive under section 409 of the act. The Delaney clause, however, prohibits any such classification for residues of a carcinogenic pesticide.

EPA may also exempt a particular pesticide from any tolerance limit whatsoever if residues of that pesticide do not show up in food in detectable levels, or if EPA deems such tolerance to be "not necessary to protect the public health" for some other reason.[259]

Since any pesticide that leaves residues on food must have either a tolerance or an exemption from a tolerance, a company seeking to register a new pesticide for use on a food crop also typically simultaneously petitions EPA for such a tolerance or exemption, and submits data supporting its application. The information the company is expected to submit includes the results of animal experiments conducted at the company's expense, and the results of field tests in which company-employed scientists measure the residues left on crops at harvest time after the pesticide is applied according to the instructions on the proposed label. Generally, the company will request that EPA approve a tolerance level 50-100 percent above the residue level measured in this field test.

In setting the tolerance, EPA is required to

> give appropriate consideration, among other relevant factors, (1)

> to the necessity for the production of an adequate, wholesome, and economical food supply; (2) to the other ways in which the consumer may be affected by the same pesticide chemical or by other related substances that are poisonous or deleterious; and (3) to the opinion of the Secretary of Agriculture . . . [EPA] may establish the tolerance applicable with respect to the use of any pesticide chemical in or on any raw agricultural commodity at zero level if the scientific data before the Secretary does not justify the establishment of a greater tolerance.[260]

How does EPA actually assess what residue level is safe for human consumption? In general, EPA attempts to determine how much residue is "safe" for a person to consume in a day's food (the Acceptable Daily Intake, or ADI). EPA then sets the tolerance, using USDA surveys of Americans' food consumption patterns, so that an individual would be extremely unlikely to consume more than this "acceptable" amount.

EPA determines the ADI, in turn, by determining what concentration of pesticide produced no observed adverse effect on experimental animals (the No Observed Effect Level, or NOEL), and dividing that amount by a safety factor of 100. The custom of using 100 as a safety factor began in 1954, when FDA issued a Proposed Rulemaking Notice that stated:

> In predicting the quantity of a poisonous or deleterious substance that may be consumed over a long period without hazard to man, it is reasonable and advisable to assume that:
>
> a) Man is ten times more prone to injury from the substance than other species of warm-blooded animals.
>
> b) The most sensitive men are ten times more susceptible to injury from the substance than the average man.

Although EPA has used safety factors between 10 and 2000 in the past to calculate ADIs, the use of 100 is so common than EPA generally feels called on

to justify in detail the choice of a different safety factor.[261]

A second safety factor comes from EPA's use of a "worst case" assumption that all the prepared food one eats was made from raw agricultural commodities containing residues at their tolerance limit, and that none of these residues dissipated in the food preparation process.

It should be apparent, however, that EPA's method of comparing "acceptable" residue consumption with projections of actual consumption depends on accurate estimates of how much of each kind of food different groups of people actually eat. If, for example, EPA sets tolerances for pesticide residues on avocados assuming that the average person eats only one-half avocado per year, and you eat two avocados per week, you may consume more pesticide than EPA is allowing for. In fact, many of the older tolerances were based on a 1965 survey of U.S. eating patterns that gave average consumption figures such as these:[262]

Produce	Estimated Consumption for One Year
Avocados	.36 lbs (half an avocado)
Brussel Sprouts	.36 lbs. (about one serving)
Cantaloupe	6.2 lbs. (3 cantaloupes)
Eggplant	.36 lbs. (about one serving)
Spinach	.58 lbs. (1/3 of a bunch)

Currently, EPA is in the midst of overhauling its system for estimating individuals' intake of pesticide residue. This year EPA obtained computer tapes containing information from a 1978-79 USDA survey of food consumption

patterns of 33,000 U.S. families. Computerization makes it easier for EPA to generate data, not only on "average" consumption levels, but on food consumption patterns of atypical groups in the population, and to factor in the statistical uncertainty resulting from the small size of some of these atypical groups in the sample. For "newer" registrations and for the reregistration of older pesticides, EPA is taking atypical as well as typical food consumption patterns into account.[263]

Deciding how to weigh the various possible risks and where to draw the line between "acceptable" and "unacceptable" risk, however, still entails judgments within EPA. Decisions tend to be made on a case-by-case basis, using informal guidelines that are nowhere written down.[264]

Formally, the tolerance-setting process works as follows:

1. When a company first submits a pesticide to EPA for registration, it is required to propose a tolerance for that pesticide, submit test results demonstrating that applying the pesticide according to label instructions will not cause that tolerance to be exceeded, and provide data from additional tests on the pesticide ingredients' ability to cause cancer, mutations, birth defects, or sterility in experimental animals. A notice of the proposed tolerance appears in the Federal Register.

2. The Registration Division refers the pesticide to the Hazard Evaluation Division, which must assess risks, and the Benefits and Use Division, which evaluates the pesticide's efficacy and its potential economic benefits. Risk assessment is shared among four branches within Hazard Evaluation:

    a. The Residue Chemistry Branch runs tests to verify the amount of residue (including chemical breakdown products) that remains when the pesticide is applied according to the label directions, and determines whether the analytical method proposed by the company for detecting those residues actually works.

    b. The Toxicology Branch examines the dietary and toxic effects data and makes a judgment about what human health risks

result from pesticide residues at the tolerance level. It is this branch which compares the expected dietary consumption of the pesticide by different groups in the population to its own calculation of an acceptable daily intake of that pesticide.

c. The Environmental Fate Branch determines how persistent the residues and their breakdown products are in the environment: whether, for example, the chemical may be expected to show up in groundwater six months later if soil conditions are right.

d. The Ecological Effects Branch determines the possible effects of these residues on other animal and plant species.

3. These divisions report their findings back to Registration, which makes a decision whether to recommend that the tolerance be granted or not. This decision must be approved by the head of the Office of Pesticide Programs (the next higher level in EPA above Registration); after another publication of the tolerance in the Federal Register and a usually uneventful sixty-day comment period, the tolerance goes into effect. Occasionally, a particularly politically sensitive issue (such as the EDB "guidelines") will be decided by the administrator of EPA.

We now turn to the two agencies mainly responsible for enforcing these tolerances in Texas food: the U.S. Food and Drug Administration and the Texas Department of Health.

7.4 FDA'S FOOD INSPECTION PROGRAM

Working out of its Dallas laboratory, FDA gathers approximately 300 samples of Texas food per year to test for pesticide residues.[265] Most of these are samples of citrus and other produce collected at packing sheds, but occasionally the agency takes samples directly from farms. In deciding which food items to sample, top priority goes to milk and eggs, which are widely consumed; and to crops that have been found most often in the recent past to contain residues in excess of tolerance. A second priority is placed on those food crops that are produced in largest volume.

The laboratory tests for residues of four broad categories of pesticides:

1. Chlorinated hydrocarbons, such as DDT and dieldrin, many of which have been banned but still persist in the environment in the United States (and are still legal in many countries outside the United States);
2. Organophosphates, which are less persistent but more acutely toxic;
3. Carbamates, a family of pesticides which the laboratory looks for because they are so widely used;
4. Synthetic pyrethrins, a number of which have been put on the market and heavily promoted recently.

Chapter 8 contains a more complete discussion of these families of pesticide ingredients and their acute health effects.

As of 1980, these FDA "multiresidue tests" were capable of detecting between 20 and 35 percent of the pesticide active ingredients then on the market.[266] However, the supervisor of FDA's Dallas laboratory stated that he would have difficulty supplying current exact figures for how many residues present broad-spectrum tests can detect.[267]

Approximately 2-3 percent of the samples tested in FDA's Dallas laboratory are found to contain residues above legal tolerances. The problem is slightly greater for produce imported from Mexico: approximately 5 percent of those samples are found to be in violation. Among Texas-grown crops, leafy green vegetables are more often found in violation than either citrus fruits or root crops.[268]

When it finds a sample with residues exceeding the tolerance, FDA may take enforcement action if it can show that the food is being prepared for

interstate shipment, or was brought in from outside the state. Th "enforcement action" consists of seeking a court order to enable FDA to seize the food if the manufacturer does not voluntarily recall it. Alternatively, FDA may notify TDA, which has enforcement jurisdiction over food in the fields, or TDH, which has jurisdiction once the food has been taken from the farm and put on sale elsewhere.

For a commodity imported from outside the United States with a particularly persistent history of residue violations, FDA may invoke its "certification procedure." This is done by notifying U.S. customs to hold all shipments of the commodity in question at the border until FDA can test a sample from the shipment and give that shipment a certificate of compliance with all pesticide tolerances. FDA used this procedure most recently in 1982-3 in the case of Mexican strawberries. This enforcement tool is not available to FDA, however, in the case of domestically produced agricultural commodities.[269]

FDA classifies food recalls into three categories, depending on the perceived hazard if the food is consumed. Class I recalls are for products that may cause serious injury or death; food containing botulinal toxin would fit in this category. Class II recalls involve food that may cause "a temporary health problem, or pose only a slight threat of a serious nature." Class III recalls cover food that is "unlikely to cause any adverse health reaction, but that [is] in violation of FDA regulations." An example might be margarine that is mislabeled as butter. FDA monitors compliance with class I recalls more closely than class III recalls; in the case of a class I court-ordered recall, the agency is likely to inspect every store to which the offending product was distributed, whereas occasional spot checks are

considered sufficient to confirm that a class III item was taken off the market.[270]

7.5 TDH'S PROGRAM FOR MONITORING FOOD SAFETY

TDH has the primary responsibility for protecting Texans from food hazards of all sorts. TDH's program centers on inspections of food producing establishments by sanitarians trained to spot potential health problems. Since "food producing establishments" may consist of anything from a major cannery or meat packing plant to a small neighborhood bakery, TDH's approximately thirty sanitarians, most of whom work out of one of TDH's ten regional offices, concentrate on inspecting the largest enterprises most frequently. According to the agency's director of food programs, the person in charge of the inspection program, TDH's sanitarians attempt to visit every large plant in the state at least once a year (more often if the plant has a history of violations), and to visit even small food-producing establishments once every two years. Inspection of supermarkets, restaurants, and fast-food establishments is lower on TDH's priority list.[271]

A thorough inspection of a large food-producing plant may take up to a day. When a sanitarian visits a plant, he or she examines all areas of the plant for routes by which food contamination might take place. If pesticides are used in or around the establishment, the owners are required to keep records of that use to show to the sanitarian. On a routine visit, the sanitarian is expected to look at those records and verify that any restricted-use pesticides are applied properly under the supervision of a commercial applicator. However, sanitarians do not generally take food samples to be spot-checked for pesticides unless they have a specific reason to suspect that pesticides in the plant were incorrectly applied.

These procedures, and the two- to three-year on-the-job training proce: that sanitarians undergo,[272] make the sanitarian likely to find possible routes of food contamination by microorganisms, molds or yeast, insects, rodents, or other biological agents. Moreover, TDH routinely spot-checks around 3,500 food samples a year for contamination by these causes. However, this process is extremely unlikely to discover food contamination by pesticides in excess of their tolerance limits unless the contamination resulted from use of the pesticides within the plant itself.[273]

Moreover, TDH has no separate program for routine spot checking of food for pesticide residues. The department's laboratory facilities in Austin test one or two food samples a month for pesticide residues, and the majority of these samples are submitted by physicians requesting tests of food consumed by their patients.[274]

The director of food programs at TDH stated that his division does not currently have enough personnel to conduct a program to spot-check food for residues and estimated that ten additional sanitarians and four or five additional laboratory personnel would be needed to carry out a full-scale spot-checking program.[275] Commissioner of Health Robert Bernstein has stated that he does not think that monitoring of food for pesticide residues is necessary on a routine basis.[276]

When TDH finds that a food contains pesticide residues above tolerance limits or is otherwise adulterated, it has an enforcement process that FDA lacks: the TDH inspector can, as soon as he or she sees any indication that a lot of food may be contaminated, "tag" the food with a notice of detention on

the spot.[277] This temporarily bars the sale of that food until laboratory tests are run and a court order obtained mandating that the food be destroyed. The court may also rule that the food may be sold, but must carry a warning label. During the court proceeding, the burden of proof is on TDH to show that the food is adulterated in a way that may render it injurious to health. TDH may also seek an injunction restraining the food producer from violations of the adulterated or misbranded food provisions of TFDCA.[278]

TDH may also force a manufacturer to recall a specified batch or batches of food. This is done by threatening, if the food is not recalled, to have the local district attorney or the state attorney general prosecute the offender under section 32.42 of the Texas Penal Code (hich covers "Deceptive Business Practices") for deceptively marketing adulterated food as clean food. If a food manufacturer commits a particularly flagrant violation of TFDCA, or is a repeat violator of same, TDH is especially likely to seek the use of section 32.42.[279] Conviction under this section is a class A misdemeanor carrying a maximum penalty of one year's imprisonment and/or a $2,000 fine. The stiffest penalty that may be levied for violations of the TFDCA is a $200 fine. Generally, the simple threat of invoking section 32.42 is sufficient to persuade the manufacturer to recall the shipments in question.[280]

TDH's policy is to detain and seek the removal of food whose sale would create a "public health emergency."[281] Food contamination by possible disease-causing biological agents is regarded prima facie as a potential public health emergency. TDH's program also reflects a societal consensus that food contaminated with mold, putrefying bacteria, insect larvae, or rat urine or feces is unfit for human consumption.

When food contains small quantities of possibly carcinogenic chemicals tha pose a chronic health risk of uncertain magnitude, on the other hand, TDH's criteria for determining a public health emergency are much less clear. Here, too, TDH's lack of explicitly stated guidelines reflects a lack of consensus in society and among the scientific community about what sort of weight to give to these uncertain hazards. Currently TDH lacks explicitly, spelled out criteria for weighing risks against benefits, although a study group within the agency is now working on such criteria.[282] TDH's Food Division uses FDA's class I, II, and III criteria for classifying hazards, which distinguish between products that "could cause serious health problems or death" and those that "cause a temporary health problem, or pose only a slight threat of a serious nature."[283] Dr. Bernstein stated that epidemiological studies of humans exposed to a chemical provide the most convincing evidence of that chemical's threat to health;[284] experiments performed on animals closely related to humans, such as chimpanzees, provide slightly less convincing evidence; and experiments which feed very large doses of a chemical to animals less closely related to humans, such as rats and mice, provide fairly unconvincing evidence of human health risk unless those experiments are corroborated by other studies such as the epidemiological ones.[285] TDH also relies heavily on the reactions and opinions of federal agencies, particularly EPA and FDA, in order to decide what to do.

Although TFDCA (whose rules on pesticides are basically identical to those in the federal statute) gives TDH the legal authority to set its own tolerances for pesticide residues, in no instance has TDH done so.[286] Instead, TDH uses the federally set tolerance as the state standard. This means that in instances where no federal tolerance has been set or a federal exemption from

tolerance has been granted, there is also no state tolerance for the pesticide in question. TDH's administrators contend that for states to set such standards subjects food processors to numerous different tolerance standards instead of one national standard, thus imposing an unfair economic burden on the industry. Moreover, these administrators do not think that they have enough specialists in toxicology and risk-benefit analysis to be able to set such tolerances intelligently.[287]

How many people does TDH have available to assess the seriousness of chemical risks? Currently, the agency has two environmental epidemiologists it feels it can spare from other, short-term assignments such as investigating hepatitis outbreaks, and one of these can be spared only part-time to analyze chemical risks. (By contrast, the State of California has 65 people in the field of environmental epidemiology alone.) TDH likewise has no toxicologists; the agency's resources in this area are limited to two individuals, an ex-navy and an ex-air force physician, whose military training had some emphasis on toxicology. In addition, the agency has two public health technicians who can help with gathering data, and one biostatistician to help analyze the data.[288]

TDH has been unsuccessful in previous budget requests in convincing the legislature to fund more positions for environmental epidemiologists. In the 1979 legislative session, TDH requested three additional epidemiologists; in 1981, five epidemiologists; and in 1983, the agency requested that the legislature fund twelve such positions. None of these requests was granted.[289]

As part of its program for detecting cancer risks, since 1979 TDH has

collected statistical data from hospitals on cancer patients (a "statewide cancer registry"), in order to determine whether particular geographical, occupational, or demographic factors are associated with an unusually high incidence of cancer. With its present staff of data-collecting and epidemiological personnel, one TDH administrator estimates that the job of collecting these data from hospitals cannot be completed; the agency will simply fall further and further behind.[290]

Currently, TDH is planning an overall program to assess which chemicals pose the greatest hazards in the environment. Since this would entail doing a literature search on thousands of chemicals in addition to the 800 or so pesticide active ingredients, TDH is going to have to set priorities and investigate first the chemicals that it thinks are the most hazardous. In this endeavor TDH hopes to gain the assistance of experts at the University of Texas and the UT Medical School in San Antonio. The Health Department official in charge of planning this project estimates that to protect the public properly from environmental cancer risks, his agency needs to hire a minimum of fourteen additional environmental epidemiologists to gather and assess information from public sources and to conduct field epidemiological studies. In addition, the agency would like to hire one toxicologist and eighteen more people to gather information for the statewide cancer registry.[291]

TDH hopes to be able to pool resources with other state health departments to do some of this research. Such a sharing of effort is currently in the talking stage, but no definite dates have been set for starting it and no commitments of resources have been made. Likewise, TDH hopes to share more data on pesticide health effects with EPA and FDA, and to develop a more

cooperative relationship with TDA.[292]

7.6 OPTIONS

7.6.1 Enforcement

1. Other than FDA's limited sampling program and TDH's monitoring of food contamination by in-plant pesticide use, there is no routine enforcement of pesticide tolerance limits in Texas. The consequence of increased enforcement of these tolerances may be a reduction in the average pesticide residue content of food sold in the marketplace, as growers become more cautious about using pesticides on soon to be harvested crops.

The argument against expanding pesticide tolerance monitoring is that the existing levels of pesticide residues on food pose little threat to the consumer, because:

a. The tolerance limits already theoretically contain a wide safety margin.

b. If FDA's samples are representative of the crops currently being marketed, only 2-3 percent of those crops (and 5 percent of the Mexican crops) contain residues in excess of tolerance limits.

c. In the light of the above, scarce state health monitoring resources would be better spent elsewhere.

The principal argument for increased residue monitoring is that we need all the safety margin we can get, because of:

a. Incomplete knowledge about the full effects of many of the pesticides currently on the market (because of inadequate or incomplete testing data).

b. Uncertainty in the science of risk assessment, and the belief on the part of many scientists that there is no "safe" level of substances containing certain properties (such as oncogenicity and mutagenicity); lower exposure levels for a sufficiently large population reduce but do not eliminate the number of increased cancers caused by exposure to the substance.

c. Belief that, in the light of the above, a large weight should be assigned to the benefits of reducing the exposure of humans to pesticide residues in food.

2. The Texas Department of Health's policy of never setting an independent tolerance leaves the public unprotected when the federal tolerance-setting process fails to function properly. Until EPA's ten-year process of reviewing all federal tolerances is done, many of the current federal tolerances and exemptions from tolerances will continue to be based on missing or possibly erroneous data.

The arguments against TDH's setting independent tolerances are, first, that TDH lacks sufficient trained personnel (toxicologists and epidemiologists) to review the federal tolerances and that TDH's present staff is already busy performing higher-priority tasks; and second, that for states to impose their own tolerance standards places an unfair economic burden on firms selling food or pesticides in interstate commerce, a burden that is likely to be passed on to the consumer in the form of higher food prices.

The arguments in favor of state review of federal tolerances are that the public safety risks of failure to set state tolerances outweigh the economic costs, direct and indirect, of setting those tolerances and that it is TDH's job to lobby the legislature effectively for the additional personnel it may need to do the job properly.

Although TDH is the only agency with the power to set tolerances, TDA is the agency with the greater current interest in setting such tolerances. Consequently, TDA might consider conducting its own independent program to review tolerances and pass its findings and recommendations on to TDH. However, TDA itself lacks the personnel to carry out such a program and would probably need support from TDH to get a request for the necessary personnel through the legislature. TDA needs to assess what kind of review effort could be mounted with the small number of staff that are likely to be available, what outside resources (university researchers and "experts") might help out with the task, and whether such a review could produce useful results with a relatively small input of person-hours.

An alternative approach (to state review of federal tolerances) for protecting the public from carcinogenic or teratogenic pesticide residues would be for TDH to adopt, either as regulatory policy or as legislation to be sought from the state legislature, an automatic policy of zero food tolerance for any pesticide that has ever had a statistically significant and repeatable positive test for carcinogenicity in any animal experiment. Such a state "Delaney amendment" would in effect ban the use of any such pesticide on food crops. Alternatively, TDA could implement the same policy (but only for food grown in the state of Texas) by refusing to register any pesticide containing

such an ingredient. This last approach would, in effect, create a different policy for food brought in from outside the state from that applied to Texas-grown food.

The argument against the "Delaney amendment" option (assuming one agrees on the need for independent state action on pesticide tolerances in the first place) is that such a strategy would lack flexibility in dealing with cases in which a pesticide is strongly beneficial or "necessary" according to some set of criteria, but is an extremely weak carcinogen; that this policy might ban pesticides that are important in food production and lack adequate substitutes; and that since farmers in other states and outside the United States would continue to use the banned pesticides, the result of such a measure -- if it were strictly enforced -- would be a restriction of food imports into Texas and a consequent increase in food prices.

The argument in favor of this option is that even "weak" carcinogens may cause harm when a sufficiently large population is exposed to them and that the disadvantages of using such pesticides outweigh the disadvantages of not using them. Supporters of the option also tend to believe that the pesticides in question have adequate substitutes and that their economic importance has been exaggerated.

What both sides of the argument can agree on, however, is that the economic and environmental consequences of such a policy are difficult to judge when we lack adequate data on statewide patterns of pesticide use, the number of pesticides which fall into the category which would be banned, or the availability of alternatives to the prospectively banned pesticides.

3. The Texas Department of Health needs to develop better criteria for judging when chemical residues in food constitute a public health hazard. TDH's preferred tool for assessing these risks is analysis of epidemiological studies, because these provide the only direct data about the effects of a given substance in humans. However, epidemiological studies are only a useful tool when the population of exposed individuals can be clearly distinguished from an otherwise similar population of nonexposed individuals, and when sufficient time has elapsed (up to twenty or thirty years) to enable one to compare the long-term fate of both populations. If the experimental population studied is large, the difficulty of distinguishing exposed from unexposed individuals becomes greater; if the population studied is small (as in a study of worker exposure to carcinogens), the method becomes less sensitive: the chemical must produce excess cancers at a high rate in order for the results to be statistically significant.[293]

Consequently, adequate epidemiological studies on the effects of a given chemical are frequently unavailable. Federal agencies such as EPA, OSHA, and the Consumer Product Safety Commission accept the results of animal studies as sufficient evidence of a substance's carcinogenicity. These agencies accept the scientific argument that substances that cause cancer in one mammalian species are extremely likely to do so in others.

Thus, TDH needs to develop a set of explicit criteria for deciding when the evidence from animal studies, generally the most available source of evidence about a chemical's carcinogenic or toxic effects, is sufficient to require that action be taken. Arguably, these criteria ought to be issued in the form of regulations that would have the force of law.

The argument against issuing regulations embodying these criteria is that the existence of formal regulations will lead to more litigation about how the regulations should be interpreted, and this will cause the courts to become involved more frequently in issues that are highly technical in nature and thus beyond the courts' expertise. The counterargument to this is that, in the absence of adequate scientific methods of calculating risk, many decisions on what to do about specific chemical ingredients are going to be made in the political arena anyway, and courts are as good a "political" agency as any to make the choice.[294] A second counterargument is that the absence of precisely spelled out regulations is as likely to lead to litigation as their presence would be.

If one believes that TDH's standards for defining an emergency are inadequate, or that other agencies ought to be involved in making these decisions, one might favor legislation giving the power to remove food from supermarket shelves to an additional state agency, say, the State attorney general's office. The supporters of this position argue that TDH is unlikely to develop better criteria in the future; that the attorney general has, or can develop, better criteria for defining an emergency than those used by TDH; and that the attorney general is more likely to be responsive to pressure from concerned citizens. Those who disagree with this position say that TDH can develop, and is developing, adequate criteria for assessing hazards; that giving two agencies the same responsibility would lead to interagency squabbling and political rivalry with little benefit to public health; and that the proper target for citizen pressure should be the legislature.

4. TDH clearly lacks the personnel to carry out the ambitious assessment of

chemical hazards that it proposes to do. As noted above, the Health Department official in charge of planning this project estimates that to protect the public properly from environmental cancer risks, his agency should hire a minimum of fourteen additional environmental epidemiologists, one toxicologist and eighteen cancer registry data gatherers.[295]

7.6.2 Information and Coordination

1. TDA cannot adequately perform its registration function, or TDH its health-protecting function, without ready access to information such as:

a. What percentage of currently registered pesticide active or inert ingredients have had a positive test for the ability to cause cancer, genetic mutations, birth defects, or sterility, and what exactly was the outcome and statistical significance of those tests?

b. What specific data and criteria did EPA use to set tolerances for the pesticide active and inert ingredients currently approved for use in Texas?

c. What pesticide residues are present in food that the currently used broad-spectrum laboratory tests are not picking up, and that should be tested for separately?

d. What do EPA's data on food consumption (from the 1979 USDA survey) tell us about the exposure of different groups of Texas residents to pesticide residues in food? Do Texans' regionally distinctive dietary patterns result in any excessive exposure to those residues?

2. TDA and TDH need to clarify the fuzzy jurisdictional boundary between

them regarding regulation of pesticides in food. Since most of the fuzziness arises in the case of products (such as corn) that could be used either for human food (thus placing it under TDH's jurisdiction as soon as it leaves the field) or for animal feed (thus causing the product to remain under TDA's jurisdiction), the agencies could conclude an interagency agreement presuming such food crops to be intended for human consumption unless there is evidence to the contrary (thus placing the crops automatically under TDH's jurisdiction). Alternatively, the agreement could specify that these crops would remain under TDA's jurisdiction until they arrive at the loading dock of the food-processing plant or supermarket distribution warehouse, or until a bill of sale or shipment invoice is drawn up supplying the crop to such an outlet.

3. TDH needs to get the promised collaborative and information-sharing relationship of state health departments out of the talking stage. In constructing an arrangement for pooling these departments' resources to review the existing literature on chemical hazards, TDH must consider how to gain commitments of resources from state health departments in a situation in which "free riders" (noncontributing health departments) benefit as much from the information as do those health departments that contribute.

7.7 OPTIONS FOR TDA

7.7.1 Enforcement

1. Work with TDH to develop a program of routine sampling of food for pesticide residues. Seek funding from the legislature for such a program; in the meantime, appoint someone in TDA to look into the extent to which such a program can be conducted with available resources, with or without the

cooperation of TDH.

Convincing the legislature to fund a program for spot-checking food is likely to be difficult, unless TDA can gain TDH's full endorsement of the necessity for such a program. (TDH would be the logical agency to operate such a program, since it is already the state agency primarily responsible for inspecting food.) If a spot-checking program were implemented on a scale substantially larger than FDA's program of gathering 300 samples per year (as Dennis Baker estimated, 2,000 samples a year could be gathered and tested with a workforce of 15 people), the wider scale of enforcement could lead to more conservative use of pesticides close to harvest time, with consequent health benefits to farmworkers and the public, possible cost savings to farmers due to decreased pesticide use, and possible cost increases to farmers due to increased pest damage.

Measured according to this study's goals and criteria, the strengths and weaknesses of a spot-checking program are as follows:

Strengths	Weaknesses
safety benefits	political feasibility
minimization of pesticide use	resource requirements
data production efficiency	
adaptability	
effectiveness	
accountability	

(The resource costs of simply studying this option are, of course, much smaller.)

2. Set up a committee within TDA (or a joint committee with TDH) to review the literature and research results on the compounds that EPA has not yet reviewed, with the possibility of setting tolerances lower than EPA's tolerances. Have TDA's newly hired toxicologist produce an estimate of how many trained personnel (toxicologists, statisticians, epidemiologists) are needed to carry out such a program properly. If TDH is not interested in a joint effort to review tolerances, seek enough resources from the state legislature for TDA to carry out such a program on its own. If TDH is interested in such an effort, work out a division of labor between the two agencies and a cooperative lobbying effort based on that division of labor: TDA lobbies for TDH's desired expansion of its epidemiological and data-gathering staff, and TDH in turn supports TDA's request for more toxicologists to evaluate EPA's old pesticide data.

TDH's primary interest in epidemiological studies and TDA's complementary interest in evaluating the toxicological data on old pesticides are a logical basis for a division of labor between the two agencies. The recent history of feuding between the two agencies will make it more difficult for TDA and TDH to put together a cooperative effort, but will make any joint lobbying by the two agencies all the more effective. (Legislators will be impressed if the two feuding agencies agree on the necesssity for Budget Item X.)

Since a review of all the pesticide active and inert ingredients registered for use in Texas is likely to be costly in time and resources, TDA (and TDH, if it is involved in the effort) will have to establish priorities among the compounds to be reviewed, looking at only a few "highest priority" pesticide ingredients at a time. (Establishing these priorities is another instance

where pesticide use data would come in handy.) The reliability and effectiveness of such an effort will depend on TDA's ability to gain enough trained personnel to carry out the review properly.

Strengths	Weaknesses
safety benefits	resource requirements
data production	political feasibility
adaptability	
checks and balances	
accountability	

3. Urge TDH to adopt a zero tolerance level for residues of carcinogenic or teratogenic pesticides in food; alternatively, seek legislation (a state "Delaney amendment") enforcing a zero tolerance level for such residues.

This option would rank high on the scale of protecting the consumer from the possible risks of pesticide residues in food. Its overall safety impact, therefore, would be positive unless it resulted in the substitution of pesticides whose acute toxicity was higher, thus increasing the safety risk to applicators. This option is probably almost totally unfeasible politically, would carry an uncertain economic cost (because we don't know the effect it would have on pesticide use patterns in Texas, or on food imports into Texas, or on overall food costs), and would require the prior or simultaneous implementation of option 1 (a spot-checking program), with accompanying resource costs, to be properly enforced.

Strengths	Weaknesses
safety benefits	political feasibility
reliability	resource requirements
effectiveness	adaptability
	economic benefits

4. Work with TDH to develop a better set of criteria for what constitutes a public health emergency requiring the removal of food from supermarket shelves. Encourage TDH to issue formal regulations embodying these criteria.

The first half of this option should improve the public safety, and the second should increase TDH's accountability to the political process, as others outside the Health Department gain a better understanding of what TDH's criteria actually are. On the other hand, TDA and TDH may find it difficult to agree on what the proper criteria ought to be. It is uncertain whether the issuance of formal regulations would lead to more litigation (with accompanying resource costs to TDH and short-term uncertainty about what the policy will turn out to be) than would the absence of such regulations. Over the long run, having a set of regulations and a series of court interpretations of those regulations should improve the reliability and predictability of TDH's policies, which should benefit food manufacturers and (if the regulations are adequate) the public as well.

Strengths	Weaknesses
stability	adaptability
reliability	resource requirements
checks and balances	
accountability	
economic benefits	

5. Seek legislation empowering the attorney general's office, or TDA itself, to "tag" or detain food that those agencies find to be adulterated.

This option would promote agency accountability and the creation of checks and balances, because it would provide an alternative to TDH that people could go to if they were concerned about pesticide residues in food. However, this

option would probably lead to more open animosity between TDA and TDH in the next legislative session, and therefore is probably in conflict with option 2.

Strengths	Weaknesses
safety benefits	economic costs
adaptability	resource requirements
accountability	stability
checks and balances	political feasibility

6. Seek legislation empowering TDA (in addition to TDH) to set tolerances for pesticide residues in food.

This option has basically the same strengths and weaknesses as option 5.

7.7.2 Information and Coordination

7. Have EPA compile and supply a list of the currently registered pesticide active or inert ingredients that have had a positive test for the ability to cause cancer, genetic mutations, birth defects, or sterility; place someone in TDA, preferably a trained toxicologist, in charge of obtaining (when necessary) and evaluating the specific test data on those ingredients.

Assuming that TDA chooses to begin reevaluating federal tolerances, obtaining this information would give TDA one criterion it could use in establishing priorities on which pesticides to reevaluate first. Prior acquisition of this information could help TDA decide if it needs to re-evaluate the federal tolerances in the first place. The only possible problem with this option is that getting this information out of EPA may turn out to be difficult and time consuming; or that the information itself may be in such raw form that TDA will have to hire additional toxicologists to evaluate it.

Strengths	Weaknesses
data production	political feasibility (?)
safety benefits	resource requirements (?)
accountability	

8. TDA's toxicologist(s) could also be in charge of finding out, in specific instances when TDA needs to know, the criteria EPA used to set specific tolerances.

The advantages and drawbacks of this option are similar to those for option 7.

9. Obtain from FDA a list of the pesticides it is currently capable of detecting with their multi-residue tests, and an account of how frequently it has used single-residue tests to search for pesticides that cannot be detected with the multi-residue tests.

This information would be important in designing a spot-checking program for pesticide residues in food, especially since one of the purposes of such a program would be to fill in "gaps" in FDA's enforcement program. This information also ought to be less difficult to obtain and evaluate than the information sought in options 7 and 8.

Strengths	Weaknesses
data production	
safety benefits	
accountability	
efficiency	

10. Assign a specific person within TDA to the job of developing better

contacts with other enforcement agencies (such as TDH, FDA, and EPA) and with university researchers.

More efficient communication with other agencies should, over the long run, enable TDA to make more efficient use of its in-house enforcement and information-gathering resources.

Strengths	Weaknesses
safety benefits	resource requirements
data production	(over the short run, but
efficiency	not over the long run)
adaptability	
effectiveness	
checks and balances	
accountability	

11. Conclude an interagency agreement with TDH clarifying the specific lines of jurisdiction between the two agencies. Seek legislation empowering TDA to "tag" or detain food, but only within this agreed-upon area of jurisdiction.

This option would avoid some of the interagency conflicts of options 5 and 6, while giving TDA effective enforcement power over food in its jurisdiction. Consequently, this option is relatively more politically feasible than those two options, and more consistent with the goals of option 2.

Since TDH begins its inspection process at the food-processing plant or packing shed, it would be logical for that agency's jurisdiction to begin there. This would give TDA the authority to spot check and detain food being transported between the field and its first destination.

Strengths	Weaknesses

safety benefits
resource requirements
stability
efficiency
adaptability
political feasibility (?)

12. Urge TDH to develop a more specific timetable and plan for its proposed arrangement for improving the sharing of information among state health agencies, and for conducting a jointly sponsored search of the available scientific literature on hazardous chemicals.

This amounts to telling TDH to do what it should already be doing; however, TDA may discover that TDH is not able to develop such a timetable because the cooperation of the state health agencies never materializes.

Strengths	Weaknesses
safety benefits	political feasibility (?)
efficiency	
accountability	

13. Urge the Extension Service to conduct a survey of pesticide use patterns designed to determine, among other things, whether farmers are using more hazardous pesticides when safer ones (or nonpesticide alternatives) are available. If the Extension Service is not interested, consider having TDA conduct such a survey itself.

This option would have advantages similar to those of options 7 and 8: TDA would better be able to determine which pesticides it needs to focus its regulatory attention on. If the cooperation of the Extension Service cannot be obtained, TDA might find it expensive to pay for such a survey itself.

Strengths	Weaknesses
safety benefits	resource requirements (?)
economic benefits	
data production	
minimization of pesticide use	
efficiency	
effectiveness	

8. HEALTH EFFECTS OF PESTICIDES ON AGRICULTURAL WORKERS

One of the most important questions about pesticides concerns their effects on the health of those who come into direct contact with them. Establishing a clear cause-and-effect relationship between pesticide exposure and health effects requires carefully controlled scientific studies which cannot be conducted under normal field or working conditions. Therefore, there are many unanswered scientific questions that underlie policy. Nevertheless, many people believe that it is important to take action on the basis of the evidence we now have, which suggests that there are serious health effects from at least some pesticide exposures. This chapter presents a summary of what is known about the health effects of pesticides and considers some existing programs. A wider range of scientific literature, further details on these programs and policy options, and a description of the agricultural population of Texas are found in a companion volume, *Pesticides and Worker Health in Texas*, whih is also obtainable from the Lyndon B. Johnson School of Public Affairs or from the Texas Department of Agriculture.

8.1 HEALTH EFFECTS OF PESTICIDE EXPOSURE

The potential health hazard of a pesticide depends on five factors:

1. the inherent toxicity of the active ingredient;
2. the chemical and physical properties of the active ingredient;
3. the duration of exposure;
4. the dose and/or concentration;
5. the route of absorption.[296]

By design, pesticides inhibit or interfere with certain basic physiologic functions of living organisms. The inherent toxicity to humans is a function

of the relative physical similarities between people and pests, combined with the fact that most pesticides are developed to kill a broad spectrum of organisms. The physical and chemical properties of some pesticides make them more hazardous in certain situations. Parathion, for example, changes to a more toxic chemical (paraoxon) at high temperatures. Pesticides can be categorized according to chemical structure, which in turn determines the nature of their toxic effects.

The dose and/or concentration of a pesticide is the most variable and most important factor in determining the potential health hazard. A relatively small amount of some pesticides may cause severe illness, while large doses of others may be fairly harmless. The duration of exposure helps determine the dose absorbed. Brief exposure to a concentrate could produce effects similar to a longer exposure to a more dilute pesticide.

The route of absorption is another factor that determines the health hazard of a pesticide. The three possible routes are ingestion, inhalation, and dermal absorption. Ingestion is usually the result of accidents, transfer of chemical to mouth from contaminated hands or cuffs, or dusts and sprays entering the mouth during application and generally has serious effects. Inhalation occurs mainly in confined spaces (warehouses, pesticide tanks) and usually causes less serious effects than ingestion. Dermal absorption is the most common method of occupational exposure, through accidental spills on clothing or skin, dusts and sprays settling on skin during application, or repair work on contaminated equipment, with effects that vary in relation to the amount, type, and site of pesticide absorption.

Pesticides can be categorized according to chemical structure, which in turn determines the nature of their toxic effects. Table 21 gives some examples of pesticides included in three of the most important pesticide families, organophosphates chlorinated hydrocarbons, and carbamates, and two older families. Similar data for other pesticide classes are also available.[297]

Organophosphates change the functioning of the enzyme acetylcholine at nerve endings by blocking acetylcholine degradation. As a result, there are abnormally sustained nerve impulses which can be fatal as control over bodily functions is lost.[298] Thus, these pesticides are called "cholinesterase-inhibiting." Chlorinated hydrocarbons interfere with the transmission of nerve impulses, disrupting the normal function of the nervous system, especially the brain. They are known for their persistence in the environment; they can remain active for two to twenty years after application. They are also readily stored in fat tissue, which promotes bioaccumulation, or the tendency to concentrate in tissues as the substance moves upward through the food chain. Like organophosphates, carbamates act upon acetylcholinesterase, inhibiting this enzyme's normal function of breaking down acetylcholine. The carbamyl-enzyme complex, however, breaks down readily. Thus, the inhibiting effect of carbamates is "reversible," which makes the confirmation of poisoning very difficult.

The possible effects of pesticide exposure can be divided into three categories:

1. acute exposure, or immediate identifiable response, such as poisoning or topical injuries;
2. chronic low exposure, such as occurs from exposure to pesticide residues on food, which may cause long-delayed health effects;

Table 21. Examples of Four Pesticide Types

Arsenical compounds	
Arsenic acid	Disodium methyl arsonate
Arsenic trioxide	Lead arsenate
Cacodylic acid	Methane arsonic acid
Calcium acid methanearsonate	Monoammonium methyl arsonate
Calcium arsenate	Monosodium methyl arsonate
Calcium arsenite	Sodium arsenate
Copper acetoarsenite	Sodium arsenite
Copper arsenite	
Chlorinated hydrocarbons	
Benzene hexachloride	Kepone
Chordane	Heptachlor
DDT	Hexachlorobenzene (HCB)
Dicofol (Kelthane)	Lindane (Isomer of BHC)
Dienochlor	Mirex
Dieldrin	Thiodan
Endrin	Toxaphene
Organophosphates	
Abate	Ethion
DDVP	Fenthion (Baytex)
Diazanon	Gardona
Dicathon	Malathion
Dimethoate	Naled (Dibrom)
Dursban	Parathion
EPN	
Carbamates	
Baygon	Vapam
Carbaryl (Sevin)	Zectran
Thiram	
Pyrethrins	
Allethrin	Fenpropanate
Barthrin	Fenvalerate
Bioresmethrin	Permethrin
Cypermethrin	Phthalthrin
Decamethrin	Resmethrin
Fenothrin	

Sources: U.S. Environmental Protection Agency, "Recognition and Management of Pesticides Poisonings," Technical Report EPA 540/9/80/005, January 1982; National Institute for Occupational Safety and Health, "Occupational Exposure during the Manufacture and Formulation of Pesticides," July 1978.

3. chronic high exposure, the long-term effects of more intense exposure to pesticides, which often occurs occupationally.

Occupationally exposed workers, including pesticide manufacturers and agricultural workers, are at risk in all three categories. The general public is also at risk in the first two categories. Pesticide accidents in the home or garden pose a risk of acute poisoning to individual urban users, while the public in general is chronically exposed to small amounts of pesticides in water, air, food, and clothing.

The symptoms of acute systemic poisoning are well understood and well known. Accurate diagnosis, however, is difficult, because symptoms of pesticide exposure mimic those of many other diseases, including cerebrovascular disease, cardiovascular disease, heat stroke, and pneumonia. In addition to these systemic symptoms, topical (local) effects of pesticide exposure, such as dermatitis or eye problems, are quite common among agricultural workers.

There is also evidence to suggest links between chronic pesticide exposure and serious delayed effects, which are usually termed "chronic." Unlike most acute toxic effects, these chronic effects tend to be irreversible. The liver is the organ most frequently damaged; however, irreversible damage to the central nervous system, the peripheral nerves, the kidneys, and other organs may occur. In addition to neurotoxicity, the major chronic effects may be classified as carcinogenetic, mutagenetic, teratogenetic, and reproductive. Most evidence on chronic effects must come from laboratory studies, the results of which are not always directly applicable to people. Even though these concerns limit the conclusiveness of any one study, the cumulative effect of so many studies suggests that the deleterious effects of chronic

pesticide exposure must be taken seriously.

8.1.1 Pesticides and Worker Health in Texas

Although there may be some question about chronic health effects of pesticide exposure, the symptoms associated with acute poisoning are widespread. Studies from other states are reported in the companion volume; here we report only evidence from Texas.

The data on pesticide poisonings have not been collected in a systematic way; in general, voluntary reportings by doctors, poison control centers, and hospitals underestimate the total incidence, since not all poisoning victims are seen by doctors and not all doctors report them. One early set of data showed that medical care was obtained for about 275 pesticide poisoning cases in the Valley from 1960 through 1966.[299] In 1964, 1965, and 1966 about 70 cases were reported.

From 1971 through 1976, Texas data are available from the *National Study of Hospital Admitted Pesticide Poisonings*. During that period, the number of hospital admitted poisonings decreased in the state. In 1971, there were an estimated 355 hospital cases; in 1976, the number had dropped to 256. Again, the number of poisonings treated outside a hospital, and the number not treated at all are simply not known. Another source of data on pesticide poisonings in Texas is the federally sponsored Pesticide Incidence Monitoring System, or PIMS. Founded by EPA as a voluntary program to gather a data base on pesticides from hospitals, doctors, and other medical centers, the program was initiated in Texas in 1977 in San Benito. In 1980, 2,335 calls were recorded from the five PIMS centers in the Southwest.[300] About 60 percent of the reports came from centers in Texas. Since PIMS centers accept and record

all calls whether substantiated or not, some critics argued that they were documenting incidents that would otherwise be dismissed for insufficient evidence. In the 1980 Texas PHAP summary, of the 2,335 total reports only 153 (6.5 percent) were confirmed as cases of a specific chemical leading to illness, death, or damage to property. In the other incidents, although potential hazards existed, no illness or damage was documented. One estimate is that only one of every ten or fifteen Hotline inquiries is a documented incident.[301] (As a result of this and other criticisms, the Reagan Administration drastically cut funding for PIMS. A revised PIMS program has been approved for 1984, however. Under this program, the state agency responsible for pesticide regulation would coordinate a multi-agency data collection effort. The new program also involves guidelines for assessing the validity of the incidents reported.)

In April 1980, a pesticide forum was convened in Pharr, Texas, by the National Rural Health Council of Rural America. The forum was attended by farmers and workers as well as representatives of all other interested groups, including manufacturers and officials from several levels of government.[302] The forum group did not attempt to estimate the number of poisonings cases occurring in the state. Rather, farmworkers submitted affidavits that further document the pesticide-related health problems in the Valley.

These affidavits, field studies conducted since 1980, and the records of several major pesticide exposure incidents in the state all confirm that Texans suffer in the same ways as other agricultural workers. Dermatitis, headaches, dizziness, and eye problems are widely reported. At the Pharr conference, for example, the health complaints due to pesticide exposure most

commonly mentioned were rashes and sores on the skin, headaches, and eye irritation. Other conditions detailed include nose bleeds; swollen hands, arms, faces, and eyes; vomiting; dizziness; difficulty in breathing; miscarriages; and chest pains. Two cases of permanent disability, loss of eyesight and amputation of a foot due to infection, were also described.

Similarly, preliminary analysis of a survey conducted in 1981 by the National Association of Farmworkers' Organizations "found that 80 percent were experiencing dermatitis linked to pesticide exposure, 40 percent suffered from chronic headaches, 51 percent complained of dizziness and 23 percent reported blurred vision. In a study funded jointly by the EPA and the National Academy of Science, 56 percent of the agricultural workers surveyed had abnormal liver and kidney functions, 78 percent reported chronic skin rash and 54 percent had chest cavity abnormalities."[303] Similar symptoms have been documented in several major pesticide exposure incidents. These incidents are important since they provide the most direct evidence of a causal relationship between pesticide exposure and health effects.

Verifying pesticide poisoning and connecting symptoms to particular pesticides is difficult for a variety of reasons. First, acute toxicity varies with a number of genetic and environmental factors, including route of exposure, the age, sex, and genetic susceptibility, ambient temperature, diet, absence or presence of other active compounds, and the duration of exposure.[304] Second, as noted, symptoms can mimic other disorders such as influenza. The tests used to diagnose the presence of pesticide poisoning are also problematic; this is discussed below. Third, a generally low standard of health reduces farmworkers' concerns about the specific effects of pesticide

exposure.[305] Finally, workers may not know exact locations in which they worked; this hampers attempts to confirm exposures to specific pesticides after the fact.[306] In 1970, the U.S. Department of Health, Education and Welfare estimated that 800 persons were killed and 800,000 injured annually as a result of pesticides.[307]

8.2 PRESENT POLICIES TO REDUCE EXPOSURE

Present policies are based on the assumption that exposure can be reduced enough to preserve the health of workers using pesticides. Most pesticide labels specify protective clothing that should be worn, and many also indicate a "reentry period," which is the amount of time after spraying before people should go back into the area. Both these options have disadvantages that make them difficult to use as the only means for reducing pesticide exposure.

8.2.1 Personal Hygiene

One of the simplest means of reducing exposure to pesticides is to wash them off. Perhaps the most salient point to emerge from a review of the literature is that washing is most effective immediately after exposure, and less effective as time goes on. This implies that to be effective, washing facilities must be very nearby, in the fields themselves. For example, washing one minute after exposure to parathion is capable of removing one-fourth to one-third of the pesticide. However, after more than one minute, washing is of little benefit.[308] A study of volunteers exposed to parathion found that a soap and water wash for thirty seconds removed only 36-48 percent of the remaining parathion if such cleaning was delayed for six hours.[309] In fact, some evidence suggests that washing four hours after exposure to malathion and eight hours after exposure to parathion may actually increase dermal absorption.[310]

In light of these findings, NIOSH has advised that washing methods and facilities should be designed to minimize recontamination or exposure. It recommends foot-operated faucets, individual-use towels, dispensable soap, and nonabrasive detergents. The employer needs to take responsibility not only for providing these facilities but for selection of soap, since frequent cleaning increases dermal absorption of pesticides. Creams which counteract this effect should be available.[311] The Texas Department of Health has recently promulgated standards for field sanitation facilities that come close to those described by NIOSH. Farmers in Texas who comply with the regulations will provide a means for workers to wash, but the extent to which washing is effective will depend on many factors not controllable by the department or employers.

8.2.2 Protective Clothing

Protective clothing is specified on most pesticide labels as a means of reducing the effects of exposure. Under federal law, protective clothing may mean as little as a long-sleeved shirt and long pants, but includes more impermeable clothing. In general, impermeable protective clothing for farmworkers is not feasible since high temperatures usually require the worker to dress lightly just to dissipate body heat.[312] Furthermore, there is some question about the effectiveness of such clothing. One study found that additional rubberized clothing offered no extra protection against dermal absorption.[313]

More important is the finding that covered skin may absorb more pesticide than uncovered skin. For example, one study found that while the bare palm of the hand absorbed about 11.8 percent of a given amount of applied parathion, the hand absorbed 31.6 percent if "protected" by a canvas glove for a period

of eight hours.[314]

The California Department of Health has recommended wearing nonwoven laminar-treated clothing, which is reportedly lightweight, disposable, cool to wear in hot climates and less permeable to pesticides than tightly woven cotton material. It has also been reported that, based on urinary metabolite measurements, workers wearing clothing (shirts, pants, socks, and shoes) dipped in a silicone solution sustained less exposure than workers wearing untreated clothing.[315]

8.2.3 Reentry

Another way to safeguard farmworkers against the hazards of exposure to pesticide residues is to prohibit entry into treated fields for a period of time during which residues are presumed to decay to "safe" levels.[316] Reentry periods are established by EPA as part of the registration process and are subject to many of the same scientific uncertainties as other aspects of our understanding of pesticides. Because of these problems, EPA has specified reentry intervals for only twelve active ingredients. However, workers not wearing protective clothing should not be permitted to enter a treated area until sprays have dried or dust settled. Reentry periods also present a variety of problems in implementation, discussed in more detail in the section on policy options in this chapter.

Data on reentry incidents that would confirm or disprove their effectiveness in maintaining worker health are difficult to obtain. Between 1966 and 1979, EPA classified only 86 of 25,500 pesticide incident reports as reentry incidents; of these, 39 involved nonfieldworkers. One study of 47 of the fieldworker reentry incidents in nine states (Texas was not one of them) found

that reentry problems tended to cluster around particular pesticides. Incidents of exposure to carbamate, aldicarb, and sulfur occur within four days of application; chlorinated hydrocarbon incidents have occurred with same-day or next-day reentry into treated areas. However, organophosphate incidents have been linked to reentry incidents up to 120 days after application, or well beyond a reasonable reentry period. These delayed reentry incidents have been limited primarily to the use of the insecticides parathion and dialifor in California.

Despite the absence of authoritative scientific evidence for specific reentry periods, it appears to be common sense that people should not enter an area where pesticides have been recently used. One day is widely accepted as a period that allows pesticide residues to dissipate. The policy options section includes a discussion of some administrative questions associated with a reentry requirement.

8.3 MONITORING PESTICIDE EXPOSURE

Farmworkers and applicators of pesticides are exposed to substances that we know are dangerous. Programs that monitor this exposure can help to achieve several of the goals of pesticide programs, including protection of agricultural workers, public health, and the environment, and can assist in enforcing other programs designed to achieve these same goals. If health monitoring, for example, reveals that workers are exposed to high levels of pesticides, this information could be used as the basis for enforcing existing regulations or to show that those regulations are inadequate. At the same time, many of the gaps in the existing information about the health effects of pesticide exposure can be filled by a health monitoring program with good record-keeping facilities. Thus, while monitoring itself is conducted after

the fact, it can form the basis for future preventative measures.

There are three kinds of health monitoring activities: recording acute pesticide poisoning incidents, monitoring exposure levels of workers, and keeping records over long periods of time to discover chronic health effects. We already record many acute pesticide poisoning incidents. Counting them tells us whether the present system is working. The efficacy of this method depends on the abilities of doctors to recognize pesticide poisoning; the wide variety of symptoms makes this difficult. If appropriate care is provided, the worker's health is improved and new data are gathered; at the same time, the data may serve as the basis for an enforcement action.

Monitoring exposure levels of workers can itself be achieved in two very different ways. One way is simply to measure environmental residues of pesticides; this allows us to infer exposure to people living or working in a residue-ridden area. The other is to take samples of blood or urine from workers and test them for evidence of exposure. Each form of monitoring has advantages and drawbacks.

8.3.1 Residue Monitoring

Monitoring for residues entails taking samples from affected fields or other areas, running residue tests, and comparing the results to existing standards. Not only are resources required for obtaining samples (although this could be part of routine inspections), but determining which pesticides are present and in what amount is very expensive and time consuming and not always accurate. Nevertheless, this system is used in several places, including California, which monitors air and collects residue samples from crops.[317] At present, TDA does not monitor the exposure levels of pesticides or pesticide residues

with which farmworkers are likely to come in contact except in response to a complaint.

8.3.2 Biological Monitoring

Biological monitoring detects not the pesticides but the evidence of their presence in the body. Cholinesterase monitoring tests a portion of the blood; the other common form of biological monitoring is urine metabolite testing. The 1974 study by the Presidential Task Group on Occupational Exposure to Pesticides concluded that the safety of farmworkers hinged, not on the availability and effectiveness of emergency medical care, but rather on the preventive measures taken. Prevention requires some form of medical surveillance. The study argued that monitoring the activity of cholinesterase enzymes in plasma and erythrocytes (red blood cells or RBC) is the best available technique for detecting the clinical effects of pesticide exposure, and it recommended a program to monitor blood cholinesterase activity levels on a weekly basis.[318]

The establishment of individual baseline values of cholinesterase activity during the off-season is essential to interpreting cholinesterase test results. Subsequent periodic testing would allow detection of significant exposure whenever an individual's level of cholinesterase decreased appreciably relative to his or her baseline level.[319] However, true baseline values for cholinesterase levels may be difficult to achieve for people who work with pesticides on a routine basis. For this reason, baseline data should be limited to those workers who have been out of the fields for at least one week.[320]

As with so many other facets of pesticide health effects, the conclusions to

be drawn from cholinesterase testing are disputed because of the absence of basic scientific knowledge about the meaning of depressed cholinesterase levels. In addition to these scientific uncertainties, implementation of a cholinesterase monitoring presents a number of serious difficulties. These are discussed in the policy options section. Despite these difficulties and the scientific uncertainties, biological monitoring is the only way to build a data base which will allow accurate correlation of pesticide exposure with health effects. Some of the scientific problems can be overcome by using a related technique for monitoring pesticide exposure -- urine metabolite analysis. This technique is superior to cholinesterase monitoring because it simplifies sample collection, reduces the need for stringent standards of processing, and eliminates much of the guesswork in interpreting the significance of findings.[321]

California has a cholinesterase and urine monitoring program. The three geographical study teams in California which measure pesticide residues and air levels of pesticides also are responsible for biological sampling to quantify known pesticide metabolites in urine and blood samples. However, this testing is generally done in response to a problem or complaint, rather than routinely. Cholinesterase testing thus has been used more as a diagnostic tool than as a monitoring action.

Cholinesterase testing on a routine basis has recently been initiated in federally sponsored migrant worker health clinics in Texas.[322] A test is performed on any patient who exhibits pesticide poisoning symptoms, and on anyone who has worked in a field up to seven days prior to the clinic visit.

The testing program is still in the initial stage of development. Clinic personnel were trained during 1982 and 1983, and clinics began testing as equipment was received during 1983. By November 1983, only eleven of the sixteen clinics in the state had begun testing. The number of tests per clinic ranges from 4 to 432. (The wide range is due to the differing start-up dates of each clinic's program.) The total number of tests performed by November 1983 was 952. Of these, only 4 showed abnormal levels, with 1 patient requiring hospitalization. It should be emphasized that the data are acknowledged to be questionable, sinced clinic personnel were still relatively unfamiliar with testing equipment and testing procedures in general in 1983.[323] The program has also been criticized for under-participation. Because farmworkers are reluctant to undergo testing, many do not "confess" that they have been in the field within seven days.[324]

The lab in San Benito, Texas, will soon begin a urinary metabolites screening system at the migrant worker clinic in Hidalgo (the Hidalgo County Health Corporation). Since the urine metabolite test is more sophisticated than the cholinesterase test, it will be used as a check on the validity of the cholinesterase testing program. The Hidalgo County clinic was chosen because of its proximity to the San Benito lab, since the urine metabolite test must be done within 72 hours of suspected exposure.

8.4 NEW TDA POLICIES

Until December 8, 1983, there was no program or office within TDA with a specific emphasis on farmworkers. The TDA complaint form did not include health problems as one of the reasons for reporting a complaint. In December 1983 the first Farmworker Safety Pesticide Task Force was established. Headed by Ed Gutierrez, newly appointed coordinator of the Farmworker Program, the

task force is an internal group whose purpose is to gather information from throughout the state on ways to improve farmworker conditions. Members of the task force include representatives of the enforcement area of TDA's Agricultural and Environmental Sciences Division (Ken Kadlec), the assistant deputy for Regulatory and Consumer Services (Ron White), legal counsel (Jim Butler and Delores Alvarez Hibbs), and the supervisor of field operation (Lamarcus Johnson).

Initially, four areas have been under consideration for immediate action: worker protection standards, farmworker education, applicator training, and modification of labeling on pesticides. The group sponsored informal hearings around the state in order to solicit opinions from a variety of sources on how TDA can modify or develop farmworker regulations. A report incorporating the testimony was developed by the Farmworker Safety Pesticide Task Force and must be submitted to the agriculture commissioner for approval. If it is approved, the TDA will publish proposed regulations in the Texas Register for notice and comment and through the administrative process new regulations will be adopted, probably by May 1984.[325]

Public education is a priority for the Farmworker Program. Pamphlets in both Spanish and English, videotapes for public clinics and farmworker organizations, and public service announcements for rural TV and radio are some of the ways TDA will be alerting workers and their families to potential hazards. A statewide hotline for pesticide calls was proposed which could help disseminate information, document incidences of health problems, and notify TDA investigators of possible problems that need attention.

8.5 POLICY OPTIONS

8.5.1 Usage Data

Texans do not have reliable basic information on pesticides in the state. Texas has no program like that of California for assessing how much of any particular chemical is used even on a county by county basis.[326] As we have noted, there is also no consistent reporting of health problems caused by pesticidal chemicals. Effective regulation depends on accurate knowledge of the locations where pesticides are being applied and on dependable monitoring of the health of people working with these compounds.

The California Department of Food and the California Department of Agriculture have a pesticide use report with which a farm operator must document each pesticide application, its dosage and volume, the crop treated and location, and the date and time of application for every pesticide that has a reentry safety interval assigned by the state.[327] This record-keeping system can then be used when investigating reported misuse or overexposure. Texas now requires dealers to document and save for two years records of their sales of restricted pesticides.[328] Dealers do not routinely have to submit these figures to TDA, although TDA does have the right of access. Texas law also requires licensed applicators to maintain records of pesticide use, with the amount of detail at the discretion of the agency.[329] Again, a copy must be sent to TDA if requested. Without going beyond its existing authority, TDA could require these forms to be sent in. Coded and entered on the computer, the data could form the basis for improved regulation.

8.5.2 Medical Data

Usage data are not enough for a complete assessment of problems caused by pesticides. The State also needs adequate systems of reporting health and safety complaints by workers affected by the chemicals. As described above, existing voluntary systems for obtaining data are unreliable. California has overcome this problem in part through a system that allows an employed worker to go to any physician and get examined for any illness or injury the worker believes is work-related. The physician must submit the work injury form in order to be reimbursed for the examination, regardless of the diagnosis. Texas might adopt a similar system which provides an incentive to health care providers that would encourage better documentation of incidents, or TDA could make pesticide health complaint reports mandatory. The advantage of the incentive method is that enforcement is built into the system, whereas a mandatory system entails significant enforcement costs.

Applicators and/or growers could also be held legally responsible for providing health care to workers exposed to pesticides, again alerting the medical community to incidents of pesticide-related health complaints. Each employer would make arrangements with a physician to treat any cases of poisoning experienced by workers. This requirement would put a financial burden on the employers, yet provide added incentive to them to assure a safe work environment for employees who use toxic substances. There will be more incentive to obtain accurate reports of acute pesticide poisoning if workman's compensation is extended to agricultural workers.

Physicians and other health care personnel would need to be trained in the proper diagnosis and treatment of pesticide complaints; the protocol for such

training already exists in numerous programs run for migrant clinics, which are described in appendix A of the companion volume, *Pesticides and Worker Health in Texas*. The Department of Agriculture, the Department of Health, or the State Board of Medical Examiners could distribute information to county health associations at minimal cost (relative to the benefits) for dissemination throughout the state. A strong commitment from each of these organizations would be necessary in order to ensure adequate training and interest on the part of individual health care personnel throughout the state. One approach could include pesticide-related health training in continuing education requirements for physicians.

TDA has considered setting up a state hotline which would be widely publicized so that even individuals not likely to get medical attention could obtain some aid. In addition to giving information about treatment, the hotline personnel could document reported symptoms and which chemicals were involved, although accurate information will be difficult to obtain over the telephone. Such a system is relatively inexpensive to operate, but requires wide publicity to succeed.

All these plans will improve reporting of acute pesticide poisonings, but will not monitor chronic illnesses. Biological monitoring is almost the only way to achieve that goal.

8.5.3 Regulating Farmworkers' Exposure: Reentry

The risk of exposure to pesticide poisoning is greatest at the time of application. For this reason it is generally agreed that farmworkers and others should not be in or immediately adjacent to these fields during the time of application. There is disagreement and some lack of knowledge as to

when farmworkers should be permitted or obliged to "reenter" the fields following application.

Three policy options for reentry are: 1. continue the present (EPA based) system, 2. monitor residue levels prior to permitting reentry, and 3. adopt reentry intervals based on specific toxicity, residue behavior, and exposure mechanisms as they exist in agricultural areas within Texas.

The present regulatory strategy is to prohibit entry into treated fields for some prescribed period of time during which residues are presumed to decay to "safe" levels. However, there are guidelines for only a few chemicals and the data on which these are based are old. An environmental monitoring system, such as the one used in California, actually measures existing residues. Again, the absence of underlying scientific data on residue levels, especially ones that are acceptable in the specific climate of Texas, may reduce the utility of this kind of program.

The flexible reentry option assumes that reentry regulations should vary as the risk of exposure varies. This regulatory strategy also requires a sound scientific understanding of the variables that affect reentry times, including crop, pesticide, weather, and other human and environmental factors. TDA's toxicologist proposes to undertake the necessary research. He estimates that with a small staff and a modest budget most of the Texas-specific reentry data base could be realized in about two or three years.

A flexible reentry strategy recognizes the changing character of pesticide residues. Some areas and some pesticide-crop settings in Texas at some times

of the year may require very stringent reentry intervals (as is the case in California). Special reentry regulations may be needed to the extent that agricultural areas in Texas have the following conditions:

1. very dry periods -- especially around harvest time;
2. extended dry periods and a large quantity of particulate matter below 50 micrometers;
3. high use of organophosphates -- especially parathion and dialifor;
4. special considerations such as crop pest management practices, work practices, and labor relations.

8.5.3.1 Implementation Issues

Once a general reentry strategy is adopted, several specific issues in implementation arise. Two of the most important of these are the way in which time intervals are defined and posting.

It may be more practical and enforceable to specify reentry intervals in terms of "working days" rather than "24- or 48-hour periods." Requiring a minimum of one full working day between application and reentry might eliminate substantial regulatory guesswork in investigating any complaints of violations. For instance, a field treated late in the afternoon on Tuesday could not be entered until Thursday morning. Most importantly, the full working day buffer ensures that the 24-hour period cannot be compressed.

Posting supplements reentry regulations by informing workers of areas affected by reentry requirements. One possibility is to require "posting notices" to be aired over the radio or published in the newspaper to inform local residents what substances are scheduled to be applied in specific areas. This unusual procedure is similar to one used to announce public hearings, but

would probably have a more limited audience, especially among workers, and would require a detailed knowledge of local land ownership to be effective.

A more common procedure is to require signs or flags in fields. Growers may object to signs and flags because of their cost, because their liability for damages when signs are stolen or deteriorated is unclear, and because there is no clear evidence that posting is effective. Advocates of posting say that workers have a right to know the risks to which they are exposed and argue that without posting reentry regulations are ineffective.

One decision that affects the cost of posting is the specificity of the notices. Pesticide-specific signs would require that a more extensive inventory of signs be kept on hand. A more reasonable and manageable approach might be a color or code number to signify only the class of pesticide used (e.g., organophosphate). This, of course, would require an effort to educate farmworkers about the significance of the color or number. But any posting strategy would require some corresponding educational program.

Another decision that affects costs is the placement of notices. Costs can also be expected to be higher the closer together signs are required to be placed. It seems reasonable that all fields should have signs posted at well-defined entry points (e.g., gates, if fenced) and corners. Perimeter posting at some fixed distance may serve no added useful purpose with very large, open fields that have multiple entry points if some lesser number of signs strategically placed at access roads and junctions provides adequate notice.

8.5.4 Biological Monitoring

We have discussed the ways in which biological monitoring can serve to protect worker health directly by discouraging further exposure and to provide a set of data for monitoring exposure over long periods. In assessing monitoring options, it is important to remember that it is a post hoc method that can detect pesticide exposure only after it has occurred. Its role in prevention is limited to telling exposed workers not to be further exposed. It could play a role in enforcement as well, with consistently lowered cholinesterase levels indicating that existing regulations are not being followed or are inadequate.

The testing options can be listed on a continuum of frequency:

1. Require those tests as diagnostic measures whenever a person reports symptoms of pesticide poisoning, or when an accident happens which may have resulted in pesticide exposure.

2. Require routine biological monitoring--cholinesterase testing or urinary metabolite testing--for all workers who use or might reasonably be expected to come into contact with pesticides that cause the biological changes that these monitoring tools detect.

3. Design a plan of comprehensive medical surveillance for all those who use or come into contact with pesticides in their work. Such a plan would include, but not be limited to, routine cholinesterase or urinary metabolite testing. It would also include regular general physical examinations, and more specific testing for possible chronic effects of pesticides (cytogenetic testing, for example).

Results of these kinds of programs could be used in several ways:

1. Reporting of adverse findings to TDA. This reporting would have limited use for prosecution of violations, but could be used to obtain post-marketing information for registration reviews.

2. Tie enforcement actions to the results of tests. If routine monitoring of workers' cholinesterases levels at a particular site indicated unacceptable exposure to pesticides, then TDA would conduct more frequent and thorough inspections at that place,

and/or impose sanctions. Or, if TDA found a violation, and at the same time workers were showing changes in cholinesterase levels, then TDA would move the violation into a more serious category.

3. Require farmworkers to carry a card specifying their baseline cholinesterase value; farmers would not be allowed to put a farmworker into the field unless his current cholinesterase level was at or near his baseline level.[330]

4. Require the employer to provide a genuine alternative to working at the same hazardous job for workers found to have unacceptable cholinesterase levels. One option would be to require the employer to provide an opportunity to transfer to another available and comparable job (not offering something the worker can't do or wouldn't want to do) at the same rate of pay. Another would be to guarantee workers' compensation. (This generally only covers lost work time of a week or more, however.)

5. Provide a mechanism to ensure that the worker will not face or fear retaliation from the employer for submitting to these tests or seeking medical care.

There are a variety of problems with implementing any of these programs of biological monitoring. The main one is that people are usually not anxious to have blood or urine samples taken. This disadvantage is compounded by the fact that the altered level of cholinesterase is not a health problem in itself, just an indication that there may be a problem. Thus, individuals have few incentives to submit to testing. Furthermore, there are few if any treatments to be offered if tests show depressed cholinesterase levels; the treatment is to limit exposure until normal healing processes occur. If limited exposure means not working, most people will choose to work. Finally, one of the major advantages of this kind of invasive monitoring is to build up data on which to base future action. There is very little incentive for individuals to undergo unpleasant procedures for the public good.

The major incentive to participate in a program is that the workers will learn when they are seriously at risk. With so many disincentives, however, a

program might have to be mandatory to succeed. This creates a terrible administrative burden and puts the onus on the workers to comply.

Employers similarly have absolutely no incentives to provide monitoring or encourage employees to participate in programs unless monitoring is linked to enforcement. Even if fines and sanctions could be issued on the basis of testing, the fact that workers move from field to field would make assignment of responsibility to a particular employer extremely difficult. The possibility that sanctions could be invoked would actually give employers incentives to discourage workers from submitting to tests.

9. CONCLUSIONS

This report has explored a variety of topics relating to pesticide regulation in Texas. It has not explored every aspect of this topic; nevertheless, the findings allow some general conclusions about the state of pesticide regulation in Texas. This chapter presents those conclusions in four parts. The first section assesses the overall regulation program according to the criteria and goals outlined in chapter 1. The subsequent sections consider more specific topics: consistency, intergovernmental and interagency coordination, and what information is needed to implement a good program of pesticide regulation following a general evaluation of Texas' current program.

9.1 PROGRAM EVALUATION

In FIFRA and its amendments, Congress assigned the primary responsibility for pesticide regulation to a federal agency, now EPA. In 1910, Congress gave the federal government a role because states were derelict in ensuring that consumers received effective pest control from the formulations they purchased. The federal role became stronger and stronger through 1972. In 1978, the trend changed; state powers were increased. This change came about in part because of the recognition that a central agency cannot take into account all special local conditions. The strong federal role was retained, however, to ensure consistency of regulation and to limit the duplication of effort and especially of data collection that is entailed for adequate regulation of pesticides.

The primary criterion for assessing a state pesticide program is, therefore, whether it is successful in tailoring regulation to the particular conditions of the state. This study suggests that Texas is probably not very successful

in meeting this goal, although a full evaluation is impossible without additional data. Evidence from several chapters supports this statement:

1. Texas does not require applicants for special local needs registrations under Section 24(c) of FIFRA to submit data about Texas conditions.

2. Texas does not collect information on amounts or kinds of pesticides used in the state.

3. Texas does not acquire information on the health effects of pesticides under the sustained hot and dry conditions prevailing in the state.

4. Texas does not acquire information about the pesticide residues remaining on crops and in food under the unusually dry conditions prevailing here.

5. Texas does not acquire information about resistence, which is likely to develop with use as intensive as that prevailing in the state.

6. Texas has not developed an urban pesticide program despite the fact that the tropical climate of many of the urban areas of the state are conducive to the growth of insect populations undesirable to urban dwellers, as well as of insect populations that are vectors for public health problems.

7. Texas does not have an independent program for establishing pesticide tolerances that reflect dietary patterns unique to the state.

Structuring a policy to meet special local conditions entails first characterizing them to see whether they are different, and then determining appropriate responses to those differences. The findings of this study suggest that information does not exist to characterize differences, so that appropriate responses cannot be formulated. Thus, we question whether the state program is fulfilling its primary mission of responsiveness to local conditions.

Chapter 1 also outlined several other goals of pesticide regulation

generally; these include protecting human health and the environment and increasing agricultural yields. The chapters above suggested that Texas is not fulfilling the health and environmental goals any better than EPA or the country at large, mainly because the Texas program does not differ in any significant ways from EPA's program. That states can exceed these minimum national standards in collecting and using state-level information is confirmed especially by the California pesticide regulation program, but also by the programs of other states; we noted Maine's close oversight of aerial application and the careful review of special registrations conducted by Florida and many other states.

In addition to describing the various goals of a pesticide regulation program, chapter 1 listed a series of administrative criteria for judging policy alternatives. These same criteria can be invoked to assess Texas' current pesticide regulation program.

One of these criteria is adaptability. Throughout the study, we have mentioned actions currently being taken by TDA that suggest at least some flexibility and adaptability within the agency and the program. The new complaint form that allows inspectors to report human and environmental damage as well as crop damage, the newly formed committee on farmworker health, and computerization of a variety of data, including those from complaint forms, all attest to the agency's willingness to make changes and to incorporate some flexibility into programs.

On the other hand, current pesticide regulation programs seem to be characterized by a low degree of representation of a variety of interests in

decisionmaking. Negotiations about violations, for example, do not usually involve others who may have been harmed, nor are there provisions for several interests to be represented during the evaluation of requests for special local needs or emergency registrations. While the Agricultural Extension Service, which is closely involved in several aspects of pesticide regulation, may in some sense be said to represent farmers, it does not participate in either of these two activities. Farmworkers have even less representation.

We have also implied in several places that the resources presently devoted to pesticide regulation are inadequate to the complex tasks facing the agency. Seven urban and seventeen rural inspectors obviously cannot do an adequate job of overseeing thousands of farmers and millions of urban pesticide users. Thirty sanitarians are not adequate for thorough policing of pesticide residues found on food in Texas. The political feasibility of obtaining additional resources for pesticide regulation is probably quite low, however.

In sum, Texas' current pesticide regulation program is improving but is at best an uninspired and underfunded effort that has in the past succeeded neither in responding to local needs nor in protecting human health and the environment especially effectively. In the following section, we examine one further characteristic of pesticide regulation in more detail.

9.2 CONSISTENCY

One of the criteria for assessing a program which we have not yet mentioned is consistency or reliability. Perhaps the most outstanding feature of the Texas pesticide regulation effort is its lack of consistency or reliability.

There are several features of the program that hinder consistency. First,

Texas is perhaps unique among the states in having two different laws that regulate chemicals to kill pests: the pesticide law and the herbicide law. The overlapping jurisdictions of these laws, the lack of training of local law enforcement officials in matters relating to pesticides, the dependence on many different local officials both for establishing the areas in which the herbicide law will have effect and for providing inspectors to oversee its implementation, and the fact that requirements for public notification differ between the two laws all combine to make consistent regulation of pesticides virtually impossible in Texas.

Another inconsistency virtually built into the statutes is the difference between urban and rural pesticide use embodied in the different mandates and actions of the Structural Pest Control Board and TDA. SPCB can oversee only commercial applicators, while TDA's jurisdiction covers all kinds of applicators. SPCB has been very restrained in implementing its mandate as well; it has not promulgated any rules and seldom applies penalties to applicators under its jurisdiction.

Another statutory source of inconsistency is the authority given to the Texas Department of Health to license and certify applicators of pesticides intended to control health-related pests, especially mosquitoes and rodents, and to oversee residues in food produced and sold within the state. TDA, of course, licenses most other applicators and may conduct tests to determine whether certain foods contain pesticide residues.

In addition to these problems of institutional coordination that arise from Texas law, there are problems of coordination between federal and state

agencies. In addition to EPA, the Food and Drug Administration, which enforces tolerances for pesticide residues on food in interstate commerce, and the Federal Aviation Administration, which partially certifies aerial applicators, are both important actors in pesticide regulation and may take actions that overlap or contradict those of state agencies. Table 22 summarizes the various powers of the several agencies.

The statutory arrangements in Texas for many kinds of regulation are characterized by similar overlaps and lacunae. In pesticide regulation, however, there are also inconsistencies in implementation of the program that seriously affect its quality. The following list includes examples that have been given in more detail in the preceding chapters.

1. Dealers must maintain data about restricted-use pesticides sold but need not submit it.
2. Pesticide inspectors both enforce the law and attempt to educate people about it.
3. Private applicators of restricted-use pesticides are subject to different requirements than other applicators (this is partly a function of federal law).
4. There are no guidelines for imposing consistent settlements on violators of the pesticide act.
5. Urban and rural applicators are subject to different rules.
6. Pesticide residues on food raised and sold within Texas are treated differently from pesticide residues on food sold in interstate commerce.

While perfect consistency is neither necessary nor desirable, the many sources of inconsistency in the pesticide program could lead reasonable observers to conclude that it is unfair. Inconsistencies among statutes can

Table 22. Areas of Concern of Pesticide Regulatory Agencies

	HEALTH	FOOD	AERIAL APPLICATION	LICENSING & CERTIFICATION	SPECIAL REGISTRATION	URBAN	ENFORCEMENT
TDA	X	X	X	X	X	X	X
EPA		X		X	X	X	X
TDH	X	X		X		X	
SPCB	X			X		X	X
FDA		X					
USDA		X					
FAA			X				
A&M Ext.			X	X	X	X	
Tx. Animal Health Comm.				X			
Tx. Water Quality Board				X			

Source: Compiled by authors.

only be remedied by the legislature. Inconsistencies in implementation, however, can be partially remedied within TDA. This requires the setting of guidelines or criteria, the meeting of which will trigger certain regulatory action.

The checks and balances of the rulemaking process necessitate that such criteria or guidelines rest on sound scientific information. For example, tolerances in food should be set on the basis of health effects observed in laboratory animals. We discussed some possible guidelines for imposition of sanctions for violators of the regulations. Unfortunately, the necessary information -- laboratory tests, numbers of infractions, nature and extent of harm -- is frequently unavailable. In the following section, we consider what information TDA should obtain in order to improve its pesticide regulation program.

9.3 INFORMATION NEEDS FOR PESTICIDE REGULATION

Information is a critical component of policymaking. As suggested, it forms the basis of rational rulemaking. If policies are formulated in the absence of appropriate information, their effectiveness will depend upon good fortune alone. In the chapter on enforcement, we noted another important use of information -- to provide the basis for evaluation of existing programs. Information about the success of existing programs is used to determine whether refinements of those programs or completely new approaches are required, and a feedback loop is formed. Many federal programs require that a certain proportion of expenditures be used to acquire such evaluative data.

Information is not costless. Agencies must decide what information is worth acquiring, and what information they can do without. In fact, most

policymaking is done in the absence of complete information. We can characterize two conflicting attitudes toward information acquisition (and subsequent action) by regulatory agencies. Some people argue that if no problem has manifested itself, then information should not be gathered to document that a problem exists. This philosophy may be summarized as "if it ain't broke, don't fix it." On the opposite end of the spectrum is the philosophy of risk aversion, or "better safe than sorry," which holds that there are often very serious dangers of which we do not become aware until a great deal of damage has been done. Any action that poses a risk of great harm would be required to establish its safety according to some criteria and would be monitored carefully. Safety can only be documented through extensive information about the substance in question.

TDA must, of course, balance these two arguments. Pesticide regulation at the federal level is already characterized by the tremendous information requirements imposed on applicants. It could be argued, therefore, that TDA need not acquire any further information; indeed, TDA's registration process does not call for any additional information, and even the special registrations do not impose too many additional information requirements on applicants.

Nevertheless, one of the major findings of this study is that TDA needs to obtain some additional information. In particular, we found that we could not evaluate the effectiveness of the present program, nor could we accurately estimate the effects of possible policy alternatives because of the absence of so much of the necessary information. Computerization of complaint forms and of the special registrations should alleviate some of this problem, but even

this will not be adequate to allow TDA or future researchers to evaluate the efficacy of current programs.

To do so, TDA should obtain, analyze, and publicize pesticide use data. Such data would include amounts and kinds of pesticides used, by whom, and application methods employed. This information would enable TDA to analyze the effectiveness of its program in each of the areas discussed in this report. It could ascertain the degree of correlation between the incidence of health problems in certain areas and the patterns of pesticide usage. It would also enable TDA to target enforcement efforts more effectively and efficiently. Pesticide use data should also aid personnel in the special registration program. The agency would be better able to 1. evaluate applications for special registration; 2. determine whether the need for special registrations arises from pesticide use patterns; and 3. monitor possible harmful effects of special registration pesticides. In addition, applicator certification efforts can be effectively designed and evaluated only with reliable data on pesticide uses. The characteristics of persistence and concentration of pesticides used in urban environments result in an even greater necessity for pesticide use data in these areas. Finally, basic pesticide use data are a prerequisite for any efforts to regulate pesticide residues in foods.

Representatives of pesticide production companies have expressed their opposition to such a requirement. Chemical company opposition to TDA compilation of use data rests on several arguments. One of the most important is that such information is or should be protected as a trade secret of the company, and collection of it could jeopardize the company's market

positions. Although protection of trade secrets is explicitly provided under FIFRA[331], the federal statute also provides that the state agency may require producers to submit copies of records "showing the delivery, movement, or holding of such pesticide or device, including the quantity, the date of shipment and receipt, and the name of the consignor and consignee."[332] Whatever competitive value use data may have for pesticide producers is almost certainly outweighed by the public good that could result from making that information available to TDA and to the public.

Opposition to collection of these data also rests on a fear of misuse of the information by environmentalists, including the publication of the data and a consequent increase in public unrest. The case study of EDB suggests that press coverage may create a public outcry for a policy to regulate a particular substance that is inconsistent with treatment of similar substances or would better be applied to a whole class of substances. Proponents of data collection argue that it is often ignorance that breeds fear, and that consistent collection of data about all pesticides will reduce the likelihood of sporadic, intense public calls for immediate government action -- the "chemical of the month" syndrome.

Another argument against collecting data on pesticide use is that both collection and analysis are very expensive. In fact, the costs of collection should not be too high, since much of the necessary information is already collected. Pesticide distributors and applicators are already required under both federal[333] and state[334] law to keep records of pesticide sales and uses. Further, state law specifies that TDA may require that a copy of such records be furnished by the license holder to the department in response to a written

request to that effect[335]. A TDA interdepartmental memo concluded that the department may require all licensees to furnish TDA with such records for restricted-use and state-limited-use pesticides through the promulgation of regulations, but that the compilation of general-use pesticide records would require the amendment of state law. The herbicide law also requires applicants to maintain records. In many cases, therefore, the major additional cost will be mailing to Austin records already required to be kept. For other pesticides, there will be costs entailed in developing records of sales and use.

Analysis of data will be a new cost of the program. However, TDA's new computer system should minimize the difficulties of entering and aggregating the data. The offsetting benefits of collecting this information are great, as we have suggested, allowing the agency to distribute the limited resources allocated to pesticide regulation to meet the most pressing needs. Furthermore, if pesticides offer few risks, as their proponents argue, then the availability of use data will only confirm this contention. Information can be the basis of deregulation as well as of new regulation.

This study has identified other kinds of information that would also be useful in improving pesticide regulation. For example, knowing the long-term effects of pesticide residues in food, the health effects of long-term, low-dose exposure, appropriate reentry periods, or the rates of application at which pests build resistance would allow the most appropriate application of regulations. However, obtaining these data is costly, and the applicability of the data goes well beyond the borders of Texas. We have suggested, therefore, that Texas should join with other states to urge EPA to facilitate

additional studies that would benefit pesticide regulators at all levels of government. Another class of studies, however, are those that pertain to special conditions in Texas. Action of herbicides in alkaline soils or degradation of pesticide residues under very hot and dry conditions are factors that may be especially pertinent to this state. Federal law gives states power to regulate pesticides specifically in order that they may be responsive to such conditions. TDA should consider asking the Extension Service to conduct basic research on these questions and should also consider asking manufacturers to submit this data as part of the Texas procedures for both regular and special pesticide registrations.

In sum, information forms the basis of sound regulation. Of all the information that is needed to allow a state program to be appropriate to the state's own needs, pesticide use data are the most important. This information would be useful in assessing the effectiveness of existing programs as well as in formulating appropriate new reponses.

9.4 INFORMATION DISSEMINATION

In addition to determining that the Texas pesticide regulation program suffers from both legislative and administrative inconsistencies and from a lack of data, our study has also confirmed that information provision is a critical component of pesticide regulation. It is impossible to monitor the actions of hundreds of thousands of pesticide users in their homes and offices and on their farms. In the final analysis, therefore, safe pesticide use depends on the goodwill and understanding of all those users. The pesticide label serves as the primary means of imparting product-specific information to users, but there are other means of providing information as well. We have focused on these in many of our chapters, especially those on urban use,

applicator certification, and aerial application, since commercial applicators constitute an important subcategory of users whose sound application practices will make an important contribution to overall pesticide safety.

In addition to imposing strong information requirements on licensed applicators, TDA can assist in providing information to other groups as well. Urban users constitute such a diversified group that reaching them may be difficult; television spots might be of use. Again, TDA might consider working with other states to get EPA to develop a more effective program for household users. Other very important users are farmers, who make over a million decisions about pesticide use annually.[336] There are very few studies of the way in which farmers make decisions about pesticides; of the few that have been made, most indicate that pesticide sales personnel are the most influential source of information.[337] A study conducted in 1983 by Texas A&M University found that county agents, newspapers/magazines, and pesticide salespeople were all important sources of information; this survey did not, however, ask users which source was the "most important" as did the others.[338]

In order to collect our own data on the subject, we interviewed rural pesticide users in an agricultural community in northeast Texas. Since dairy farming is prevalent in the area, most of the eleven interviewees were dairyfarmers. Our results differed from the others, because nine respondents stated that county agents were the most important source of pesticide information; conversely, several expressed some distrust of pesticide salespeople. The county agent confirmed the importance of his role in helping farmers determine which pesticides to use, attributing some of that importance to the fact that these farms are small or moderate in size and revenue. He

suggested that in counties with larger units, it is more worthwhile for pesticide salespeople to work directly with farmers.

Providing information to farmers about safe, effective pesticide use could be expensive for TDA, since the surveys suggest that farmers look to a variety of information sources. To reach most farmers in the state, TDA would probably have to use television and radio as well as magazines and newspapers. Not all of these media provide public service information. However, there are a more limited number of extension agents; in those locales where they serve as the critical providers of information about pesticide use, TDA can concentrate on these intermediaries. Continuing education, periodic training sessions, and pesticide bulletins for extension agents could be of use.

One area in which extension agents are especially important is in the teaching of techniques of IPM, or integrated pest management. One goal of IPM is to minimize the use of pest control techniques that are potentially hazardous to the user, other people, or the environment. A more important goal is the strictly economic one of reducing pest control costs and maximizing profits for farmers. Thus, IPM is a tool-kit of pest control techniques, including chemicals, biological controls, crop rotation, and use of pest-resistant varieties. IPM requires periodic monitoring of fields to gather information on the nature and seriousness of pest problems and assessment of the economic returns to controlling any pests found. IPM techniques have been developed for only a few crops, but have often proven quite successful; in the Rio Grande Valley, cotton farmers using IPM have obtained profits between $12 and $94 per acre greater than those under conventional systems.[339]

The effectiveness of IPM depends in part upon its adoption by all farmers within an area. Beneficial insects employed for IPM, for example, might be destroyed by a neighbor's use of inappropriate chemicals. Thus, IPM requires a greater degree of cooperation and communication among farmers than do traditional pest control methods.[340] County agents are especially important links in this communication process, since there are few if any private IPM "salespeople." Training of county agents in IPM has not been systematic, however. TDA is planning to hire a liaison to work with the Texas Agricultural Extension Service on IPM, to replace the informal communication between the two agencies.[341] TDA may be able to use this link to foster teaching agents IPM techniques as well as to stimulate basic research on IPM for different Texas crops.

9.5 CONCLUSION

Pesticides, which by definition are designed to kill unwanted things, are widely used in Texas. The present state program includes few inspectors and imposes few requirements beyond those of the federal program. As in many other areas, effective regulation, especially effective use of resources that are very limited compared to the number of pesticide users and the amount of chemicals they use, depends on effective gathering and dissemination of relevant information. Information about the kinds of pesticides used in Texas and the ways in which they are applied would allow TDA to determine more accurately whether reforms in the present program are required and what those reforms should be. It would also allow the agency to provide its clients -- especially farmers, but also urban pesticide users--with information about how best to control unwanted side effects from pesticide use. In a state that ranks third in agricultural production in the United States, continued use of pesticides is inevitable. A sound program to regulate them will ensure all

inhabitants of the state that the benefits of continued use outweigh the costs.

[1]U.S. General Accounting Office, *Stronger Enforcement Needed against the Misuse of Pesticides*, CED-82-5, October 15, 1981, p. 2.

[2]U.S. Department of Agriculture, Economic Research Service, "Pesticides: Weighing Benefits against Risks," *Farmline* 1, no. 9 (December 1980): 16.

[3]U.S. Department of Agriculture, Economic Research Service, *Agricultural Outlook*, ao-92, "IPM: The Route to Efficient Pest Control," by Katherine Reichenfelder (Washington, D.C., October 1983), p. 22.

[4]Ibid.

[5]U.S. Environmental Protection Agency, *National Household Pesticide Usage Study, 1976-1977* (Washington, D.C., November 1979), p. 76.

[6]Ibid.

[7]Ibid.

[8]Study cited in U.S. General Accounting Office, *Stronger Enforcement Needed*, p. 72.

[9]Karen Mountain and Dr. Mary Walker, *Pesticides in Texas: The Facts* (Austin: Texas Rural Health Field Services Program, University of Texas at Austin School of Nursing, 1981).

[10]U.S. General Accounting Office, *Stronger Enforcement Needed*, p. 72.

[11]Dallas Morning News, *Texas Almanac 1982-83* (Dallas: A. H. Belo Corp., 1983), p. 517.

[12]Telephone interview by C. Miller with Dr. Rodney Holloway, Entomologist, Texas A&M University, College Station, Texas, November 3 and 4, 1983.

[13]Rodney Holloway, D. Spencer, and A. Cosby, *Pest Control Practices in Texas Households: A Survey of Pesticide Knowledge, Usage, and Sources of Information* (College Station: Texas A&M University, 1980).

[14]Susan Hadden, *Read the Label: Proving Information to Control Risk* (New York: Macmillan Co. for the American Association for the Advancement of Science, forthcoming 1985), chap. 7; and National Research Council, *Regulating Pesticides* (Washington, D.C.: National Academy of Sciences, 1980), p. 20.

[15]Hadden, *Read the Label*, chap. 7.

[16]National Research Council, *Regulating Pesticides*, p. 20.

[17]Hadden, *Read the Label*, chap. 7.

[18]U.S. Congress, Senate Committee on Agriculture and Forestry, *Pesticide Control: Report to Accompany H.R. 10729*, 92d Cong., 2d sess., Report No. 92-838, June 7, 1972, p. 7; and National Research Council, *Regulating Pesticides*, p. 20.

[19]National Research Council, *Regulating Pesticides*, p. 21.

[20]Ibid.

[21]*Congressional Record*, 80th Cong., 1st sess., June 16, 1947, vol. 93, pt. 6: 7007-8; and U.S. Congress, Senate Committee on Agriculture and Forestry, *Pesticide Control*, p. 7.

[22]U.S. Congress, House, Committee on Agriculture, *Federal Insecticide, Fungicide, and Rodenticide Act: Hearings before the Subcommittee*, 80th Cong., 1st sess., April 11, 1947, pp. 4, 50-51.

[23]Rachel Carson Council, Inc., *Federal Regulation of Pesticides 1910-1981* (July 1981), p. 1.

[24]*Congressional Record*, 80th Cong., 1st sess., June 16, 1947, vol. 93, pt. 6: 7008.

[25]National Research Council, *Regulating Pesticides*, p. 21.

[26]Ibid.

[27]Rachel Carson, *Silent Spring*, (Greenwich, Conn.: Fawcett Publications, 1962); and National Research Council, *Regulating Pesticides*, p. 21.

[28]Ibid.

[29]Rachel Carson Council, Inc., *Federal Regulation*, p. 3.

[30]Hadden, *Read the Label*, chap. 7; and *Congressional Record*, 88th Cong., 1st. sess., October 22, 1963, vol. 109, pt. 15: 20080.

[31]*Congressional Record*, 88th Cong., 1st sess., October 22, 1963, vol. 109, pt. 15: 20080.

[32]*The Federal Insecticide, Fungicide, and Rodenticide Act*, 7 U.S.C.A. 135a(c)(2)(D)(5).

[33]Ibid., 136(bb).

[34]U.S. Congress, Senate, Committee on Agriculture and Forestry, *Federal Environmental Pesticide Control Act : Hearings before the Subcommittee on Agricultural Research and General Legislation*, 92d Cong., 2d sess., March 7 and 8, 1972, p. 94.

[35]U.S. Congress, Senate, Committee on Agriculture and Forestry, *Protection of Man and the Environment, Supplemental Report on H.R. 10729*, 92d Cong., 2d sess., October 3, 1972, S. Rept. 92-838 (part II), p. 43.

[36]Ibid., p. 44.

[37]Ibid., p. 22.

[38]National Research Council, *Regulating Pesticides*, p. 22.

[39]Rachel Carson Council, *Federal Regulation*, pp. 11-12.

[40]*Federal Insecticide, Fungicide, and Rodenticide Act*, 7 U.S.C.A. section 136 (v).

[41]U.S. Congress, Senate, Committee on Agriculture, *Reauthorization of the Federal Insecticide, Fungicide, and Rodenticide Act: Hearings before the Subcommittee on Agricultural Research and General Legislation*, 98th Congress, 1st Session, May 24, 1983, p. 39.

[42]*Texas Pesticide Control Act*, sec. 76.003.

[43]Ibid.

[44]The herbicide law is found at chapter 75 of the *Texas Agriculture Code*. Chapter 76 of the *Agriculture Code* is the pesticide law.

[45]*Texas Agriculture Code*, sec. 75.022.

[46]"Emergency" is defined in 40 CFR 166 to exist when "(a) A pest outbreak has or is about to occur and no pesticide registered for the particular use, or alternative method of control, is available to eradicate or control the pest, (b) significant economic or health problems will occur without the use of the pesticide, and (c) the time available from discovery or prediction of the pest outbreak is insufficient for a pesticide to be registered for the particular use. In determining whether an emergency condition exists, the Administrator will also give consideration to such additional facts requiring the use of section 18 as are presented by the applicant."

[47]Environmental Protection Agency, Steven Jellinek, "Final Regulation for Registration of Pesticides by States to Meet Special Local Needs -- Action Memorandum," memo to the Administrator, September 24, 1980, p. 1.

[48]40 CFR 166.

[49]Registration Division, Office of Pesticide Programs, Environmental Protection Agency, "Audit of Emergency Exemption and Special Local Needs Programs as Authorized under Section 18 and 24(C) of the Federal Insecticide, Fungicide, and Rodenticide Act, as Amended," March 1983, p. 11; hereafter "Audit."

[50]Audit, p. 47.

[51]These reasons included: 1. delays in normal tolerance setting and section 3 registration processes where there is pending action for the same use as requested under section 18; 2. a more liberal policy regarding what situations constitute an emergency in response to administrative changes at EPA; 3. increased involvement by pesticide producers and specialty agricultural groups; 4. increased incidence of regional (multiple states) rather than local emergencies; 5. utilization of section 18 exemptions to bring quarantine programs into compliance with FIFRA; and 6. increased familiarity with the section 18 program.

[52]Audit, p. 23.

[53]Audit, p. 23.

[54]Interview with Elvis Cozart, Agronomist, Texas Department of Agriculture, Agricultural and Environmental Sciences Division, Austin, March 15, 1984.

[55]Audit, p. 19.

[56]Interview with Ken Kadlec and Elvis Cozart, Texas Department of Agriculture, Agricultural and Environmental Sciences Division, Austin, November 18, 1983.

[57]EPA has granted section 18s for canceled pesticides without requiring significant new information. Environmental groups contend that a cancellation is essentially meaningless if it can be subsequently used under a section 18 without any new risk/benefit information. Subpart D of the Agency's Rules of Practice for Pesticides states that a section 18 request for a canceled pesticide is a request for a reopening of the cancellation hearings. EPA has granted section 18s for canceled pesticides solely on the basis of unavailability. These precedents have not been fully resolved, but indicate the potential for serious and sober possibilities with the availability of section 18s. See generally, T. O. McGarity, "The Death and Transfiguration of Mirex: An Examination of the Integrity of Settlements Under FIFRA," *Harvard Environmental Law Review* 3 (1979), pp.112-135.

[58]Interview with Elvis Cozart, Texas Department of Agriculture, Austin, April 19, 1984.

[59]U.S. Congress, House of Representatives, Committee on Agriculture, Subcommittee on Department Operations, Research, and Foreign Aid, *EPA*

Pesticide Regulatory Program Study: Hearing, 97th Congress, 2d session, 1983, p. 113; herafter House, *Hearing*.

[60]Except when use would constitute an imminent hazard or when it could result in a residue on food or feed exceeding or not covered by a tolerance, exemption, or other clearance.

[61]Audit, pp. 35-36, based on a survey of 3,833 24(c) applications, with 30 rejections, October 1, 1979, through March 31, 1982.

[62]U.S. Congress, General Accounting Office, *Strong Enforcement Needed Against Misuse of Pesticides: Report to Congress*, 1981, p. 30; hereafter *Strong Enforcement*.

[63]Audit, p. 38.

[64]U.S. Congress, Senate, Committee on Agriculture, Nutrition, and Forestry, *Extension of FIFRA, Report,* May 15, 1981, 97th Congress, 1st session, Report no. 94-75, p. 13; hereafter *Extension*.

[65]Audit, p. 3; interview with Elvis Cozart, Texas Department of Agriculture, Austin, February 15, 1984.

[66]House, *Hearing*, table 3.9, p. 128.

[67]Edwin L. Johnson, Environmental Protection Agency, Office of Pesticide Programs, letter to Texas Agriculture Commissioner, February 19, 1981.

[68]Johnson, letter, p. 2.

[69]Texas Department of Agriculture, "Data Required for 24(c) Special Local Need Applications in the State of Texas," undated.

[70]40 C.F.R. 162.151(i).

[71]40 C.F.R. 162.153(b).

[72]Jellinek, memo, p. 3.

[73]Jellinek, memo, p. 3.

[74]"Similar" is defined by TDA to mean same active ingredient(s) as a currently registered product. Interview with Elvis Cozart, April 19, 1984.

[75]40 C.F.R. 162.153.

[76]EPA, Office of Pesticide Programs, "Final Rule -- State Registration of Pesticides to Meet Special Local Needs," October 6, 1980, p. 18. One recent representative 24(c) registration for health purposes illustrates the type of data required. The Penick Corporation's 24(c) registration for SCOURGE/ULV for mosquito control (SLN-TX-830009) application included extensive efficacy test data, both from prior experience in New Jersey and from experiments in Louisiana, both using aerial application as requested for the 24(c). Fifteen studies with ground equipment done in four states, including Texas, were also included. The New Jersey tests were conducted by the N.J. State Experiment

Station and Department of Environmental Protection and the Louisiana tests by parish mosquito abatement districts. Review of the data is accomplished by the TDA employee handling section 24(c)s.

[77]House *Hearing*, p. 43.

[78]40 C.F.R. section 162.152(b) and (c).

[79]EPA, Office of Pesticide Programs, "Final Rule -- State Registration of Pesticides to Meet Special Local Needs," October 6, 1980, p. 16.

[80]Information in this section is from an interview with Lonnie Mathews, Division of Pesticide Management, New Mexico Department of Agriculture, March 12, 1984.

[81]Interview with H. F. Calhoun, Louisiana Department of Agriculture, March 12, 1984.

[82]Interview with Raymond Hefner, Arkansas State Plant Board, March 12, 1984.

[83]Interview with Bob Chada, Program Administrator, Oklahoma Department of Agriculture, March 12, 1984.

[84]Ibid.

[85]Interview with Tom Kaczoroski, Bureau of Pesticide Control, New Jersey Department of Environmental Protection, March 12, 1984.

[86]There are some indications that TDA consulted with other states more regularly in the past than it does now. Interview with Lonnie Mathews, March 12, 1984.

[87]The goals were drawn from the TDA Goals and Objectives Memorandum, 1983, Quentin Woomer, Deputy Commissioner.

[88]In order to receive a "+" or "0" rating, they must require minimal resources compared to other programs, piggyback on other programs, or bring in funds to offset their costs at least partially.

[89]24(c) and 18 are two of many pesticide programs, the pesticide programs only one of several regulatory programs, and regulatory programs only one of several activities of the department. Marketing is the area with the largest single share of the agency's resources, since "regulatory" programs encompass an extremely wide set of activities united only by their common location in the organizational structure. In fiscal year 1982, TDA expended $4,009,842 (21.2 percent) on marketing programs, $1,889,204 (9.4 percent) on administrative programs, and $13,146,035 (69.4 percent) on various regulatory programs. Regulatory programs groups are diverse, including seed regulation, pesticide regulation, piece rate crop survey, weights and measures, gasoline pump regulation, egg certification, and several others. Pesticide regulation accounts for $1,018,918 (5 percent) of the department budget. (This does not include the laboratory expenses of pesticide programs or the pest control programs such as fire ant control.) Marketing programs constitute a coherent block of programs, unlike regulatory programs, which do not share a common focus (*Department of Agriculture Revised Budget Request 1984-85 Biennium*,

p. vii).

[90]Interview with Elvis Cozart, Texas Department of Agriculture, February 15, 1984.

[91]*The Federal Insecticide, Fungicide, and Rodenticide Act as Amended (FIFRA)*, 7 U.S.C. 136b(a)(1) (November 1978).

[92]Ibid., 136a(d)(1)(C).

[93]Ibid., 136a(d)(1)(C)(i).

[94]Ibid., 136b(a)(1).

[95]Ibid., 136b(a)(1).

[96]Ibid., 136(e)(2).

[97]Texas Agricultural Extension Service (TAES), Texas A&M System, *Using Pesticides: Commercial Applicator Manual: General*, (College Station, Texas, undated).

[98]See chapter 2.

[99]TAES, *Commercial Applicator Manual*, p. 1.

[100]Interview by Jerry Threet with Lamarcus Johnson, Agricultural and

Environmental Sciences Division, Licensing Department, Texas Department of Agriculture (TDA), April 13, 1984. Figures taken from the December 1983 Pesticide Enforcement report to EPA. These figures are high, as they include applicators no longer eligible for certification,

[101]Interview by Susan Wilger with David Ivie, Executive Director, Structural Pest Control Board, State of Texas, Austin, March 12, 1984.

[102]Interview by Jerry Threet with Lamarcus Johnson, April 13, 1984.

[103]*Texas Pesticide Laws*, sec. 76.105.

[104]Ibid., sec. 76.112.

[105]*FIFRA*, 136(e)(4).

[106]Interview by Jerry Threet with Lamarcus Johnson, April 13, 1984.

[107]Interview by Jerry Threet with Jim Butler, Legal Counsel, Agricultural and Environmental Sciences Division, TDA, Austin, April 13, 1984.

[108]*Texas Pesticide Laws*, sec. 76.112(c).

[109]TDA, *State of Texas: Plan for Certification of Pesticide Applicators*, submitted to EPA as required by *FIFRA*, p. 2 (Austin, undated).

[110]Ibid.

[111]*Texas Pesticide Laws*, sec. 76.102. Numbers from interview by Jerry Threet with Lamarcus Johnson, April 13, 1984.

[112]*Texas Pesticide Laws*, Regulation 7.11 (c).

[113]EPA, Office of Pesticide Programs, *Regulatory Pest Control*(Washington, D.C., 1978).

[114]*Texas Pesticide Laws*, regulation 7.11(b).

[115]*State Plan for Certification*, p. 3.

[116]Structural Pest Control Board, State of Texas, *Texas Structural Pest Control Act and Rules and Regulations*, sec. 4(a) (Austin, 1980).

[117]TAES, *Commercial Applicator Manual*, p. 3; also *Structural Pest Control Act*, sec. 11A.

[118]*State Plan for Certification*, p. 18.

[119]Interview by Jerry Threet with Lamarcus Johnson, April 13, 1984.

[120]*State Plan for Certification*, p. 5.

[121]TAES, *Commercial Applicator Manual*, p. 4.

[122]See chapter 5.

[123]*Texas Pesticide Laws*, regulation 7.10(b).

[124]For an example of a recent test revision, see chapter 5.

[125]*Texas Pesticide Laws*, sec. 76.113(c).

[126]Ibid., sec. 76.108.

[127]Ibid.

[128]Ibid.

[129]Ibid.

[130]EPA, Office of Pesticide Programs, *Evaluation of the Private Applicator Pesticide Training and Certification Program: A Five-State Study* (Washington, D.C., 1981), p. 21.

[131]Ibid., p. 23.

[132]Interview by Susan Wilger with David Ivie, March 12, 1984.

[133]Interview by Jerry Threet with Lamarcus Johnson, April 13, 1984.

[134]*Texas Pesticide Laws*, regulation 7.10(b).

[135]Ibid., sec. 76.112(c).

[136]*FIFRA*, 136b(a)(2).

[137]Ibid., 136(e)(4); *Texas Pesticide Laws*, sec. 76.105(c).

[138]Interview by Susan Wilger with David Ivie, March 12, 1984.

[139]Structural Pest Control Board, *Structural Pest Control Act and Rules and Regulations*, Introductory provisions 46.01.05.004(8). Under these regulations, the board requires business licensees to provide in writing the names, home addresses, employment locations, and dates of employment of all employees of the structural pest control business.

[140]Interview by Jerry Threet with Lamarcus Johnson, April 13, 1984.

[141]*Texas Pesticide Laws*, sec. 76.113(c).

[142]Ibid., sec. 76.110.

[143]Benjamin Shimberg, *Occupational Licensing: A Public Perspective* (Princeton, N.J.: Educational Testing Service, 1980). The discussion of guidelines for a performance testing program draws upon this publication extensively.

[144]*Texas Pesticide Laws*, sec. 76.113(c).

[145]See chapters 6 and 8.

[146]*Texas Pesticide Laws*, sec. 76.104.

[147]Ibid.

[148]*Texas Pesticide Laws*, sec. 76.003(c); see also Pesticide Regulation 7.24.

[149]State of California, Legislative Research Staff, *Organization and Funding of Pest Management in the Department of Food and Agriculture* (Sacramento, April 1977).

[150]Interview with Al Hernandez, Administrator, Enforcement Section, Texas Department of Agriculture, Austin, November 11, 1983.

[151]TDA, "Inspector's Pesticide Inspection Guide" (Austin, September 1981).

[152]Annette Lovoy, Assistant Deputy Commissioner for Administration, class presentation, January 24, 1984.

[153]Interview with Al Hernandez, November 11, 1983.

[154]Ibid.

[155]Ibid.

[156]Interview with Jim Butler, Pesticide Specialist, Office of General Counsel, TDA, Austin, November 14, 1983.

[157]See TDA Memo from Sam Biscoe to Ron White et al., "General Guidelines for Penalties in Pesticide Cases," December 16, 1983, p.5.

[158]Interview with Jim Butler, Pesticide Specialist, Office of General Counsel, TDA, Austin, November 16, 1983.

[159]Ibid.

[160]TDA memo from Biscoe, "General Guidelines."

[161]Section 76.155.

[162]TDA memo from Biscoe, "General Guidelines," p.6.

[163]Section 76.154.

[164]Ibid.

[165]Ibid.

[166]See secs. 76.201 [e] and 76.202 [b], *Tex. Agric. Code*.

[167]Section 76.116 defines violations punishable by change in license status; 76.201 defines the other violations.

[168]Interview with Lamarcus Johnson, Administrator, Licensing Section, TDA, Austin, March 20, 1984.

[169]15 U.S.C. 2601 et seq.

[170]TDA memo from Biscoe, p. 6.

[171]Ibid., sec. 75.021.

[172]See, for example, section 75.012, which gives the department the authority to prohibit the application of a herbicide where the herbicide "is hazardous to crops or valuable plants . . . for the period during which the hazard exists." There is no authority to prohibit spraying because of a hazard to people, animals, or the environment. Similarly, section 75.014 requires certain herbicide applicators to carry crop damage insurance. There is, of course, no requirement for a surety bond or insurance to cover claims of harm to human health, animals, or the environment.

[173]Interview with Al Hernandez, Administrator, Enforcement Division, Texas Department of Agriculture, Austin, November 29, 1983.

[174]TAES, *Commercial Applicator Manual*, p. 25.

[175]Ibid. p. 26.

[176]Ibid. pp. 26-28.

[177]Ibid. p. 28.

[178]Interviews with pilots, Texas Agricultural Aviation Association

Convention, San Antonio, January 26, 1984.

[179]TAES, *Commercial Applicator Manual*, p. 6.

[180]TAES, *Aerial Commercial Applicator Manual*, College Station, Texas, undated, p.6.

[181]TAES, *Commercial Applicator Manual*, p. 19.

[182]TAES,*Aerial Applicator Manual*, pp. 7-9.

[183]Ibid., p. 12.

[184]Ibid.

[185]Ibid.

[186]*Code of Federal Regulations*, title 14. secs. 137.11 -137.77 (1983).

[187]Ibid., sec. 137.19.

[188]Ibid., sec. 137.21.

[189]Interview with O. D. Brown, Inspector, Federal Aviation Administration, San Antonio Regional Office, San Antonio, November 21, 1983.

[190]Federal Code of Regulations, title 14, sec. 137.39 (1983).

[191]Ibid., sec. 137.71.

[192]Interview with Lamarcus Johnson, Administrator, Licensing Division, Texas Department of Agriculture, Austin, November 21, 1983.

[193]Ibid.

[194]Ibid.

[195]Interview with John Fisher, Texas Agricultural Aviation Association, Austin, November 29, 1983.

[196]Interview with Ron Sweirski, Inspector, Federal Aviation Association, San Antonio Regional Office, San Antonio, March 16, 1984.

[197]Ibid.

[198]Ibid.

[199]Ibid.

[200]Ibid.

[201]Interview with Dr. Jon Arvik, Senior Development Associate, Monsanto Agricultural Products Company, Austin, March 15, 1984.

[202]Interview with Tom Crull, Insurance Agent, Ordway Saunders, March 16,

1984.

[203]*Texas Pesticide Laws*, sec. 76.113 (1983).

[204]Interview with John Fisher, Texas Agricultural Aviation Association, Austin, March 1, 1984; and interview with Tom Crull, March 16, 1984.

[205]Lloyd Irland, "Maine's Spruce Budworm Program: Moving toward Integrated Management," reprint from *Journal of Forestry* (December 1977): 2.

[206]Ray Dyson, "Spruce Budworm Campaign "83," *Ag Pilot International*, December 1983, p. 36.

[207]Specific buffer zones for carbaryl, a pesticide extensively used in the program, may be found in Board of Pesticide Control, "Carbaryl -- Application Guidelines for Suppressing Forest Insects," p. 5.

[208]Ibid., p. 3.

[209]EPA, *National Household Pesticide Usage Study 1976-77*, (Washington, D.C., 1980), p. 5.

[210]TEAS, *Commercial Applicator Manual*, p. 16.

[211]Telephone interview by Susan Wilger with David Ivie, Executive Director, Structural Pest Control Board, State of Texas, Austin, March 12, 1984.

[212]*Texas Structural Pest Control Law and Rules And Regulations*, secs. 5-6.

[213]Ibid.

[214]Telephone interview by Susan Wilger with Phil Hammon, Head of Entomology Department, Texas A&M University, College Station, March 12, 1984.

[215]Ibid.

[216]*Structural Pest Control Law*, sec. 406.01.05.001, p. 10.

[217]*SPC Law and Rules and Regulations*.

[218]Telephone interview by Susan Wilger with David Ivie, March 12, 1984.

[219]Ibid.

[220]Telephone interview by Joanie Raff with David Ivie, Austin, April 12, 1984.

[221]David Hanners, "Small Staff, Thin Budget Hamper 'Bug Board'," *Dallas Morning News*, February 12, 1984.

[222]Section 406.05.01.001, "Grounds for Revocation."

[223]Interview by Susan Wilger with David Ivie, March 12, 1984.

[224]TAES, *Commercial Applicator Manual*.

[225]Telephone interview by Susan Wilger with David Ivie, November 12, 1984.

[226]EPA, *National Household Pesticide Usage Study, 1976-77* (Washington, D.C., 1980), p. 29.

[227]Ibid., p. 77.

[228]Ibid., p. 7.

[229]Texas A&M University, *Pest Control Practices in Texas Households: A 1980 Survey of Pesticide Knowledge, Usage, and Sources of Information* (College Station, 1980).

[230]G. W. Frankie and H. Levenson, "Insect Problems and Insecticide Use: Public Opinion Information and Behavior," in *Perspective in Urban Entomology*, ed. G. W. Frankie and C. S. Koehler (New York: Academic Press, 1978).

[231]*Texas 1980 Structural Pest Contol Law and Rules and Regulations*, sec. 4(k), p. 7.

[232]Ibid., sec. 4(j).

[233]This figure was derived from the 1980 Austin Census Data for rental units and from monthly new housing figures from April 1980 through February 1984. Approximately 45.9 percent of housing units in Austin are owner occupied, so

this was deducted from the new housing figures.

[234]*Texas 1980 Structural Pest Contol Law and Rules and Regulations*, sec. 11.1.

[235]Interview by Robert Jackson with Rick Bjornson, Environmental Health Technician, University of Texas at Austin, Austin, November 23, 1983.

[236]Telephone interview by Robert Jackson with John Burns, Grounds Maintenance Supervisor, University of Texas at Austin, Austin, November 22, 1983.

[237]Precise figures from EPA on the number of pesticide ingredients that leave detectable residues in food, or the number of ingredients that have ever tested positive for cancer or birth defects, are difficult to obtain. A 1978 Congressional report lists nineteen such pesticides, seventeen of which still have tolerances ("Cancer-Causing Chemicals in Food," Report by the Subcommittee on Oversight and Investigations of the House Committee on Interstate and Foreign Commerce, 95th Congress, 2nd Session, December, 1978, p. 77, and *Code of Federal Regulations*, 40:180.110-335, July 1, 1983.)

[238]"Cancer-Causing Chemicals in Food," p. 6.

[239]Telephone interview with Dave Ritter, Toxicologist (head of the program to review inert ingredients), Toxicology Branch, Hazard Evaluation Division, EPA, March 28, 1984.

[240]Keith Schneider, "Faking It: The Case Against Industrial Bio-Test Laboratories," *The Amicus Journal* (Spring 1983): 14.

[241]The 1978 Congressional report "Cancer-Causing Chemicals in Food" (p. 5) states that 5,984 tolerances were granted to 271 pesticide active ingredients between 1954 and 1978.

[242]Telephone interview with Tom Adamczyk, Deputy Chief, Fungicide and Herbicide Branch, Registration Division, EPA, Washington, D.C., February 24, 1984.

[243]Telephone interview with Chris Chaisson, Supervisory Toxicologist, Toxicology Branch, Hazard Evaluation Division, EPA, Washington, D.C., March 23, 1984.

[244]*Dallas Morning News*, January 8, 1984.

[245]"Position Document (PD) 2/3," Office of Pesticide Programs, p. 8.

[246]*Federal Register* 42:240, p. 63141. An RPAR, or "Rebuttable Presumption Against Registration," is EPA's formalized procedure for studying what to do about a suspect substance. As in the case of EDB, the RPAR process may take several years.

[247]PD 4, Office of Pesticide Programs, p. 55.

[248]*Dallas Morning News*, January 8, 1984.

[249]See the discussion of this issue in Richard A. Merrill and Michael Schewel, "Environmental Contaminants and Food," *Virginia Law Review* (December 1980): 1357-1441.

[250]Sec. 408(a), *FFDCA*.

[251]Telephone interviews with Darryl Brown, Supervisor, FDA Dallas pesticide residue laboratory, February 24 and 27, 1984.

[252]See the discussion in the following section based on Merrill and Schewel, "Environmental Contaminants."

[253]Ibid.

[254]"Cancer-Causing Chemicals in Food," p. 24.

[255]Telephone interview with Jim Butler, Attorney for Pesticide Programs, Texas Department of Agriculture, Austin, March 1, 1984.

[256]The source for this and the following discussion of the FFDCA is Merrill and Schewel, "Environmental Contaminants."

[257]Sec.409(c)(3), *FFDCA*.

[258]Sec. 402(a), *FFDCA*.

[259]Sec. 408(c), *FFDCA*.

[260]Sec. 408(b), *FFDCA*.

[261]"EPA Pesticide Regulatory Program Study," Hearing before the Subcommittee on Department Operations, Research, and Foreign Agriculture of the House Committee on Agriculture, 97th Congress, 2d Session, December 17, 1982, p. 81. The above discussion of No Observed Effect Levels (NOELs) and Acceptable Daily Intakes is based on chapter 4 of this study.

[262]Ronald B. Taylor, "Detection of Pesticides a Matter of Who Runs Tests," *Los Angeles Times*, September 3, 1980.

[263]Telephone interview with Chris Chaisson, February 27, 1984.

[264]Telephone interviews with Tom Adamczyk, February 29, 1984; and with Edwin Budd, Section Head, Toxicology, February 29, 1984.

[265]Telephone interview with Darryl Brown, February 24, 1984. Appendix N contains a list of the crops FDA sampled last year.

[266]Taylor, *Los Angeles Times*, September 2, 1980.

[267]Telephone interview with Darryl Brown, February 24, 1984.

[268]Ibid.

[269]Telephone interviews with Darryl Brown, February 24 and 27, 1984.

[270]"FDA Recall Policies," consumer memo published by FDA, Rockville, Md., 1979.

[271]Interview with Dennis Baker, TDH Director of Food Programs, Bob Henna, TDH Director of Food and Drug Division, and Neil Travis, Director, Bureau of Consumer Health Protection, Austin, February 9, 1984.

[272]This training process includes two weeks of formal classes in FDA's food inspection school in Cincinnati, Ohio; three months of on-the-job training with an experienced inspector; and two years or so of periodic review of the sanitarian's work to discover any weaknesses in his or her inspection procedures (Telephone interview with Dennis Baker, February 10, 1984).

[273]Interview with Baker, Henna, and Travis, February 9, 1984.

[274]Telephone interview with Charles Sweet, Director, Austin laboratory, Texas Department of Health, February 14, 1984.

[275]Interviews with Dennis Baker, February 9 and March 5, 1984. With this number of people Baker estimated that the Health Department could gather and test approximately 2,000 samples a year.

[276]Interview with Robert Bernstein, Commissioner, Texas Department of Health, Austin, March 5, 1984.

[277]FDA lacks the power to "tag" (detain) food before obtaining a court order. By the time the agency obtains the court order, frequently the food

has already been sold. The exception to this, as we have seen, is FDA's ability, using the authority of the U.S. Customs, to hold imported food at the border until it has been tested for safety (the "certification" process).

[278]Gail McDonald, Inter-office memorandum from the TDH Office of General Counsel to Health Commissioner Robert Bernstein, January 30, 1984.

[279]Interview with Dennis Baker, February 9, 1984.

[280]Ibid.

[281]Commissioner of Health Bernstein and Director of Food and Drug Programs Robert Henna emphasized this criterion in separate interviews on March 5, 1984. In addition, Bernstein stated that TDH was not willing to remove all foods containing detectable amounts of EDB because consumption of small amounts of EDB over a period of one or two years does not constitute a public health emergency.

[282]Interview with Dr. Jerome Greenberg, Associate Commissioner for Preventable Diseases, Texas Department of Health, Austin, March 29, 1984.

[283]Interview with Robert Henna and Dennis Baker, March 5, 1984.

[284]Well-known examples of such studies are those that linked cigarette smoking to cancer and those that showed a relationship between certain rare cancers and occupational exposure to asbestos or vinyl chloride.

[285]Interview with Robert Bernstein, March 5, 1984.

[286]Interview with Robert Henna and Dennis Baker, March 5, 1984.

[287]Interview with Baker, Henna, and Travis, February 9, 1984.

[288]Interview with Jerome Greenberg, March 29, 1984.

[289]Ibid.

[290]Telephone interview with Jerome Greenberg, April 4, 1984.

[291]Interview with Jerome Greenberg, March 29, 1984.

[292]Interview with Robert Bernstein, March 5, 1984.

[293]"Identification, Classification, and Regulation of Potential Occupational Carcinogens," FR45:15, January 22, 1980, p. 5060.

[294]Even if we could calculate risks precisely, the matter of weighing the relative importance of A's risk and B's benefit is a political question, not a scientific one.

[295]Interview with Jerome Greenberg, March 29, 1984.

[296]This section comes almost in its entirety from U.S. Environmental Protection Agency, Office of Pesticide Programs, *Pesticide Protection: A*

Training Manual for Health Personnel, by J. Davies, March 1977.

[297]EPA, *Recognition and Management of Pesticide Poisonings*, Report No. EPA-540/9-80-005 (Washington, D.C., EPA: January 1982).

[298]William T. Keeton, *Biological Science* (New York: W. W. Norton and Co., 1980), pp. 423-29.

[299]G.A. Reich, et al., "Characteristics of Pesticide Poisoning in South Texas," *Texas Medicine* 64 (September 1968): 56-58.

[300]Texas Tech University Health Services Center, "1980 Pesticide Incident Summary," Pesticide Hazard Assessment Project, San Benito, Texas, unpublished data.

[301]Telephone interview by C. Miller with Dr. James Minyard, Project Manager, PIMS II, Mississippi State University, Mississippi State, November 28 and December 5, 1983.

[302]National Rural Health Council, *Pesticide Use and Misuse: Farmworkers and Small Farmers Speak on the Problem* (Washington, D.C.: Rural America, 1980), p. vii.

[303]Karen Mountain and Mary Walker, *Pesticides in Texas: The People and the Issues* (Austin: Texas Rural Health Field Services Program, 1981).

[304]National Institute for Occupational Safety and Health (NIOSH), *Criteria*

for a Recommended Standard: Occupational Exposure during the Manufacture and Formulation of Pesticides (Washington D.C.: U.S. Government Printing Office, July 1978), pp. 132-35.

[305]Interview with Rebecca Harrington, Director of United Farm Workers, AFL-CIO, Texas Chapter, Austin, November 29, 1983. She reports that when asked on a weekly basis, field workers almost invariably offer no complaints about exposure to pesticides. Harrington attributes much of this silence to the workers' general outlook that a skin rash or headache is nothing to get upset about.

[306]Ibid.; and Ephraim Kahn, "Pesticide-Related Illness in California Farm Workers," *Journal of Occupational Medicine* 18, no. 10 (October 1976): 693-96.

[307]Jay Feldman, "Statement of Jay Feldman, National Coordinator, National Coalition against the Misuse of Pesticides, before the Subcommittee of Department Operations, Research and Foreign Agriculture, Committee on Agriculture, U.S. House of Representatives, October 6, 1983." Mimeograph.

[308]NIOSH, *Recommended Standard*, p. 57.

[309]Ibid.

[310]Federal Working Group on Pest Management, *Occupational Exposure to Pesticides: Report to the Federal Working Group on Pest Management from the Task Group on Occupational Exposure to Pesticides* (Washington, D.C.: U.S. Government Printing Office, January 1974), p. 70.

[311]NIOSH, *Recommended Standard*, p. 273.

[312]Federal Working Group on Pest Management, *Occupational Exposure to Pesticides*, p. 69.

[313]C. A. Franklin et al., "Correlation of Urinary Pesticide Metabolite Excretion with Estimated Dermal Contact in the Course of Occupational Exposure to Guthion," *Journal of Toxicology and Environmental Health* 7 (1981): 715-31. For similar results, see also NIOSH, *Recommended Standard*, p. 255.

[314]Federal Working Group on Pest Management, *Occupational Exposure to Pesticides*, p. 70.

[315]NIOSH, *Recommended Standard*, p. 255.

[316]Robert Spear, "Technical Problems in Determining Safe Reentry Intervals," *Journal of Environmental Pathology and Toxicology* 4 (1980): 293-304.

[317]California Worker Health and Safety Program Statement Outline, 1982-1983. Sacramento: California Department of Health, n.d.

[318]Federal Working Group on Pest Management, *Occupational Exposure to Pesticides*, pp. 34, 71.

[319]Ibid., p. 71.

[320]Ibid., p. 109.

[321]Jess F. Kraus et al., "Epidemiologic Study of Physiological Effects in Usual and Volunteer Citrus Workers from Organophosphate Pesticide Residues at Reentry," *Journal of Toxicology and Environmental Health* 8 (1981): 169-84.

[322]Migrant health clinics are located in rural areas throughout the U.S., and provide care to migrants and seasonal farmworkers and their dependents. Centers usually provide a comprehensive range of care, from primary medical services to supplemental care such as dental and vision services. The centers are coordinated through the Migrant Health Program in the Bureau of Health Care Delivery and Assistance, within the Public Health Service of the U.S. Department of Health and Human Services.

[323]Telephone interview by A. Rader with Salvador Mier, Regional Program Consultant, Migrant Health Program, Bureau of Health Care Delivery and Services, Public Health Service, U.S. Department of Health and Human Services, October 31, 1983.

[324]Interview by A. Rader with Rebecca Harrington, Director of United Farm Workers, AFL-CIO, Austin, November 29, 1983.

[325]Interview by C. Miller with Ed Gutierrez, coordinator of Farmworker Program at TDA, Austin, February 16, 1984.

[326]*California Administrative Code*, title 3, chapter 4, subchapter 1, group 2, #2481.

[327]Ibid.

[328]*Texas Pesticide Laws*, subchapter D, section 76.075 Records.

[329]Chapter 76 . *Pesticide Law*, subchapter E, sec. 76.114.

[330]Federal Working Group on Pest Management, *Occupational Exposure to Pesticides*, p. 71.

[331]*FIFRA*, 7 U.S.C., 136h.

[332]Ibid., 136f(b).

[333]Ibid., 136f(a).

[334]Texas Department of Agriculture, *Texas Pesticide Laws and Regulations*, sec. 76.114.

[335]Ibid., sec. 76.114(d).

[336]David Pimentel and John H. Perkins, *Pest Control: Cultural and Environmental Aspects* (Boulder: Westview Press, 1980), p. 86.

[337]See, for example, a 1974 EPA study and an older study by George Beal of Iowa State University, both reported in Jerome Goldstein, *The Least Is Best Pesticide Strategy* (Emmaus, Pennsylvania: The JG Press, 1978), pp. 32 and 35, respectively.

[338]John K. Thomas et al., *Pesticide Usage by Livestock Producers in Texas* (College Station: Texas A&M University System, 1983), p. 41.

[339]U.S. Department of Agriculture Economic Research Service, "IPM: The Route to Efficient Pest Control," in *Agricultural Outlook* (Washington, D.C.: USDA, 1983), p. 22.

[340]Interview with Mike Moeller, President, Texas Farmers Union, Austin, January 21, 1984.

[341]Interview with Ken Kadlec, Director, Agricultural and Environmental Sciences Division, TDA, Austin, March 14, 1984.

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