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EXECUTIVE SUMMARY

What pesticides are used in Texas? Where and when are they used and in what quantities? Are the more toxic pesticides being used near your drinking water source, in your children's school or on neighborhood parks, playgrounds or golf courses?

These might seem like questions that our state's environmental or agricultural agencies could easily answer. But it turns out that answering these questions is very difficult—almost impossible—under our current set of laws and regulations. There is simply not enough site-specific data being collected, reported or analyzed to provide the public or government decision makers with a clear picture of pesticide use in Texas communities. This situation contrasts sharply with the case of industrial toxic emissions—most manufacturing industries are required to submit detailed reports on their emissions of toxic pollutants to air, water and land.

Federal agencies such as the Environmental Protection Agency (EPA) and the U.S. Department of Agriculture (USDA) have some figures on overall sales of pesticides in Texas and on agricultural cropping patterns. These data, however, do not provide specific information on pesticide use in Texas. They do not tell the public exactly where or in what quantities pesticides—even the most dangerous pesticides— are being used. Overall sales and crop pattern data do not, for example, tell public drinking water suppliers exactly which agricultural or urban pesticides are being used in the watershed or over the aquifer or when they are being used. Thus water supply managers have difficulty targeting expensive water quality testing, because it is like looking for the proverbial needle in a haystack.[i] Similarly, pesticide sales data are not useful for evaluating health problems that might be linked to use or mis-use of particular pesticide at a school or park.[ii]

The overall agricultural sales and cropping pattern information has been supplemented to a certain extent by university research, particularly at Texas A&M, on the practices of farmers growing specific crops. The researchers have surveyed farmers growing cotton, rice, turf grass and a few other crops to provide a slightly more detailed picture of pesticide use trends for these crops. These studies, however, do not provide enough information to accurately understand what pesticides are used, for example, in a particular river basin. The data are limited to a few major crops and, often represent the practices of only a small portion of the growers.

Even less information is available about non-agricultural uses of pesticides—in parks and schools, on golf courses, on highway right-of-way or by individual homeowners. While the volume of pesticides used in non-agricultural settings may be less than the overall volume of pesticides used in agriculture, humans may be more directly exposed to the pesticides used in non-agricultural settings.

This report analyzes what the public and Texas government agencies know—and do not know—about pesticide use in Texas. Chapter I provides an overview of pesticide use in the United States and discusses some recent discoveries about the health effects of pesticides. Chapter II examines available data about pesticide use in Texas. Existing federal and Texas regulation of pesticide use is reviewed in Chapter III. Chapter IV briefly discusses alternatives to pesticide use. Recommendations are presented in Chapter V.

Briefly, this report recommends that Texas follow the lead of several other states and phase-in a **pesticide use reporting system** for both agricultural and non-agricultural uses of pesticides. Under this system, priority pesticide uses would be reported to the state, which would then make the pesticide use information available to the public, water supply systems, researchers and others. Chapter V discusses the general scope and benefits of a pesticide use reporting system for Texas.

KEY DATA ELEMENTS OF PESTICIDE USE REPORTING SYSTEM

*Location and date of pesticide application
*Amount of active ingredient applied and target pest
*Application method
*Applicator license/certification identification
*Sales reporting to capture urban use patterns

[i] Texas Center for Policy Studies and Consumers Union, Pesticides and Texas Water Quality (Austin: 1998). (Forthcoming, September 1998).

[ii] American Medical Assn., Council on Scientific Affairs, "Educational and informational strategies to reduce pesticide use" in Preventative Medicine 26(2):191-200, Mar-April 1997.

Chapter I.
PESTICIDE USE IN THE UNITED STATES

Overview

Pesticides are chemical compounds used to control plants and animals classified as pests. The term “pesticides” includes insecticides, herbicides, fungicides and other materials designed to kill or control “pests”. Despite benefits for crop production and control of disease-carrying pests, pesticide use is of concern because pesticides can reach humans through the food chain, through drinking water or by direct contact. Pesticides can also build up in fish and other aquatic life, in birds and animals, and can destroy beneficial plants and insects.[1] The potential adverse effects of a few of the pesticides highlighted in this report are summarized in **Appendix A.**

Before the development of synthetic pesticides, many farmers used naturally-occurring substances such as pyrethrums to control insects.[2] Widespread use of synthetic pesticides in the United States began following World War II. Having become an integral part of agricultural practices by the mid-1950s, pesticide use is often credited with increasing crop yields by reducing natural threats to production. Beginning in the late 1940s, federal and local governments sponsored widespread pesticide spraying programs, using DDT and other chemicals in urban communities in an effort to eradicate mosquitoes, gypsy moths, the Japanese beetle and other insects. Homeowners, commercial exterminators, golf course managers, parks departments, schools, highway departments, utility companies and others also use a wide variety of pesticides—some more toxic than others—to control insects, weeds and other pests in non-agricultural settings.

Estimates of pesticide use in the United States are largely based on sales data, extrapolations from voluntary farmer surveys and crop data from major producing states. Comprehensive reporting of pesticide use by farmers and other applicators (lawn services, commercial applicators, golf course superintendents, etc.) is required by state law in California and New York.[3] Other states, including New Hampshire, New Jersey, Montana, Arizona and Connecticut also have varying forms of use reporting laws.[4]

According to sales and marketing data collected and evaluated by the U.S. Environmental Protection Agency (EPA), almost 1 billion pounds of conventional active pesticide ingredients were used in the United States in 1995, amounting to approximately 3.7 pounds of pesticides per person.[5] Use of conventional pesticides, combined with other chemicals used as pesticides, such as sulfur and petroleum, reached an estimated 1.22 billion pounds of active ingredients in the U.S. in 1995, accounting for one-fifth of the worldwide use.[6] (**Figure 1**). Herbicides continue to account for a large percentage of total pesticide use (45% in 1995). (**Figure 2**).

Figure 3 shows trends in estimated pesticide use between 1979 and 1995. According to these data, home and garden pesticide use has remained at about the same level throughout this period, while industrial/government/commercial use has shown some decline. Agricultural use is more variable, due in part to variations in cropping patterns, weather and other factors.[7] The data show a general pattern of decreasing agricultural use from 1979 to 1987, but then a general increase in use from 1987 to 1995.

The economic value of the pesticide market is significant. EPA estimates that $11.3 billion was spent on pesticides in the U.S. in 1995, with farmers spending about 70 percent of this amount, or $7.9 billion, an average of $4,200 per farm. The average U.S. household spent $20/yr for pesticides applied by the homeowner (but not by hired applicators).[8] According to

EPA estimates, 74 percent of all U.S. households used some form of pesticide in 1994.[9]

Over 960,000 private pesticide applicators and about 384,000 commercial applicators were

registered in the United States in 1995. A large majority of the private applicators are individual farmers. Region VI of the U.S. Environmental Protection Agency (Texas, New Mexico, Oklahoma and Louisiana) accounted for the most private applicators of any region (236,314), but was among the regions with the fewest commercial applicators (23,191).[10]

THREE MAJOR GROUPS OF CONVENTIONAL PESTICIDES

Chlorinated hyrdocarbons, or organo-chlorines—these pesticides generally breakdown very slowly and can remain in the environment for long periods of time. Dieldrin, chlordane, aldrin, DDT and heptachlor are pesticides of this type.

Organic phosphates or organo-phosphates—these pesticides are often highly toxic to humans, but generally do not remain in the environment for long periods of time. Diazinon, malathion, dimethoate and chlorpyrifos are pesticides of this type.

Carbamates—generally less toxic to humans, but concerns about potential effects on immune & central nervous systems persist for some carbamates. Carbaryl, carbofuran and methomyl are examples of carbamates.

Source: Nancy Blanpied, ed., Farm Policy: the Politics of Soil, Surpluses and Subsidies(Washington, D.C.: Congressional Quarterly, 1984), p. 69 and—for carbamates—National Research Council, Pesticides in the Diets of Infants and Children (Washington, D.C.:National Academy Press), 64.

After World War II, pesticides became a component of what has been called a “green revolution”, aimed at producing abundant food for the world. During the past fifty years, agricultural production in many areas of the world has increased dramatically, partly because of the use of herbicides and insecticides. Health benefits, such as those related to eradication of malaria-carrying mosquitoes, were also foreseen and, in many cases, attained.

Despite this long history of pesticide use, most pesticides have never been systematically reviewed for their full range of potential long-term health effects on humans, such as potential genetic damage or damage to nervous, endocrine or immune systems.[11] Data are particularly lacking for pesticides used in non-agricultural settings.[12]

Federal regulatory agencies such as the EPA have traditionally concentrated on the cancer-causing potential of pesticides based on the expected levels of pesticide residues in food prepared for human consumption. With the passage of the Food Quality Protection Act in 1996, this has begun to change. This new law directs EPA to reassess the risks of over 9,700 pesticide tolerances and re-evaluate the allowable levels of pesticides that can remain in or on food by 2006. As discussed in more detail in Chapter III, this re-evaluation process will include special consideration of the risks to infants and children and of cumulative exposures (i.e. exposures to combinations of similar pesticides through a combination of pathways).

The effects of pesticides on wildlife are also poorly documented. Prior to 1985, EPA did not review pesticides on the basis of potential adverse effects on wildlife. Since then, EPA has canceled some pesticides, based partially on their effects on the environment and wildlife.[13] Discoveries of pesticide residues have also resulted in fishing bans in many bays, lakes and rivers.[14]

The introduction of synthetic pesticides and fertilizers, combined with the opportunities associated with more global food markets and favorable U.S. agricultural policies, have driven farm yield far beyond pre-World War II levels. This increase has not been without costs to farmers, however.[15] Studies have shown that pesticides have helped keep crop damage at between 5 and 30 percent of potential production, particularly in large-scale single crop operations that leave themselves vulnerable to severe pest damage.[16] Nevertheless, pesticides do pose a number of problems for agriculture, including increased production costs, destruction of beneficial insects, secondary pest outbreaks, development of pesticide-resistant pests, and the potential for harmful health effects on agricultural workers and their families.[17]

Pest resistance is a serious problem. According to one study, 7 percent of U.S. agriculture production was lost to pests in the 1950s; in 1993, 13 percent of all production was lost to pests.[18] A different study concluded that crop losses from pests increased from 31 percent in 1945 to 37 percent in 1990 while during that same period farmers used 33 times more pesticides.[19]

Today, more than 500 species of insects and mites and more than 150 types of fungi (a 50% increase over the last decade) are now resistant to some pesticides.[20] Increased pest resistance has led to combining pesticides, increasing applications or substituting more expensive, toxic or ecologically hazardous pesticides to maintain the same level of pest control. In addition to the problem of pesticide resistance, millions of dollars worth of crops have been lost due to improper pesticide application.[21] Consequently, pesticides alone are rarely seen today as the solution. More and more farmers and other pesticide users are seeking to better target their use of pesticides and implement pesticide use reduction strategies. (See Chapter IV).

TOP TEN PESTICIDES USED IN U.S. AGRICULTURE IN 1995 (millions of pounds)

Atrazine	Metolachlor
Metam sodium	Methyl bromide
Dichloropropene	2,4-D
Glyphosate	Cyanazine
Pendimethaliln	Trifluralin

Source: EPA, Pesticides Industry Sales and Usage: 1994-1995 Market Estimates (EPA:Washington, D.C., August 1997), p. 19.

Recent Discoveries About Pesticides

New scientific research is uncovering some important health-related issues associated with pesticide use. For example, pesticides were identified by a National Cancer Institute study as a likely cause of elevated rates of certain cancers among farmers.[22] Farmers are at higher risk than the general population for certain cancers: non-Hodgkin's lymphoma, skin melanomas, multiple myeloma, leukemia and cancers of the lip, stomach, prostate and brain. Exposures to 2,4-D, 2,4,5-T, mecoprop, acilfluorfen and other pesticides have also been linked to non-Hodgkin's lymphoma. Exposure to insecticides has been associated with leukemia, multiple myeloma and brain cancer.[23]

The National Cancer Institute has documented that some childhood cancers have increased at the rate of nearly one percent per year for the last several decades.[24] Some of that increase may be attributable to urban pesticide use. A study published in the *American Journal of Public Health* in 1995 suggested that "use of home pesticides may be associated with some types of childhood cancer."[25]

One recent study concluded that every day "more than one million children age 5 and under (1 out of 20)" in the U.S. may exceed what the USDA has determined to be a safe daily dose of organophosphate insecticides (OP).[26] The report analyzed more than 80,000 food samples tested for OP pesticides by the federal government, using residue levels found after washing, cooking, peeling and preparing the food for normal consumption. Thirteen OP insecticides showed up in the data collected by the Food and Drug Administration and the USDA. The OP compounds dimethoate, chlorpyrifos, pirimiphos methyl and azinphos methyl accounted for more than 90 percent of the overexposure of children under two years old. The report also concluded that the use of OP insecticides in the home compounded the risk to infants and toddlers.[27]

Many organophosphates are toxic to the brain and nervous system, which are especially vulnerable during infancy and early childhood. Under the Food Quality Protection Act, EPA will give the OP pesticides priority in the food tolerance reassessment process.

CHILDREN AT RISK

Infants and children are more susceptible to the effects of pesticides than adults because of their developing physiology and increased proportional exposure. Infants consume two-and-a-half times more calories per body weight than adults, breathe twice the amount of air, per body weight, as adults, and have twice the skin surface area per body weight as that of an adult. Children drink many more liquids per body weight than adults, including 21 times more apple juice. Children living in homes with indoor air contaminated by the pesticide pentachlorophenol (PCP) were found to have almost twice as much PCP in their blood as their parents.[28] The National Research Council reported that "exposure to neurotoxic compounds at levels believed to be safe for adults could result in permanent loss of brain function if it occurred during the prenatal and early childhood period of brain development."

Source: Natural Resources Defense Council, Our Children at Risk, New York, 1997. See also: National Research Council, Pesticides in the Diets of Infants and Children, Washington, D.C.: National Academy Press; Environmental Working Group, Pesticides in Children's Food, by R. Wiles and C. Campbell, 1993.

Scientists are debating the relationship between pesticides that mimic the estrogen hormone and the disruption of the endocrine system in humans and wildlife. Pesticides with endocrine disruption effects or effects on the reproductive system are among the most commonly used and include the herbicides alachlor and atrazine; the fungicides mancozeb and benomyl; and the insecticides carbaryl, dicofol, endosulfan, methomyl, methoxychlor, parathion and the synthetic pyrethroids.[29]

The complex human endocrine system consists of a series of glands, organs and tissue that secrete and respond to hormones. Hormones play very important roles in reproduction, child development and the control of other bodily functions. Thus, anything disrupting the endocrine system may have "far-reaching" effects.[30]

Uncertainties about the potential endocrine disrupting effects of many chemicals, including some pesticides, have been sufficiently serious for Congress to require EPA to develop guidelines by August 1999 for screening chemicals for their endocrine-disrupting potential.

Public Opinion

Many opinion polls have been taken over the years to gauge the public's attitude toward pesticides. These polls have generally shown high levels of concern about pesticide use, particularly with respect to food safety.[31]

In April 1997 survey of 700 Texas registered voters (including an over-sample of 100 rural residents), respondents were most concerned about the potential impact of pesticides on children and drinking water, and over 70% wanted to know more about the possible effects of pesticides. Over half (54%) believed that farmers used pesticides properly, but only 43% believed homeowners were likely to use them properly. Over 60% of the respondents supported enactment of requirements that large farms and commercial pesticide applicators report their pesticide use to the state.[32]

A 1996 report by the City of Fort Worth Water Department on home pesticide use, using focus groups of Fort Worth residents, found that 85 percent thought the "environmental quality of local waterways" was extremely important in considering the need to change pesticide use patterns. The department reported that "most homeowners would voluntarily reduce pesticide usage to protect local waterways."[33]

Monitoring Chemicals in Food

Legally, food may contain a number of pesticide residues as long as the amount is within allowable tolerance levels. As discussed earlier, under the Food Quality Protection Act, many of these tolerances are being recalculated to take into account their possible cumulative impact and their impact on infants and children.

Various federal agencies share responsibility for monitoring chemical residues and environmental contaminants in food. The federal Food and Drug Administration has primary responsibility for these matters, but the U.S. Department of Agriculture, the Environmental Protection Agency and the National Marine Fisheries Service also have responsibility for monitoring chemical residues in food. Since 1991, the USDA has coordinated and funded a nationwide food testing program known as the Pesticide Data Program. Under a contract with the USDA, the Texas Department of Agriculture receives funds to conduct an annual testing program in the state.[34] The two major objectives of the program are to: 1)determine whether produce has pesticide residues beyond the limits allowed by the Environmental Protection Agency and/or 2) determine whether the residues are from pesticides not registered for use on that particular fruit or vegetable.

Throughout the year, the Texas Department of Agriculture takes samples of produce from wholesale outlets and tests them in the TDA. The test results are sent to the USDA. If the test results indicate there is a problem with the produce, this information is sent to the FDA for enforcement follow-up. This program was not designed, however, to take adulterated produce off the market. It was designed to "provide government agencies with a data base to react to food safety issues. The main recipient of the program's data is the Environmental Protection Agency, which uses this information to support its risk assessment process."[35]

In 1992, the USDA's Pesticide Data Program analyzed residues in 12 fruits and vegetables from major agricultural production regions in the United States, including Texas.[36] Unlike other pesticide residue studies performed by the FDA or USDA, this was the first that tested residue on fruits and vegetables after they were peeled and washed. The results of this study showed that fresh fruits and vegetables routinely contain residues of several different pesticides.[37] According to the USDA, 5,592 samples were analyzed. "Residues of 49 different pesticides were detected in approximately 60 percent of all samples. Many samples contained multiple residues, with as many as eight found in one sample. In other words, neither the washing nor peeling of food guarantees the removal of pesticide residues."[38]

This study revealed that the levels of many pesticide residues were substantially below tolerances, but residues in violation were found in 63 samples, 15 of which were in imported commodities: "Of the 63 violative samples, 10 exceeded the tolerance level and the other 53 had residues where no tolerance was established."[39]

Non-Agricultural Pesticide Use

Public policy at the national level has generally been focused on the agricultural uses of pesticides and the health risks posed by pesticide residues on food, with much less concern for home and commercial exposure to pesticides.[40] One exception has been the action taken to ban or limit the widespread use of highly toxic pesticides for control of termites and fire ants. Improper use and disposal of home and garden pesticides, however, have the potential to pollute creeks and lakes. The presence and/or misapplication of pesticides in homes and buildings can also have serious adverse health and environmental effects.[41]

One survey estimated that 85 percent of all households in the United States have at least one pesticide in storage in and around the home, and most families have between one and five pesticide products stored. An estimated seventy-six percent of all households self-treated their homes for insects and other pests. Among households that disposed of leftover concentrates of pesticides, 67 percent disposed of the concentrates in their regular household trash and 13 percent used special collections.[42]

In 1995, Americans used an estimated 133 million pounds of pesticides in their homes and gardens, including 47 million pounds of herbicides.[43] About one in ten single-family American households used a commercial lawn service, while one in five applied lawn chemicals themselves.[44] The most common pesticides used by homeowners are the herbicides 2,4-D and Glyphosate (sold under trade names Roundup and Rodeo). Marketed as Lawn-Keep, Weedone, Plantgard, Miracle, Demise and Ded-Weed, 2,4-D is a popular weed killer for use on lawns, gardens and golf courses, as well as on farms and in timber stands. It is also used in lakes and rivers to kill aquatic weeds such as hydrilla and water hyacinth. There has been much debate over whether 2,4-D is a carcinogen, and the issue is still under review by EPA. Possible links to non-Hodgkin's lymphoma are of special concern.[45] Glyphosate exposure was the most common reported cause of pesticide illness for landscape workers.[46]

PRIMARY PESTICIDES USED IN U.S. HOMES AND GARDENS IN 1995

2,4-D*
Glyphosate*
Dicamba*
MCPP
Diazinon*
Chlorpyrifos
Carbaryl*
Benefin
Dacthal*

*pesticides on drinking water monitoring list for public water supply systems.

Source: EPA, Pesticide Industry Sales and Usage; 1994-1995 Market Estimates (Washington, D.C., August 1997), p. 20.

Home pesticide use is a particularly critical issue when considering the health of children. EPA reports that indoor air has much higher pesticide concentrations than outdoor air and noted that small children spend close to 90 percent of their time indoors. The report estimates that 85 percent of a person's total daily exposure to airborne pesticides comes from indoor air.[47] Indoor pesticide exposure can result from use of household pesticides, disinfectants containing pesticides and flea treatments for pets, among other sources. Pesticides can also be found in soil and dust tracked into homes from lawns, gardens and job sites. One study showed that the greatest number of pesticides and highest concentrations were found in carpet dust.[48] A study of the application of chlorpyrifos in Dursban for fleas found insecticide residues on the carpet 24 hours after application and concluded that the amount of the insecticide infants would absorb up to 24 hours after application was ten to fifty times higher than the acceptable exposure limits for adults.[49]

Exposure to pesticides does not only occur in the home or workplace. Private businesses and public facilities use a variety of pesticides. In 1995, for instance, industrial, commercial and government institutions used about 150 million pounds of pesticides, accounting for 12 percent of all active pesticide ingredients used in the U.S.[50]

PRIMARY PESTICIDES USED IN INDUSTRIAL, COMMERICAL AND GOVERNMENT APPLICATIONS IN 1995

2,4-D*
Chlorpyrifos
Glyphosate*
Methyl bromide
Copper Sulfate
Methanearsonate (MSMA)
Diazinon
Diuron
Malathion

*pesticides on list for monitoring in public drinking water systems.

Source: EPA, Pesticide Industry Sales and Usage; 1994-1995 Market Estimates (Washington, D.C., August 1997), p. 20.

Parks often use herbicides such as glyphosate, 2,4-D, triclopyr and oryzaline and the insecticide diazinon.[51] Many pesticides that could pose serious potential adverse health effects, including 2,4-D, are commonly used for turf management on golf courses.[52]

Pesticide use in schools is an important issue to many parents and teachers. A 1998 survey of pesticide use in California schools found that 87% of the 46 school districts responding to the survey reported using "one or more of 27 particularly hazardous pesticides …", including pesticides classified as known or possible carcinogens, developmental and reproductive toxins, endocrine disruptors and acutely toxic pesticides.[53] A 1993 survey of 556 school districts by the California Department of Pesticide Regulation found that only 2 % of the districts had plans or policies meeting "integrated pest management" criteria and 62% of the districts did not have any pest management plan or program.[54] (See Chapter IV for a discussion of IPM requirements for Texas schools).

CHAPTER II.

PESTICIDE USE IN TEXAS

This chapter briefly reviews what state and federal governments know—and don't know—about pesticide use in Texas.

Texas Agricultural Pesticide Use

While it is currently very difficult to find accurate, credible documentation of pesticide use in the state, by location or by individual farmers, there are some sources that can provide a rudimentary understanding of overall agricultural pesticide use in the state. In 1995, the Texas Agriculture Statistics Service estimated that Texas farm and ranch operators spent $376 million dollars on pesticides, up from $ 310 million in 1991. When this is combined with $642 million in fertilizer costs, it equals one-third the net cash income received by all Texas farmers and ranchers in 1995. Thus, farm chemicals represent the single largest yearly input cost for field-crop production.[55]

Table 1 provides available information on top ten fungicides, herbicides and insecticides used on Texas crops. **Table 2** provides information on the use of these pesticides on specific crops in Texas, while **Table 3** compares the reported use of pesticides in Texas to the information on crop sheets developed by the Texas Department of Agriculture for the farmworker right-to-know program.

The overall pesticide use estimates for Texas crops are derived from the database established by the National Center for Food and Agricultural Policy, a non-profit organization in Washington, D.C. and are widely used. The estimates, however, are not based on actual reported use for Texas farms. Instead, they are based on a combination of (1) the 1992 Agricultural Census data which provides information on cropping patterns and (2) federal and state pesticide use "surveys" conducted between 1991 and 1993.[56] As noted below, these surveys are often based on just a small portion of the growers in a particular industry. The NCFAP estimates are also reviewed by representatives of the pesticide industry, to help resolve "discrepancies among survey results and reviewer comments."[57]

The data in **Table 2** show some interesting patterns. For example, according to the NCFAP data, corn and sorghum account for over 97% of all the atrazine use in the state—atrazine has been the subject of much attention recently due to its potential to contaminate groundwater and its detection in the tap water being supplied by some public drinking water systems. In another example, the NCFAP estimates indicate that over 90% of the 2,4-D use in the state is associated with pasture and hay. But that estimate is largely determined by the much larger acreage for pasture and hay than for the other crops on which 2,4-D use is reported, not by the percentage of total acreage treated.

The NCFAP data indicate that rice accounts for all the use of the herbicides propanil and molinate in Texas. A closer look shows that this estimate is based solely on data from surveys in a "nearby" state.[58]

Some pesticides, such as the insecticides carbaryl and chlorpyrifos and the fungicides chlorothalonil, maneb and metalaxyl are used on a very diverse range of crops, many of which are vegetables grown largely in the Lower Rio Grande Valley and the Winter Garden areas.

Table 3 illustrates some significant inconsistencies between the NCAFP data and the pesticides listed as most commonly used on the TDA crop sheets. For example, the NCAFP data indicate that 26% of the cotton acres were treated with glyphosate, but that herbicide does not show up on the cotton crop sheets prepared by TDA (Though glyphosate was on an older South Texas crop sheet for cotton, it was deleted from the

1995 version). Similarly, the NCFAP data indicate that 23% of the lettuce acres were treated with diazinon, but that insecticide is not on the lettuce crop sheet.

On the other hand, many of the pesticides listed on the crop sheets do not show up in the NCFAP database for that crop in Texas. For example, the crop sheet for corn lists such pesticides as carbaryl, methoxychlor, diazinon and trifluralin, which are not reported in the NCFAP data base.

These discrepancies demonstrate both the limitations of the NCFAP data and the probable need to regularly update the TDA crop sheets, many of which were prepared in the late 1980s. More fundamentally, they indicate the need for better pesticide use information to reflect actual on-farm practices and account for year-to-year differences in pest problems, acreage planted and acreage treated.

In addition to the basic NCFAP data, there are a few more detailed studies of pesticide use on specific crops, as summarized below.

In 1994, the Texas A&M Agricultural Extension Service conducted a survey of 1500 Texas cotton farmers, accounting for about 10% of the total cotton growers in the state and about 14% of the cotton acreage.[59] This survey found that 64 percent of the respondents identified themselves as "IPM growers," meaning they used beneficial insects, rotated crops and/or chemicals or used other management practices to reduce pesticide use. The survey estimated that about 4.2 million pounds of insecticides were applied on more than 2.7 million acres of cotton in 1994. Two-thirds of the volume of insecticides used was made up of methyl parathion, malathion, azinpyhos methyl and profenofos. Forty-six percent of the insecticides were applied by aerial application. An estimated 6.1 million pounds of herbicides were applied to 5.2 million acres (96% of total acreage) of cotton. Farmers reported that trifluralin was the most widely used herbicide. While all the planting seed for cotton was treated with fungicides, just a little over 2 percent of cotton acreage received further fungicide treatment.

A 1995 NAPIAP study by the Arkansas Extension Service,[60] surveyed rice growers in Arkansas, Louisiana, California and Texas. Fifteen percent of the 1,300 Texas rice growers responded to the survey. The study found that "virtually all rice growers employ both chemical and non-chemical measures to control pests." The survey data showed, however, that chemical measures far outweigh non-chemical means.

Weeds were found to be the biggest problem for rice growers. Five herbicides—propanil, molinate, 2,4,-D, bensulfuron and thiobencarb—accounted for 85 percent of the total pounds of herbicide used in the four states. While 100 percent of the Texas rice growers reported using propanil for weed management, only 16.5 percent said they used any kind of non-chemical treatment, such as water management, for weed control.

Between one-quarter and one-half of the acres planted in rice used seeds treated with fungicides. The most common fungicides used were carboxin, gibberellic acid, mancozeb, and zinc. Benomyl, propiconazole and iprodione were the most common fungicides used after planting.

The report also indicated that while no more than 3.7 percent of Texas rice growers used alternative insect control practices, 57.7 percent used methyl parathion to control insects. Texas rice growers also commonly employed carbofuran, carbaryl, malathion and copper sulfate. Given the nature of rice growing, the report noted that aerial applicators account for almost all post-planting pesticide application.

A 1993 study of turfgrass producers[61] estimated that 95 percent of the 30,000 acres in turfgrass production was treated with pesticides. Atrazine, fenoxycarb, simazine, chlorpyrifos, and metolachlor were the primary pesticides used. The results were based on the responses of about 4% of the Texas turfgrass growers, estimated to account for about 13% of the total turfgrass production in Texas.

A 1991 study of Texas nursery crop growers, [62] found that 86 percent of survey respondents used six or more different pesticides. The 37 study respondents were estimated to account for "well over half" of Texas nursery production. The respondents also reported using non-chemical pest control methods, such as mowing, hand pruning and culling. The primary reasons given for use of non-chemical methods included "concern about effect on non-target [pest] species" and "less expensive than agricultural chemicals."[63]

Pesticide Use in Other Sectors

Specific data on non-agricultural pesticide use is generally not available. As with agricultural pesticides, some sales and market data are collected by the federal government, but these data do not allow one to determine sales or use by location within Texas.

Most governmental entities—such as schools, parks departments and highway maintenance departments—likely keep some records of their pesticide use. These records should generally be available to oversight agencies and to members of the public through the Texas Public Information Act. There is, however, no public compilation or reporting of these uses which would allow the oversight agencies or the public to readily know what pesticides are being used in the community, even in locations such as parks and schools where children may come into most direct contact with them.

Only through an extremely laborious process would it be possible to put together a picture of pesticide use by government agencies, schools and other entities subject to the state's open records act. This would involve requesting and analyzing thousands of invoices or other records that may be kept on pesticide use. As far as can be determined, such an exercise has not yet been undertaken in Texas.

One controversial category of non-agricultural pesticide use in Texas is the use of herbicides to kill aquatic weeds such as hydrilla and water hyacinth. Commonly used aquatic herbicides include 2,4-D, glyphosate, endothall and fluoridone. During 1993 to 1996, the Texas Parks and Wildlife Department reported treating annually between 1750 and 3440 acres of lakes and streams with aquatic herbicides, though the amount of active ingredient used was not reported.[64] Many other entities—such as river authorities, lake managers and golf courses, as well as individual homeowners—also use aquatic herbicides, with no use reporting. This can pose problems, particularly if the herbicides are applied near a drinking water intake, since most labels for aquatic herbicides require protection of public drinking water supplies. In some cases, the labels require that the drinking water intake be shut down for anywhere from 7 to 21 days after the herbicide is used in a drinking water source. Enforcement of such label restrictions is difficult, at best, without information on location of timing of use.

The Texas Department of Transportation is responsible for right-of-way maintenance for state highways. It appears that TXDOT is making efforts to increase use of integrated pest management and non-chemical alternatives for right-of-way maintenance, but it also still relies on use of such pesticides as fenoxycarb, chlorpyrifos, triclopyr, hexazinone, glyphosate, clopyralid, imazapyr, diazinon, metsulfuron methyl and sulfometuron methyl.[65]

Limited anecdotal information on non-agricultural uses of pesticides in Texas does exist, largely as a result of problems caused by the use of a particular pesticide. For example:

• Eating fish caught in Austin's Town Lake has been prohibited for years due to the high concentrations of the pesticide chlordane. Chlordane was most commonly used to control termites, before being banned in the early 1990s.

• The widespread use of the insecticide diazinon on lawns and other urban settings has affected water quality in the Trinity River basin.[66] Wastewater from a number of city sewage treatment plants, including Fort Worth, Denton, Tyler, Temple and others, can fail monthly toxicity tests because diazinon has reached the system through runoff and is not removed by the treatment plant.[67] The City of Fort Worth's has launched a public education campaign promoting use of less toxic alternatives.[68]

• Hundreds of trees along an 11-mile stretch of road in north Dallas in August 1997 were poisoned by city workers applying a weed killer to city sidewalks.[69]

• A Dallas study of children poisoned by pesticides at home found that 15 percent had absorbed pesticides through their skin from contaminated carpets and linens.[70]

Of course, merely collecting better information on pesticide use cannot alone eliminate such problems as over-use or mis-use of pesticides. Better information on pesticide use patterns, however, will allow state and local governments, school boards, water supply systems and others to develop (and evaluate the effectiveness) of pesticide use management and education programs.

CHAPTER III.

PESTICIDE REGULATION

This chapter provides a very brief overview of national and Texas programs regulating pesticide use.

Federal Programs

In 1947, Congress took its first step to regulate pesticides with the enactment of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). This early law was intended primarily to protect farmers and others from mislabeled, ineffective or adulterated pesticides. The original document was only 35 pages long. By 1994, with billions of dollars on the line and as questions of possible adverse health effects and environmental impacts had been raised, FIFRA had expanded to more than 200 pages.[71] FIFRA initially granted jurisdiction over pesticides to the United States Department of Agriculture, but in 1970, amid allegations of the USDA's mismanagement and conflicts of interest, Congress shifted authority for pesticide regulation to the newly-created Environmental Protection Agency (EPA).[72]

Federal pesticide law establishes a national program with a division of responsibility between the federal and state governments.[73] The federal government focus is on the underlying issues of pesticide effectiveness and potential risks. In brief, EPA registers pesticides if it determines that they can be used without unreasonable adverse effects on man or the environment, reflecting a Congressional directive to balance the risks and benefits of pesticides. The EPA is also authorized to impose use restrictions (often set out in the labels required for pesticide products) and to cancel or suspend products, though the latter authority has not been broadly used. The training, licensing and oversight of pesticide sellers and users are generally left to the states, with federal grants supporting those efforts.

The USDA, however, continues to play a role. Its National Agricultural Statistics Service (NASS) has been publishing reports on chemical use in agriculture since 1991, as part of a federal water-quality initiative. These reports include annual summaries of pesticide use on field crops and bi-annual reports on pesticide use on fruits and vegetables. The summaries are based on voluntary surveys of growers in major agriculture-producing states. In addition, the USDA funds pesticide-use studies through state liaisons (including the Agricultural Extension Service of Texas A & M University) as part of its National Agricultural Pesticide Impact Assessment Program (NAPIAP). The USDA is also responsible for testing pesticide residues on fresh food through its Pesticide Data Program.

The Food Quality Protection Act

In 1958, Congress added the so-called Delaney Clause to the Food and Drug and Cosmetic Act. This amendment provided that no chemical which causes cancer could be added to processed food regardless of the level of concentration or the level of risk. In effect, Congress determined that the uncertainties surrounding any attempt to assess the risks of cancer were too great.

In 1996, the Delaney Clause was amended through the passage of the Food Quality Protection Act (FQPA). Passage of the act was a direct result of the publication of the National Research Council's report, *Pesticides in the Diets of Infants and Children,*[74] in 1993. This report questioned the government's ability to assess pesticide risks to children and to prevent dangerous exposure levels. The legislation was supported by some environmental groups, citing the report and the failure of the federal government to enforce the Delaney Clause. It was also supported by portions of the food and chemical industries, hoping to escape the "zero-tolerance" requirements of the Delaney Clause.

THE NEW LAW—KEY FEATURES

A key feature of the Food Quality Protection Act is the way it implements risk assessment in determining pesticide tolerance levels. Risk assessment has been called "the process of determining the probability of a bad outcome." In setting pesticide tolerance levels for food crops, the EPA has relied on risk assessment studies conducted on animals and, in most cases, provided by the manufacturer. In these studies, experimental animals are exposed to various doses of a single pesticide. From the resulting data, EPA extrapolated the possible harm a pesticide ingredient might pose for humans.

Key provisions of the new Food Quality Protection Act include:

• EPA must set pesticide tolerance levels for raw or processed food, with "a reasonable certainty" of no harm from aggregate exposure to pesticides;

• EPA must assess the impact on infants and children in determining tolerance levels so that aggregate exposure to pesticides will not result in harm to infants and children;

• EPA cannot consider the benefits of a pesticide when evaluating pesticide tolerances based on their impact on reproduction and pre-natal development or on exposure levels for infants and children. Pesticide benefits may be considered when evaluating existing tolerances for cancer-causing effects if the pesticide risk is less than the risk caused by its discontinuation, if its discontinuation would cause a major disruption of the food supply, and if certain criteria for lifetime risk are met;

• EPA must publish information, to be displayed in grocery stores, about any pesticide residues that do not meet the standard of reasonable certainty of no harm but are allowed because of their perceived benefits.[75]

Central to passage of the act was its requirement that EPA compensate for incomplete data on the effects of pesticides on children by applying a 10-fold safety factor. The law requires EPA to review over 9,700 existing tolerances for 470 active pesticide ingredients or high hazard inert ingredients[76] and apply the safety factor of 10 where comprehensive and complete information is not available regarding the cumulative impacts on children.

TOXIC "INERT" INGREDIENTS

For the first time, under the Food Quality Protection Act, the EPA is scheduled to examine tolerance exemptions given to "inert" pesticide ingredients—those used to dilute or carry the active ingredient. Of the 2,500 substances added to pesticides but not named on product labels, more than 650 have been identified as hazardous by federal, state or international agencies. Nearly 400 of these have been used as the active, killing ingredient in pesticides. Twenty-one of the inert ingredients have been classified as carcinogens, 127 as occupational hazards and 209 as hazardous air or water pollutants. The "inert" ingredient naphthalene, for instance, is designated a hazardous air pollutant under the Clean Air Act and a priority pollutant under the Clean Water Act. Sources: *Worst Kept Secrets: Toxic Inert Ingredients in Pesticides*, Northwest Coalition for Alternatives to Pesticides, (Eugene, Oregon: NCAP, 1998)

Texas Programs

In part to implement federal pesticide law, Texas has established a framework for regulation of pesticide use in the state. The Texas Department of Agriculture (TDA) retains the primary responsibility over pesticide use in agriculture. It runs a registration process to generate fees for the program and implements regulations for dealers and users of pesticides. This basic regulatory framework has been broadened over the last 15 years to include a wider range of government agencies.

The basic Texas laws for the regulation of pesticides have been in effect since the early 1970s, with few changes. The most significant changes occurred in the mid-1980s, with the addition of a worker protection law and several new TDA regulations.

TEXAS REGULATORY AGENCIES WITH PESTICIDE RESPONSIBILITIES[77]

• The **Agriculture Resources Protection Authority** was created by the Texas Legislature in 1989 to coordinate policies and programs of all Texas agencies related to the control of pesticides in Texas.

• The **Texas Department of Agriculture (TDA)** has primary responsibility for pesticide registration and enforcement. It is also responsible for an organic food and fiber certification program and for aspects of the Integrated Pest Management program.

• The **Structural Pest Control Board** licenses applicators of pesticides used in and around homes and other buildings. It also oversees the integrated pest management program for public schools.

• The **Texas Natural Resource Conservation Commission** regulates storage and disposal of pesticide waste and containers. The TNRCC also coordinates programs for identifying and responding to pesticides in groundwater and surface water.

• The **Texas Department of Health** regulates the use of pesticides for health purposes, including the control of mosquitoes. The Texas Department of Health regulates the use of pesticides in restaurants. Doctors are required to report pesticide-related illnesses to the Texas Department of Health.

• **Texas A&M University's Agricultural Experiment Station** is involved with research efforts on major obstacles facing agricultural production. This includes studying the use of pesticides and alternatives to pesticides.

• **Texas A&M University's Agricultural Extension Service** serves as the major education and outreach effort of the state to farmers, ranchers and the public regarding agriculture, including pesticides.

• The **Texas Soil and Water Conservation Board** is the lead agency for oversight and monitoring of agricultural non-point-source pollution, including pesticide pollution. The Board helps farmers with voluntary efforts to reduce non-point source pollution.

In 1985, worker protection legislation was extended to farmworkers, following litigation brought by the Texas United Farm Workers. Under the Farmworker "Right-to-Know" legislation, agricultural producers are required to assure that farmworkers receive training and adequate health and safety information on the pesticides to which they might be exposed. The Farmworker Right-to-Know law requires the distribution of crop sheets to agricultural workers. These sheets are printed in English and Spanish by the Texas Department of Agriculture.

The crop sheets include information on the pesticides most commonly used on particular crops in particular regions of the state. They contain safety warnings and handling instructions, including the length of time for which sprayed fields should be posted. The list of pesticides included on each sheet is put together from information provided by agricultural extension agents and informal surveys of farmers.

The Farmworker Right-to-Know legislation also requires operators of larger farms to keep pesticide application records for thirty years, although they are not required to turn these records into state agencies. The Texas Department of Agriculture has the responsibility to enforce this law. The Texas program has now been supplemented with a national program established by the EPA.

In 1984, the Texas Department of Agriculture issued rules establishing waiting periods before workers could re-enter fields recently treated with pesticides. Notice of pesticide applications must be provided and fields posted with re-entry periods.

Despite concern over farmworker exposure to pesticides, however, Texas has no systematic health monitoring for the 2 million farmworkers who work around pesticides. Industrial workers producing these same pesticides do receive health monitoring.

In 1984, Texas created one of the first programs in the country for prior notification of agricultural pesticide use. Under TDA rules, agricultural producers are required, if asked, to notify anyone whose property adjoins a field or who resides or works in a building, school, hospital, or day-care center within one-quarter mile of a field that is to be sprayed. Anyone who is chemically sensitive and resides within one-quarter mile of field that is to be sprayed may also ask for notification.

Unlike some other states, Texas does not have broad notification or posting requirements for treatments of lawns, golf courses or other non-agricultural settings. State law does, however, provide that notice signs must be posted in common areas of apartments, workplaces, hospitals, day care centers, schools or educational institutions, warehouses, hotels and food processing locations 48 hours prior to indoor pesticide applications.[78] It also requires posting for outdoor pesticide use at apartment complexes.[79]

Both the Texas Department of Agriculture and the Structural Pest Control Board license applicators to use pesticides registered by the EPA and the Texas Department of Agriculture. With money provided by the EPA, Texas takes the lead in enforcement of pesticide sales and use restrictions under both federal and state pesticide legislation. With the goal of protecting pesticide users' economic interests, the Texas Department of Agriculture inspects manufacturers, wholesalers, distributors and retail stores to verify proper labeling and formulations.

With the goal of protecting public health and the environment, the Texas Department of Agriculture and the Structural Pest Control Board license most pesticide applicators (with the exception of homeowners) and conduct some inspections at sites where pesticides are applied. Licenses to sell or use pesticides can be canceled and monetary penalties can be assessed for violations.

Besides enforcement, TDA is responsible for establishing training and licensing requirements for commercial, non-commercial and private applicators who wish to use pesticides that have been restricted by EPA or TDA because of the higher risk associated with their use. The Texas Department of Agriculture reported in 1997 that 7,244 commercial and non-commercial pesticide applicators and 122,336 private applicators were licensed by that agency, almost all for agricultural production.[80]

The Texas Structural Pest Control Board has established training and licensing requirements for commercial and non-commercial uses of any pesticides, around homes, parks, schools and other urban or industrial settings. In January 1998, the Structural Pest Control Board reported 3,093 licensed commercial pesticide businesses and 7,812 professional certified applicators.[81] The Texas Department of Health also has a regulatory program for the use of pesticides around restaurants, for disease control and several other uses.

CHAPTER IV.

PESTICIDE USE REDUCTION

Introduction

Federal and state pesticide laws do not focus on pesticide use reduction. There are several state-level efforts, however, to decrease pesticide use in crop production as well as in the home, garden care and public schools.

The reduction of pesticide use in agriculture is driven both by concerns about the costs of the chemicals themselves and by concerns about the risks to health and the environment. Use-reduction strategies are often labeled “alternative agriculture” or “sustainable agriculture.” These terms generally refer to a variety of practices, including crop rotation, integrated pest management, reduced chemical inputs and organic farming. Many of these are centuries-old successful farming practices that were abandoned with the advent of chemical pesticides. Today, however, farmers still face barriers to the adoption of alternative practices.[82]

Integrated Pest Management[83]

Since 1972, some Texas agricultural producers have used a pest population management system known as Integrated Pest Management (IPM). The Texas A&M Experiment Station and Extension Service and the Texas Department of Agriculture share responsibility for research on and implementation of IPM.

According to the National Research Council, “integrated Pest Management rests on a set of ecological principles that attempt to capitalize on natural pest mortality.”[84] Integrated Pest Management strategies are now being extended to schools, offices and home gardens.

For agricultural purposes, Texas A&M scientists define IPM as the use of two or more of the following practices: growing pest-resistant crops, crop rotation, using beneficial insects, scouting fields to determine pest populations and using an economic threshold approach that indicates when a pest population has reached a density level such that the cost of crop damage exceeds the cost of controlling the pest. Pesticide use is a component of IPM, but rather than relying on routine applications whether needed or not, IPM relies on targeted applications for specific pests.

The Texas Department of Agriculture's total budget in 1996 was approximately $24 million.[85] Of this amount, $2 million was spent on the Department’s Integrated Pest Management and Organics Certification programs. Approximately $200,000 was allocated for IPM programs through grants to the Texas A&M Agriculture Extension program and the Agriculture Experiment Station.[86] These Texas A&M programs also received direct appropriations for IPM work.

The Texas Agricultural Extension Service has highlighted some of the following as specific benefits of IPM:[87]

• In excess of 19 million pounds per year of pesticides were applied to Texas cotton in the late 1960s, prior to implementation of IPM methods. By the mid-1970s, annual pesticide use had dropped to about 2.3 million pounds as a result of cotton IPM programs.

• A vegetable IPM program in the Rio Grande Valley reduced insecticide use by 66 percent on carrots processed for baby food, soups and frozen foods. Using IPM, a single carrot grower increased her profits by $22,000.

• IPM programs for Texas pecans increased yields by 80 pounds per acre. Profits were increased by $306.25 per acre for irrigated pecans and $37.15 for dryland pecans.

• Citrus producers in the Lower Rio Grande Valley using IPM programs reduced insecticide applications by 33 percent and increased per acre net returns by $75.00.

One of the major limitations of some IPM programs as they have been implemented to date is an inability to achieve significant reduction in herbicide use. In Texas, most of the pesticides used for crop production are weed-controlling herbicides. The reduction of herbicides is difficult for a variety of reasons. Weeds are inherently difficult to control. In addition, some IPM methods for weed control tend to be labor intensive, and the labor costs can outweigh herbicide costs. Nevertheless, there is increased research into and application of IPM weed control methods, due in part to increasing resistance of some weeds to available herbicides.[88]

IPM strategies can also be applied in homes, parks, schools and other non-agricultural settings. For example, the Structural Pest Control Board has initiated an IPM program to reduce the amounts of chemicals used in public school structures and grounds. This program, mandated by state legislation passed in 1991, required all public school districts to prepare IPM plans by September of 1995 and places other restrictions on pesticide use in schools.[89]

In addition, the Structural Pest Control Board has developed a program to certify applicators who wish to advertise their practices as being safer for human health and the environment. The program involves training applicators in alternative practices, requiring applicators to keep records and using an inspection-based practice. Rather than routinely applying pesticides, the applicator is required by the program to inspect the property and see if there is an actual pest infestation. The number of pest management companies advertising IPM and other low pesticide-use strategies is growing.

While only about four golf courses in the United States have identified themselves as "organic," the Audubon Society of New York and the United States Golf Association are working with more than 70 golf courses in Texas that are seeking certification as wildlife sanctuaries. Lake Side Country Club in Houston is the first fully certified course in Texas. Texas A&M University is assisting in the effort, which includes a wildlife and plant inventory, water quality management, habitat management and integrated pest management.[90] Golf courses involved in the program rely more on biological controls, avoid pesticide use near bodies of water and leave large areas untreated, allowing the native vegetation to return.[91]

Following the passage of the 1996 federal Farm Bill, the U.S. Department of Agriculture increased its spending on IPM research and initiatives. Spending on IPM initiatives increased from $22 million in Fiscal Year 1997 to $35 million budgeted for FY98. This includes $8 million for cooperative state and extension service research grants on IPM and $15 million for IPM application programs. Nevertheless, when the new IPM initiative program is combined with the agency's ongoing IPM research, budgeted at $120 million for FY98, and with the agency's enhanced responsibilities for pesticide use surveys and analysis, the total ($166 million) still represents 1.9 percent of the total USDA budget of $88.4 billion for FY98.[92]

The overall success of IPM efforts in Texas is difficult to ascertain, largely because of the lack of pesticide use data. Data on pesticide use is not being collected to determine the success of alternative practices on a comprehensive basis. This makes it difficult to evaluate whether, where and to what extent IPM is actually helping to reduce pesticide use and pesticide risks.

Organic Production and Distribution

In 1988, the Texas Department of Agriculture developed one of the first organic farm certification programs in the U.S. Under this voluntary program, the department inspects and certifies producers and other businesses that process or handle organic food or fiber. To receive “organic” certification, these operations must comply with the department’s growing and handling standards. Producers who comply are able to use “Certified Organically Produced” labels on their products. A 1993 state law prevents a person from labeling, marketing or presenting their products as organic without Texas Department of Agriculture certification.

In December 1997, 104 Texas organic farmers[93] were certified, down from 180 in 1994. (There were 205,000 farms in Texas in 1996.[94]). Texas is home to about 90 percent of the country's organic cotton farms, currently filling an important niche in the cotton industry. In addition, TDA certified 38 organic food processors, 27 distributors and 490 retailers in 1997.[95]

In late 1997, the U.S. Department of Agriculture published its proposed rule establishing, for the first time, uniform national standards for growing and processing organic foods, including vegetables, fruits, grains, livestock, and poultry. The Organic Foods Production Act of 1990 required the USDA to create and administer a set of uniform standards for organic food, including a list of materials that can and cannot be used in organic food production as well as a system of organic certification.

The law also required the creation of a National Organic Standards Board (NOSB), to serve as an advisory committee drawn from organic food producers. The NOSB was constituted in 1992 and, through a series of meetings with organic producers, developed a set of recommendations for the organic standards program. The NOSB recommendations excluded genetically engineered organisms from use in the production of food classified as organic. NOSB also recommended that an organic livestock designation requires access for those animals to the outdoors and direct sunlight.

On December 16, 1997, following the NOSB recommendations, the USDA issued its proposed rules for implementing the act. The proposed rules contradicted many of the NOSB recommendations and were vigorously opposed by many of organic farmers, distributors, consumers and environmental and consumer organizations.

USDA received thousands of comments on the proposed rule, most criticizing its failure to prohibit the use of sewage sludge, irradiation or genetically engineered organisms in organic food production. The rules were also criticized for provisions that would have prevented producers from identifying products in stores by production practices, such as "produced without synthetic pesticides," "raised without antibiotics or hormones," "pesticide-free," etc., thereby making it more difficult for consumers to make buying decisions according to their needs or desires.[96] After the conclusion of the public comment period, the USDA announced it would drop several controversial provisions of the proposed rules. The final rules establishing standards are expected to be complete in 1999.

The Boll Weevil Wars

As the nation's leading producer of cotton, Texas pays a good deal of attention to the boll weevil. Texas farmers estimate that each year the boll weevil may claim up to 5 percent of their crop.[97] So, when several cotton-producing areas of Texas voted to take part in the USDA Boll Weevil Eradication Program in 1995, farmers in those regions looked forward to higher yields in a year when cotton prices were predicted to be at a premium.

The theory behind the federal program is to engage all cotton farmers in an area in a massive pesticide assault (generally using malathion) on the boll weevil so that it is entirely eliminated from a region. If successful, future pesticide use and costs would be reduced, and cotton yields increased. All cotton farmers within an eradication area are required to take part in the program, which led some South Texas cotton farmers to question whether the proximity to Mexican cotton farms would undermine the effectiveness of the program in their region. Despite some misgivings, the majority of cotton farmers initially supported the Texas eradication program. Funded largely by the growers themselves, the program began in full swing in South Texas in May 1995.

The initial results were disastrous. Lower Rio Grande Valley cotton growers lost an estimated 365,000 acres of cotton, valued at $140 million dollars[98]. The region produced about 54,000 bales of cotton, compared to almost 308,000 bales the previous year.[99] Cotton farmers in the San Angelo area who participated in the program lost more than half their crop, with loses valued at about $60 million.

The USDA research office in the Lower Rio Grande Valley released a report tying the crop destruction directly to the eradication program, concluding that the malathion spraying killed beneficial insects, such as spiders and wasps, which usually hold other pests in check. In this case, the predators of beet army worms were eradicated, causing the cotton-eating worms to take over the cotton fields.[100] The study found the density of beet army worms in Valley cotton fields to be 164 times the density of the worms in Mexican cotton fields 15 miles away. Less than one percent of the cotton leaves in Mexico were damaged by the worm, while 71.4 percent of the leaves on Valley plants were worm-eaten.[101]

While state and federal officials were quick to say that it takes several years before the results of the eradication program can be appreciated, cotton farmers in the Lower Rio Grande Valley voted not to participate in the program again.

Prompted in part by the disaster of 1995, but also by concerns about costs and the accountability of the private Boll Weevil Eradication Foundation that had been set up to run the program, cotton farmers from Hale County in the Texas Panhandle and the Lower Rio Grande Valley mounted a successful court challenge to the spraying program. The Texas Supreme Court found that the legislature had unconstitutionally delegated government functions to the private Foundation.

In 1997, the Texas legislature resurrected the program, giving more oversight authority to the Texas Department of Agriculture. The Lower Rio Grande Valley and seven counties in the Coastal Bend/Winter Garden area were exempted from the program. In late 1997 and early 1998, two eradication zones were re-approved in farmer referendums, but one—the Southern High Plains/Cap Rock Zone—failed to win enough votes. This large district has since been divided up into 3 smaller proposed districts by TDA and eradication programs may be carried out in smaller areas.

Current issues with the eradication program include: (1) benefit/cost ratio, especially for dryland cotton farmers who produce lower yields and thus have less ability to absorb additional costs associated with spraying and (2) tracking effects of the program in terms of insect reduction, pesticide use, effects on beneficial insect populations and other factors.

CHAPTER V.
RECOMMENDATIONS

In order to provide better scientific data on pesticide use in Texas, the state should establish a pesticide use reporting system for both agricultural and non-agricultural uses of pesticides. Depending on available resources, it may be necessary to phase-in such a program over a 2 to 4 year period.

A pesticide use reporting system would provide agencies and the public with information on when, where, what types and in what quantities pesticides are being used in Texas. The benefits of pesticide use data are clear. These benefits include[102]:

- a more accurate picture of pesticide use patterns in Texas;
- better information upon which to base pesticide registration decisions, especially for emergency exemptions or "special local needs" exemptions;
- better information with which to track the effectiveness of Integrated Pest Management initiatives and other pesticide use reduction efforts;
- better information to help understand and prevent pest resistance problems; and
- increased scientifically-valid information upon which to base pesticide regulatory decisions related to protection of water quality, food safety, worker health and public health.

A pesticide use reporting system, properly designed and implemented to avoid undue burdens on those required to report, would provide a viable mechanism for collecting important pesticide use information. Experience in other states with pesticide use reporting, such as California, New York and others, can be used to help Texas design an efficient, useful and workable program. Texas can also draw on its decade-long experience with the industrial toxics release inventory (TRI), which was put into place by the 1986 amendments to the federal Superfund law.

The TRI program basically requires manufacturing industries using greater than certain threshold amounts of any of about 650 toxics to publicly report their discharge of these compounds to the air, water and land. The TRI data is reported to TNRCC and the U.S. Environmental Protection Agency and is also available to the public. The availability of such data has allowed TNRCC to sensibly target pollution prevention efforts, many of which are voluntary in nature. In Texas, these efforts have allowed the state to document a 41 % reduction in releases and disposal of toxics between 1988 and 1996, even though there was a 30% increase in Texas manufacturing activity over that same period.[103]

RECOGNIZED BENEFITS OF PESTICIDE USE INFORMATION

*"Determinations of the types and quantities of pesticides applied in agricultural and non-agricultural settings are beneficial for monitoring usage trends and to predict potential exposure hazards…To monitor potentially hazardous situations, improved state and national systems are also needed for the reporting of pesticide usage…*AMERICAN MEDICAL ASSN., COUNCIL ON SCIENTIFIC AFFAIRS[104]

"Use reporting also provides documentation of farmers' efforts to adopt reduced-risk pest management practices, which helps increase consumer confidence in the safety of the food supply" CALIFORNIA DEPT. OF PESTICIDE REGULATION[105]

The new pesticide use reporting system in New York, even in the first year, has "provided invaluable information to the Department in the enhancement of the Pesticide Management Program." NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION[106]

"*The FQPA requirements are strict, but they are attainable, provided that EPA allows development of the best scientific methodology and data to meet the new safety standards and revised objectives for protecting children's health. They must secure data on non-food uses of pesticides. . . . Decisions must be based on actual pesticide use.*" ARTICLE IN PEST CONTROL TECHNOLOGY MAGAZINE [107]

A pesticide use reporting system in Texas should take advantage of advances in electronic reporting and, to the extent practicable, be consistent with existing recordkeeping requirements and practices of those who use pesticides.

KEY DATA ELEMENTS OF PESTICIDE USE REPORTING SYSTEM

*Location and date of pesticide application
*Amount of active ingredient applied and target pest
*Application method
*Applicator license/certification identification
*Sales reporting to capture urban use patterns

Given the large number of farms in Texas (205,000) and the numerous and widespread non-agricultural uses of pesticides, full pesticide use reporting may not be possible immediately. Instead, priority could be placed on certain areas, such as the need for information on uses of pesticides that are of concern because of their potential to contaminate drinking water sources and uses of pesticides in schools and parks, where children may be more directly exposed. Once established, the system could be expanded to cover the full range of pesticide use reporting needs.

[1] Charles M. Benbrook, et al, *Pest Management at the Crossroads* (Yonkers, NY: Consumers Union 1996), chapter 3.
[2] League of Women Voters Education Fund, *America's Growing Dilemma: Pesticides in Food and Water* (Washington, DC: LWVEF, 1989), 1. Some earlier attempts to control insects were not so benign, however. For example, in the late 1890s, efforts to control the gypsy moth relied on widespread use of arsenic-based sprays, including lead arsenate. Mark L. Winston, *Nature Wars: People v. Pests* (Cambridge, MA: Harvard Univ. Press, 1997), pp. 24-26.
[3] Estimates, survey models and differences in assumptions lead to wide variations among reports of pesticide use in a given period. A recent study found that the total amount of pesticides reported in the 1991 National Agriculture Statistics Service report was about 60% of the agricultural pesticides used that same year as reported by the EPA's estimates. NASS estimates for pesticides used on cotton in California in 1991 varied from 66% less to 511% more than the amounts of pesticides reported by applicators. Source: Pease, W.S., J. Liebman, d. Landy and D. Albright, *Pesticide Use in California: Strategies for Reducing Environmental Health Impacts*," California Policy Seminar, 1996, Berkeley, CA., Appendix II.
[4] Audrey Thier, A Review of Pesticide Use Reporting Policies (April 1997), available from the Texas Center for Policy Studies.
[5] Arnold L. Aspelin, *Pesticides Industry Sales and Usage: 1994 and 1995 Market Estimates,* U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, Biological and Economic Analysis Division, Washington, DC., August 1997, 2-3.
[6] Id.
[7] For example, there was a marked increase in agricultural herbicide use in 1994 and 1995, largely due to an increase in acreage for corn, soybeans, cotton, rice and sunflowers and in response to flooding in parts of the country. Aspelin, 3.
[8] Ibid.
[9] Aspelin, 18.
[10] Aspelin, 26.
[11] See, e.g., *Pesticides and the Immune System: The Public Health Risks* (Washington, D.C.: World Resources Institute, 1996); Theo Colborn, et al., "Developmental effects of endocrine-disrupting chemicals in wildlife and humans" in Environmental Health Perspectives, 101:378-384.
[12] Shelia Hoar Zahm, "Pesticides and Cancer" in Occupational Medicine: State of the Art Reviews (Philadelphia, PA: Hanley & Belfus, 1997) at 274 (exposure of general population to pesticides) and James C. Robinson, et al, *Pesticides in the Home and Community: Health Risks and Policy Alternatives* (Berkeley, CA:School of Public Health, Univ. of California, 1994), p. 9, 48-50.
[13] National Research Council, *Alternative Agriculture,* (Washington, D.C.: National Academy Press, 1989), 123.
[14] See, e.g., Texas Department of Health, *Fish Advisories and Bans* (Austin:TDH, 1997).
[15] *Alternative Agriculture*, supra, at 20-50.
[16] Id., 121.
[17] Id., 121-123.
[18] *Frontline*, "In Our Children's Food," Public Broadcasting Corp. Aired March 30, 1993. Martin Koughan, producer/director.
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APPENDIX A

POTENTIAL HEALTH EFFECTS OF SOME WIDELY-USED PESTICIDES

Many pesticides are not only toxic to weeds and bugs, they can also have adverse effects on human health. These effects can include causing different types of cancer, impairment of the nervous system and lingering neurological problems, birth defects, reproductive abnormalities, hormone mimicry and disruption and immunotoxicity. Of course, whether these potential effects actually manifest themselves in any particular person depends on exposure levels, exposure to other pollutants and a variety of other factors.

Cancer: Some pesticides registered for use are classified by EPA as "probable" human carcinogens, others as "possible" human carcinogens. Pesticides have been linked to various types of cancers, particularly Non-Hodgkin's lymphoma, multiple myeloma, breast cancer, leukemia, prostrate cancer and others.[107] According to the National Cancer Institute, children may be more at risk from cancer caused by pesticide exposure than adults.[107]

Nervous System Effects: The most serious neurotoxic effects often result from acute (short-term) exposures to high levels of a pesticide, but symptoms such as headaches, dizziness and even seizures from these short-term exposures can linger. The organophosphate and carbamate pesticides are particularly of concern for neurotoxic effects, as they are designed to work by interfering with the cholinesterase enzyme, which is essential to normal nervous system function in humans as well as insects. Neurotoxic effects are particularly serious for infants and children, with developing brain and central nervous systems.[107] In older people, Parkinson's disease has been repeatedly linked to pesticide use.[107]

Birth Defects: Exposure of fetuses to some pesticides poses potential risks of birth defects. For example, one extensive study in rural Minnesota found higher frequencies of birth defects in areas with relatively higher pesticide use and higher rates of birth defects in infants conceived during the spring (when pesticide use is higher).[107]

Reproductive Abnormalities: Some pesticides have been implicated in reproductive abnormalities such as miscarriages, stillbirth and premature births, though most studies have involved occupational pesticide exposure.[107]

Hormone Mimicry and Endocrine Disruption: Pesticides are increasingly being scrutinized for links to disruption of hormonal balances in humans and wildlife. The hormone system controls a variety of important functions in the body.[107] Many pesticides have yet to be tested for endocrine disruption effects.

Immunotoxicity: Investigations of pesticide links to impairment of the body's immune system is just beginning, but some studies are showing potential links to certain pesticides.[107]

Table A-1 shows the potential health effects of some of the more widely-used pesticides. Information was drawn from several sources, including material from the U.S. Environmental Protection Agency's Office of

Pesticide Programs and Office of Ground Water and Drinking Water and the reports listed below, all of which are based on detailed documentation and studies of potential health effects.

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2. National Research Council, *Pesticides in the Diets of Infants and Children*. (National Academy Press: Washington, D.C, 1993).
3. The Pesticide Information Profiles in the on-line data base Extoxnet, the Extension Toxicology Network at Oregon State University—http://ace.orst.edu/info/pips; and
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Table A-1. Potential Health Effects of Some Widely-Used Pesticides

Pesticide	Major Uses	Potential Health Effects
Herbicides		
Atrazine	Corn, sorghum, sugarcane, turfgrass uses	Possible human carcinogen and endocrine disruptor; under EPA “special review”
2,4 D	Pasture, hay, aquatic herbicide, variety of other uses	Potential sperm quality and endocrine disruption effects; carcinogenic effects in dispute and under review by EPA; possible links to Non-Hodgkin’s lymphoma
Endothall	Aquatic herbicide	High acute toxicity
Pendimethalin	Cotton, corn, peanuts	Possible human carcinogen; in a class of compounds (dinitroaniline herbicides) which are suspected mutagenic agents, developmental toxins and may damage liver and kidney.
Trifluralin	Cotton	Potential endocrine disruptor; in a class of compounds (dinitroaniline herbicides) which are suspected mutagenic agents, developmental toxins and may damage liver and kidney.
Insecticides		
Azinphos-methyl	Cotton, sugarcane, peaches	Organophosphate family; high acute toxicity also
Carbaryl	Pecans, peaches, oats	Organophosphate family; potential immune system and endocrine disruption effects

Chlorpyrifos	Corn, pecans, sorghum, cotton, household use (Dursban©)	Organophosphate; high acute toxicity (neurotoxicity); potential immune system effects
Diazinon	Lawn and garden; home use	Neurotoxic organophosphate; banned in 1990 for use on golf courses
Propargite	Corn, sorghum, peanuts	Probable human carcinogen
Fungicides		
Chlorothalonil	Peanuts, onions, watermelon, potatoes, cantaloupe, cabbage	Probable human carcinogen
Maneb	Watermelon, potatoes	Probable human carcinogen
Mancozeb	Pecans, onions, watermelons, peanuts, cantaloupes, melons	Probable human carcinogen (including thyroid cancer); genotoxic potential