

HERBICIDE REGULATION IN MICHIGAN

by

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ABSTRACT

Lawn care herbicides are a type of pesticide regulated under federal and state pesticide legislation. The Michigan Department of Agriculture implements herbicide regulation to protect the public's health and welfare. Yet, due to gaps that exist in all levels of government in the regulation of lawn care herbicide application, the public is placed at risk. The federal pesticide legislation (Federal Insecticide, Fungicide, and Rodenticide Act) provides for a lower standard of safety in the classification of herbicides applied in the residential context as opposed to the agricultural context. Michigan legislation (The Pesticide Control Act) exempts persons from the law applying general herbicides on their own premises. The state does not require public notification of risks or safety precautions prior to commercial application of these herbicides. Furthermore, on-site inspections are not performed for residential application of herbicides and the state applicator certification program is not assessed for effectiveness. These results confirm that gaps exist in the regulation of lawn care herbicide use.

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INTRODUCTION

Each year more than 25 million residential households apply herbicides to their lawns. They are applied by homeowners and commercial applicators who may purchase herbicide products on the open market. Weed control in Michigan accounts for \$6.44 million worth of herbicides sold. One of the most commonly applied herbicides is 2,4-Dichlorophenoxyacetic Acid (2,4-D). There are currently about 1,500 registered products containing 2,4-D as an active ingredient and over 303,000 commercial applicators certified to apply herbicides.

Empirical data on the hazards of 2,4-D and other lawncare herbicides has been accumulating. Canine lymphoma has been shown to afflict companion dogs of homeowners using 2,4-D on their lawns at twice the rate of dogs whose owners did not use the herbicide (Hays, 1991). A six-fold increase risk of Non-Hodgkins lymphoma in farmers exposed to 2,4-D was shown by Hoar et al. (1986). Victims of herbicide exposure have testified to Congress of permanent disabilities induced by contact with lawncare herbicides and many have been forced to move away from their neighborhoods where commercial herbicide applicators make service calls.

2,4-D and other herbicides are toxic chemicals. 2,4-D is carcinogenic, mutagenic, and teratogenic in animals and causes poisoning in humans (Reuber, 1983). These are attributes known to be associated with acute exposure and use-guidelines are established according to acute risk information. The effects of chronic exposure are now manifesting themselves as a serious concern. The risks of chronic exposure are not widely known yet health hazards increase with exposures to mist, carryover, residue, and groundwater contamination. Product labeling does not mitigate the hazards being revealed.

Because herbicides are a type of pesticide, products such as 2,4-D are regulated by the federal government through the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and by state government through the Michigan Pesticide Control Act (Act 171). These laws were enacted to protect the public by regulating pesticides and minimizing or preventing their misuse and abuse.

The potential for harm and the ever increasing amounts of herbicides applied on residential lawns suggests a public that is not sufficiently informed on or protected from the dangers that lawn chemicals created. Legislation does exist controlling the sale, distribution, and use of all pesticides. The federal government implements FIFRA through the Environmental Protection Agency (EPA). The states are given authority, upon approval of the EPA, to implement their own program for pesticide regulation. The question becomes whether the government, in its role as protector, is regulating these substances in a manner that protects the public.

This paper will examine pesticide legislation, review the regulatory structure as it relates to a state implementation framework of control, and examine institutional arrangements as they pertain to herbicide regulation. The Michigan Pesticide Control Act will be the critical focus for this study. A look at cooperative federal and state programs, funding initiatives, and decision-making processes will reveal how herbicide regulation compares with its implementation.

Are lawncare herbicides sufficiently regulated in their residential application so as to protect the public's general welfare? The purpose of this paper is to propose that the intergovernmental approach to the regulatory process has created a gap in the control of herbicides. Laws that have been made and carried out at more than one level of government have created a structure with gaps that encourages, rather than restricts, herbicide production and use in the residential environment. The focus for my proposition is on two issues, the structure of regulation, and the context in which regulation is carried out.

To address the issue of structure, federal and state legislation are examined for possible gaps in the pesticide law. Institutional arrangements pertaining to herbicide regulation are explained by a review of the major pesticide control law: the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The state's role in these arrangements is examined by reviewing the Michigan Pesticide Control Act and the Michigan Pesticide Commission.

Answers were sought to questions on the usage of herbicides at the time of legislative passage, to whom and what the law applies, how regulation impacts herbicide production, sale, and use, and what criteria were set for control at the federal level. Answers were also sought to questions about state mandated legislation. These include how state requirements compare with federal requirements, what state legislative demands are, who is involved with setting criteria and making sure they are met, what the state criteria currently are, and at what point local involvement comes in, if at all.

Legislation that was mandated at the federal level was compared with the implementation process carried out by the Environmental Protection Agency (EPA), and the Michigan Department of Agriculture. An examination was made of existing means for regulating the use and application of registered herbicides, certifying new herbicides and applicators, and procedural requirements for program evaluation. Are older herbicides allowed to be marketed until proven they are directly harmful to humans or are they banned until proven safe? A look at use-restrictions and registration cancellations helped to answer such questions. Implementation analysis was performed by reviewing state and federal matching programs, administrative enforcement provisions, funding structure, primacy rules, and the decentralized approach to control strategies.

Are matching programs offered by the federal government requested by state agencies? Which agencies have made the requests and how have they carried out the programs? Questions such as these were answered

by review of the programs offered by the EPA Office of Pesticides and Toxic Substances. Do gaps exist because enforcement procedures are not effective at achieving stated purposes? Administrative enforcement provisions are examined to answer this. The implementation analysis helps to make a determination as to the basic answers required in the question: Do gaps exist because enforcement procedures are not effective in achieving stated purposes, because stated purposes are inadequate, or because regulation does not provide effective control?

The second issue examined in the study is that of the context in which herbicide applications are carried out. Agriculture was the original user of herbicides in the United States and in the 1970's it was responsible for 228 million pounds of herbicides applied per year (McEwen, 1979). Congress was rightly concerned with the great amounts of herbicides poured into the environment and enacted legislation to address their control. But today that same legislation is relied upon for control of herbicides that have proliferated into a different type of environment; residential.

Through research on the regulation process of enforcement, determination is made as to whether the control of herbicides as originally instituted for in the agricultural setting has working applications in the newer residential-use setting. Agricultural-use regulation (which in itself has the dual purpose of controlling and protecting the industry) is compared with regulation as it applies to residential settings.

Are the standards set for herbicide use as applicable to the residential environment as they are to the agricultural environment? Criteria set for regulatory standards of herbicides in commercial use may include such measures as the amounts of herbicides used, the number of safety tests performed, number of inspections, number of applicators certified, and rate of respirator use during application. These criteria are examined for their suitability in regulating private use of herbicides.

The criteria placed on herbicide applicators were set with rural treatment in mind. Treatment in this context is carried out in wide open spaces, miles from public contact, and far from direct drinking water sources. The two weeks for the herbicide 2,4-D to break down is accommodated by the remoteness of the area (McEwen, 1979).

In a residential setting the daily activity of people close by and the immediate contact of ground water to many drinking sources places different demands on the criteria. Are warnings appropriate to the setting and are they readily available? Is the public educated to the extent that the hazards warrant? Are people made aware of the ever increasing danger being documented and the precautions that are necessary long after the commercial applicator has departed? Negative answers to these questions will help show that gaps exist in the control of herbicides under current pesticide standards.

It is suspected that patterns will emerge showing a discrepancy between criteria set at the federal level and criteria met at the local level. Such patterns would reveal another discrepancy between

the criteria applied in the agricultural context and those applied in the residential context. These patterns would support the contention that a gap exists in the regulation of herbicides.

One method of obtaining the necessary information and for carrying out the design is by examination of governmental documents. Federal documents from the EPA are reviewed as well as documents of the Michigan Department of Agriculture (MDA). Archival information is examined, with the Congressional and Michigan Record a major source for review. State documents from the DNR and the Michigan Department of Agriculture are reviewed. Legal summaries, committee and commission reports, and financial records are examined for state involvement.

Interviews were conducted with key actors within the system who are involved with the issues, including the coordinator of the pesticide program in the MDA, the director of grounds/maintenance for a Michigan public school system, and an assistant to a member of the Michigan Pesticide Commission. The questions asked of them addressed the two issues explored. Pertaining to the structural issue were questions as to why herbicide regulation was not retained or carried out at the federal level, whether and how agencies are required to interact in implementing the regulation, what is required of states in relation to the federal EPA office, and how local agencies are to participate.

The toxicity of herbicides remains the same today as when legislation first addressed herbicide use. It is the hazards of

herbicide use that have changed. The concern is that pesticide legislation and enforcement does not accommodate the problem posed by herbicide use today, reflecting a gap/gaps in the regulation of herbicides.

The important elements of this regulation are the structure of herbicide control from institutional arrangements, the structure of enforcement processes through different implementation provisions, and the context of herbicide use today. Patterns emerging from criteria and standards established for one context or purpose may reveal a difference in the patterns that emerge from measures carried out.

The context of pesticide regulation was addressed through questions on why the legislation targets the people, substances, and uses for which it was written, whether there were attempts prior to enactment of the law to include residential uses, and what has been done to include residential use and application of herbicides in the enforcement process.

The search for gaps in the regulatory process was carried out by examining the link between federal herbicide legislation and Michigan herbicide regulation and any multi-level arrangements that exist. An inadequate match between legislation and its application was expected to be found. Comparing the regulation standards set for one context of herbicide use with those carried out in another context may reveal very different patterns. This information will show that the intergovernmental approach to the regulatory process has created a

structure with gaps which encourages, rather than restricts, herbicide production and use in residential environments.

BACKGROUND

The desire for carefree and esthetically pleasing lawns has propelled the lawn maintenance industry into a billion dollar business. A large part of lawn maintenance is the use of herbicides, a type of pesticide, to keep weeds at bay. One of the most commonly used herbicide is 2,4-Dichlorophenoxyacetic acid (2,4-D). It is a herbicide which chemically destroys a plant cell's ability to process energy.

The application of 2,4-D and other herbicides on lawns by homeowners and commercial applicators has become widespread. Spraying of herbicides into the air and over the ground is no longer mainly a business or farm activity. Virtually everyone applies or has a neighbor who applies herbicides to a lawn. Along with the increase in herbicide use throughout residential areas, has been increases in its hazards.

Reports of people falling ill after applying lawn herbicides were common in the 1980's. More and more people have testified to Congress in recent years as to permanent disabilities they sustained from contact with lawn pesticides and herbicides. In May of 1991 four people testified at a hearing by the Senate Environment and Public

Works' Subcommittee on Toxic Substances (New York Times, 5-10-91).

Three were exposed to pesticides and sustained harmful effects while working on their lawns. One, a former champion ice skater, was sunning in her yard when a neighbor started spraying a pesticide. The spray, drifting to her yard, killed her cat and dog, caused blindness in her left eye, and left her permanently disabled.

In 1985, an engineer became ill after spending an hour cutting his grass. Today he has testicular cancer and suffers constant pain (Wall Street Journal, 10-14-91). The doctors diagnosed the illness as caused by pesticide poisoning absorbed through his skin and inhaled through his lungs. Commercial applicators have also reported illness and harm from pesticide poisoning. The harm to agricultural workers applying these types of chemicals has been known for decades. McEwen (1979) cites 1969 estimates that there were 100,000 pesticide poisonings per year in the United States. Rachel Carson (1962) noted the destruction caused by pesticide use over thirty years ago, citing farm worker poisonings and bird decimation.

2,4-D is a herbicide or plant growth regulator. The chemical is carcinogenic in rats, mutagenic and teratogenic in animals, and causes poisonings in human beings (Reuber, 1983). Herbicides are systematically used to control broadleaf weeds in farms, pastures, forests, and residential yards. They are used in agriculture on wheat, corn, grains, sugar, and orchard crops; in pasture and rangelands for brush control; on lawns, gardens, and parks for weed

control; and in forest management for brush control, conifer release, and tree injection.

Methods of application are by aerial and ground equipment, knapsack sprayers, pressure and hose-end applicators, and lawn spreaders. The applications are performed by commercial/private individuals and by both certified and uncertified applicators. There are about 1,500 registered products containing 2,4-D as an active ingredient and over 60 million pounds of the chemical are applied domestically each year (EPA Fact Sheet #94.1, 1987).

The chief aim for herbicide and pesticide use twenty years ago was to prevent crop loss from disease, pests, and weed competition in the farming environment. In 1975, more than 36 million pounds of the herbicide 2,4-D was applied for United States agricultural uses (McEwen, 1979). By 1987, more than 60 million pounds of 2,4-D were applied to control weeds in grain and food crops (EPA Fact Sheet #94.1, 1987). This herbicide has become so commonly used because it is effective in killing weeds and because it replaces tilling of the soil as a method of weed control.

Within the context of residential use, the chief aim is the eradication of weeds and pests for the purpose of a symmetrical and pleasing looking lawn. The lawncare industry continues to expand. A detailed study of homeowner use during 1975 revealed that 122,000 pounds of herbicides were applied to Lansing, Dallas, and Philadelphia lawns. Weeds were cited as the main reason for pesticide application in Lansing, Michigan (McEwen, 1979). In 1988 weed control in Michigan

accounted for \$6.44 million worth of herbicide products sold on the pesticide market (Trend Facts, 1990). Pesticide sales to homeowners nationwide reached \$2 billion per year (New York Times, 5-10-91).

Nineteen million households in the United States use herbicides for plant treatment (Aspelin, 1991). Home and garden owners applied 25 million pounds of herbicides to their yards in 1989. The commercial lawncare industry has expanded to accommodate ever increasing applications. There are 303,134 commercial applicators currently certified with the EPA (Aspelin, 1991). Michigan alone has 6,944 certified commercial applicators (MDA Inspection Schedule FY 1992). The numbers of applicators certified to apply herbicides to residential areas and the large amounts applied each year increase the hazards associated with their use.

Empirical data on the hazards of herbicides to mammals continue to accumulate. A recent study by Dr. Howard Hays revealed an association between canine lymphoma and companion dogs whose owners used 2,4-D on their lawns. Among owners who applied 2,4-D to their lawns for four successive summers, canine lymphoma was twice as likely to afflict their dogs (1991). Furthermore, Hays points out that the lymphoma identified in the dogs of the study is physiologically similar to Non-Hodgkin's lymphoma in humans, currently the most deadly and fastest increasing cancer in the United States (1991).

In 1986, a case controlled study conducted in Kansas showed a six-fold increased risk for Non-Hodgkin's lymphoma of farmers exposed to 2,4-D twenty days or more in a year (Hoar et al.). A similar study

by Sheila Zahm in 1990 again, showed there was an increased risk (three-fold), of Non-Hodgkin's lymphoma among men who applied 2,4-D in Nebraska agricultural settings.

The frequent use of these herbicides within more enclosed areas suggests not only health hazards from contact but also from groundwater contamination. Groundwater in Suffolk County, New York was found to be contaminated with the pesticide, aldicarb, exceeding state recommended guidelines (Zaki et al., 1982). It was found that humans had ingested the pesticide even though all laboratory and field studies stated that the substance could not reach groundwater. The pesticide ethylenedibromide was discovered contaminating wells in north central Connecticut (Segerson, 1989). The EPA estimated that 10.4 percent of the nation's community water systems and 4.2 percent of the rural domestic wells contain detectable levels of one or more pesticides (National Pesticide Survey Update, Winter 1992). EPA concluded that one percent of these drinking wells are estimated to exceed a health based limit. Even so, agricultural drainage wells are only minimally regulated as a source of pesticide contamination of groundwater (Sater, 1990).

There do exist empirical data suggesting that lawn herbicide use is not a health hazard. A 1986 study looked at occupational exposure to 2,4-D by 45 lawncare specialists who sprayed the product daily (Yeary). Urinary excretion of 2,4-D was measured systematically and found to be at extremely low levels. The lawncare specialists were required to wear full protective gear when mixing but only required to

wear rubber boots and a clean uniform when spraying. Since 2,4-D is almost fully excreted unchanged through urine, the implications from the study were that even though the specialists did not suit up for the daily sprayings, their excretion and hence absorption of 2,4-D by the body was minimal. However, the effects of this minimal absorption for extended time periods is unknown. One need only remember that extremely small exposure to asbestos is now known to pose a significant health risk.

Being in the business of spraying herbicides, employees have access to a variety of educational and hazard information required by the Federal Right-To-Know Act. With this type of information, the specialists can learn that a significant means for avoiding chemical exposure is not what you wear but whether you change out of the clothing contaminated by the application. This includes the changing of footwear so as to avoid tracking residue into living quarters. For the study conducted by Yeary, the specialists were required to wear a clean uniform while they sprayed. This would indicate that the employees changed out of their contaminated clothing thus decreasing a means of total exposure to the herbicide. More than one study has found clothing changes to be significant.

The study by Zahm in 1990 showed the risk of pesticide poisoning increased with degree of exposure by time spent in contaminated clothing. The Hays' study implicates canine exposure by residue brought into the home on the owner's clothing and shoes as one possible mode of infection (1991). The opportunities for homeowner

applicators, other people who come into contact with the homeowner, and companion animals to expose themselves and be placed at risk may be greater than for commercial specialists.

Regulation as instituted by national pesticide legislation was not only designed to put into place a more rigid testing of pesticides prior to registration. It was also meant as an attempt to restrict pesticide, including herbicide, use to competent applicators, knowledgeable about chemical substances and their safe and effective use. This should pertain to residential application just as much as it pertains to agricultural application.

The pesticide legislation currently addresses manufacturers, industrial applicators, and other occupational employees. At their disposal are the Federal Right-To-Know programs, Material Safety Data Sheets, and licensing requirements that keep them informed on possible hazards. This legislation was created to inform, certify, license, and monitor occupationally exposed mixers and applicators. Yet, the context of herbicide use has changed, particularly for products such as 2,4-D. No longer are these substances sprayed only in isolated, wide open areas by licensed applicators. The high volume of products sold to control weeds in residential areas indicates an increase in nonlicensed applicators who may not be well informed as to the hazards herbicides pose. The spraying takes place over large amounts of acreage and within enclosed areas. The hazards from applying herbicides in a residential environment are different than those in an agricultural environment.

ANALYSIS

The federal law regulating pesticides is the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), first enacted in 1947. Amendments were passed in 1972, 1978, and 1988. FIFRA is administered by the United States Environmental Protection Agency (EPA). The major provisions of FIFRA are that all pesticides sold or distributed in the U.S. must be registered with the EPA, pesticides must be classified as either a "general use" or a "restricted use" product, the EPA has authority to develop rules establishing national standards for safety and disposal, and the states have the authority to certify applicators, register pesticides and initiate programs designed to meet local needs (7 USC § 136).

To be registered a pesticide must be classified as either a restricted or a general (nonrestricted) use product (7 USC § 136a(F)). Making the determination that a product should be classified as a general use pesticide implies that it is less harmful than the higher restricted use classification. This may not be the case. In making its determination FIFRA instructs the EPA to distinguish the various classes of pesticide use (e.g., crop vs non-crop) and to adjust data requirements (e.g., toxicity tests) so as to take into account the

differences in concept and usage between the classes of pesticides (40 CFR § 158.55). This suggests that the types and amounts of data the EPA requires in order to make regulatory judgments about the risks and benefits of the different classes of pesticides are different for an agricultural setting than for a residential setting.

The next part of the determination is made by setting toxicity levels for human and nontarget hazards (40 CFR § 152.170). These levels are different also depending on the environmental setting in which they are used. As long as criteria for these hazards are not exceeded, the pesticide remains classified as unrestricted. Yet criteria for human hazards are set at higher levels for residential use than for agricultural use. In the case of acute oral toxicity levels, a pesticide used in the residential setting is 'restricted' at a thirty times higher criteria (LD_{50} 1.5g/kg) than the level at which it is 'restricted' when used in an agricultural setting (LD_{50} 50 mg/kg). LD_{50} is a term expressing the lethal dose required to kill 50 percent of the test population (40 CF § 152.170). The standard of safety by the EPA for pesticide use then, is lower in the residential context than in the agricultural context for both the safety data required to support registration and the criteria level determining general and restricted use classification.

Federal requirements for general use pesticides such as 2,4-D consist of registering the product with the EPA and seeing that the product's labeling meets certain requirements (7 USC § 136a(a), 136a(c)(5)(B)). Any pesticide that EPA determines, when applied

according to directions or in accordance with commonly recognized practices, will not generally cause unreasonable adverse effects on the environment, is classified for general use (7 USC § 136a(d)(B)).

Once the product is classified for general use or even where the product meets one of the criteria for restricted use, the EPA then determines if additional labeling language would be adequate to mitigate the identified hazards (40 CFR § 152.170(e)).

Where the labeling language meets all the criteria specified, the product will not be classified for restricted use. These criteria are:

- (1) that the user would not be required to perform complex operations or procedures requiring specialized training;
- (2) the label directions do not call for specialized apparatus not reasonably available to the public;
- (3) failure to follow label directions in a minor way would result in few or no significant adverse effects;
- (4) following directions would result in few or no significant adverse effects of a delayed or indirect nature; and
- (5) widespread and commonly recognized practices or use would not invalidate label directions.

The implication is that long term effects from the chronic use of a pesticide do not determine classification as much, if at all, as the convenience to the applicator.

Beyond the registration of the product, the main provision of FIFRA pertaining to pesticide "use" regulation is the certification requirement (40 CFR § 171). Restricted use pesticides are required by federal law to be applied only by a certified individual or by one who is supervised by a certified individual. The certified applicant is tested by written exam if a commercial applicator and by self study if a private (farming) applicator. The exams are comprehensive and assure that the applicant is competent in pesticide handling and use.

However, one of the most common agricultural herbicides and a common lawncare herbicide is 2,4-D. This herbicide is not classified as a restricted use pesticide. Its less restrictive classification exempts it from federal regulations on distribution and sales and from certification requirements. The federal government does not require farmers, homeowners, or commercial applicators be certified to apply 2,4-D and so does not expect them to be competent and knowledgeable in the hazards associated with this herbicide.

FIFRA gives the EPA authority to approve a state plan for the certification of applicators where state standards conform to those prescribed by the EPA and gives the state authority in regulating the sale and use of federally registered pesticides (7 USC § 136b(a)(2), 136v). The state of Michigan meets the minimum federal requirements

with its enactment of the Michigan Pesticide Control Act of 1976 (Act 171).

Through 1975, Michigan did not have a pesticide law that regulated pesticide use and misuse. Pesticides were regulated by the Economic Poisons Act of 1959. There were no provisions for certification. Without such a provision, the Michigan legislature found that access to restricted use pesticides by farmers and the pesticide industry could be severely limited (HR 5310, Analysis 7-15-76).

The process of utilizing pesticides under the auspices of the EPA hinged on the restriction of their use by certified applicators. In 1972, FIFRA limited the application of restricted pesticides to certified applicators. Obtaining certification and licensing through the federal agency could be a slow process for state residents. In light of this Representative Bela Kennedy sponsored a bill (HR 5310) to address the problems of access to pesticides that FIFRA presented (Analysis 7-15-76). In order for state law to conform to federal law, the legislature determined that Michigan would have to put into place the means for certifying applicators, the registration of certain pesticides for special local needs, and the issuance of experimental permits. The Michigan Pesticide Control Act 1976 did just that.

The Act provided for all pesticides distributed and sold in Michigan and those used for special local needs to be registered with the Michigan Department of Agriculture (P.A. 1976, No. 171, § 8). A provision was made to license restricted use pesticide dealers and

certify commercial and private applicators utilizing pesticides classified as restricted by the EPA or the state director (P.A. 1976, No. 171 § 11 & § 12). The state's prerequisite to an applicant obtaining a certificate or license is the satisfactory completion of an examination as set forth by EPA rule and regulation which hinges on the use of restricted pesticides.

Michigan does go beyond the minimum standards of FIFRA which requires only those using restricted pesticides to be certified. The Michigan Pesticide Control Act requires that a commercial applicator in the business of applying either general or restricted use pesticides shall obtain a license before engaging in business (P.A. 1976, No. 171 § 12(2)). Licensing prerequisites include the satisfactory completion of certification requirements prescribed by the Director of Agriculture and categorized according to types of application prescribed by rule and consistent with EPA regulations.

The prerequisite in general refers to the EPA testing requirement to include demonstration of knowledge in label comprehension, toxicity and hazards of pesticides, environmental consequences of use and misuse, pest characteristics, pesticide characteristics, equipment, application technique, and applicable laws (40 CFR § 171.4). Specific standards of competency are to be applied for categories such as ornamental and turf pest control. In this case, practical knowledge is to be demonstrated in product persistence and methods to minimize or prevent hazards to humans and pets.

Michigan law has made the above standards of competency a requirement for all commercial applicators applying general use pesticides as well as for those applying restricted pesticides (P.A. 1976, 171 § 13b(1)). It is a violation of state law to apply any pesticide for a commercial purpose or as a work assignment on the property of another for any reason, other than a private agricultural purpose, unless that person is either a certified applicator (applying restricted products) or a registered technician (applying general products).

Not only does Act 171 imply that homeowners are not under the authority of the law, it explicitly exempts homeowners from provisions of the Act. Section 15 states that the certification and registration of applicators and licensing requirements shall not apply to persons applying general use pesticides on their own premises (P.A. 1976, No. 171, 286.565, 1976). The state does not require homeowners to have experience in applying lawncare herbicides or to meet a minimum standard of competency in their use.

To be eligible to be a registered technician the commercial applicant must have one year of service as an employee of a commercial applicator and complete a training course approved by the state and then successfully complete an examination on pesticide use and application (171 § 13b(2)). The training course can only be provided by a professional recognized by the Department of Agriculture. In Michigan the course is offered by the county Intermediate School

District and a core manual is offered by the Michigan State University's Cooperative Extension Office.

The course provides the applicator with the necessary knowledge to purchase and safely use pesticides. Pest monitoring techniques and natural control methods are taught to minimize the necessity of using pesticides. Environmental effects of pesticide use and ways to minimize groundwater contamination are explained. The largest section of the course involves pesticide hazards to the applicator and how to prevent them. The initial certification Applicator Core Manual explains many hazards that the applicator should know to protect themselves but the homeowner applying general use pesticides would not be aware of unless taking such a course.

For example, a section on label signal words is presented (Landis and Rosenbaum, 1991). Products with the word 'warning' on the label means it is moderately toxic with an acute oral LD₅₀ value ranging from 50 to 500 mg/kg. This is further qualified as meaning that 1 teaspoon to 1 ounce of the pesticide ingested could kill a 150 pound person. Not many novice herbicide applicators would be aware that the simple 'warning' word on the label is loaded with such dire implications. And since the human hazard criteria set by the EPA to sustain a residential pesticide in the general use category is an acute oral LD₅₀ of 1.5g/kg, the public handling these products is placed at great risk.

A section on protective clothing is presented explaining the importance of the types of clothing worn and how to avoid

contamination. It states that clothing should fully cover the body with particular attention to the head area where the highest percentage of absorption takes place. Hats of leather, straw, or cloth are of little use since these materials are highly absorbent of pesticide chemicals. It also stresses the importance of laundering contaminated clothing.

The training manual points out that 2,4-D is a phenoxy herbicide and therefore is difficult to remove. It stresses the importance of reducing one's risk of exposure by special laundering practices. Contaminated clothing should be kept separate from the regular laundry and gloves must be worn while doing the wash to avoid residue contamination. The wash water must be very hot to be effective, the basin must be rinsed with an extra cycle of hot water to avoid contaminating other clothing, and the clean clothes should be line dried. This eliminates the possibility of residues collecting in the dryer and the exposure to sunlight helps breakdown many pesticides.

Here again, the novice home applicator and many of those allowing commercial applicators to apply herbicides to their lawn are not made aware of the stringent practices necessary to eliminate or reduce the hazards these herbicides pose. Even when one is aware that the ease of pesticide removal does not depend on toxicity but on the formulation of the product, most people would tend to associate the general use classification of 2,4-D with much less stringent protections. By exempting homeowners from provisions of the law,

herbicide use is encouraged without the necessary precautions that must be taken to avoid risk.

The training requirements target employees of golf courses, schools, hospitals, municipalities, and commercial businesses. The status of this provision only recently became effective. It was not until 1991 that the training course requirement was implemented. Local school employees were notified in the later part of 1991 that training was mandatory to apply even general herbicides to the school lawns in the preceding spring. Employees taking the initial certification training found it to be extensive and the exam demanding. One local Michigan public school employee said that there was a surprisingly high failure ratio (Interview: Mr. Dan Siminsky, 1992). Of the eleven people taking the exam with him that day only three passed. The program is understandably difficult because the material is so essential.

Regarding the application of general herbicides, applicator attitudes would have to reflect behavior in order for the public to be adequately protected by their regulation. Beyond the implementation measures on occupational safety for applicators, are measures to assure the protection of the public from herbicide exposure. The best solution to much of pesticide contamination is to prevent the problem in the first place and the current training program emphasizes this. But regulating measures to protect the public can only be accomplished where the regulatory structure includes a monitoring program to evaluate licensed applicator behavior.

Procedures applicable to research and monitoring begin at the federal level and are carried out at the state level. FIFRA mandates that the EPA shall undertake research into the hazards of pesticides and of integrated pest management and shall contract with the state or other agencies to do so (7 USC § 136r). It also mandates that the EPA shall develop a national plan for monitoring pesticides and establish procedures for monitoring man and the environment for pesticide exposure.

These directives are accomplished through grants established within the EPA and offered by the Office of Research and Development and the Office of Pesticides and Toxic Substances (Catalog of Federal Domestic Assistance 6-1991). A Pesticides Control Research cooperative agreement exists to promote the research of human and ecological effects from pesticides. There is also an agreement for Pesticide Compliance Monitoring and Programs to 'address all aspects of pesticide enforcement, certification of pesticide applicators, and special pesticide initiatives; sponsor cooperative surveillance, monitoring and analytical procedures; and encourage regulatory activities within the states.'

The division responsible for state implementation of the regulation of all pesticide application in Michigan is the Pesticide and Plant Pest Management Division (PPPMD). It is located within the Michigan Department of Agriculture. A pesticide control fund was established in the Michigan State Treasury by the legislature (P.A. 171, Sec. 14). The fund receives as revenue all fees collected for

licenses issued and registrations granted. It also receives fines collected for violations money appropriated by the legislature, and federal grants.

Without sufficient funds appropriated by the legislature, the PPPMD would have a difficult time meeting expenses. Fees for registration are a one time event, licenses are renewed every three years, and pesticide cooperative agreements are a 50 percent matching program. Fines for violations of the act range from \$1,000 civil to \$25,000 criminal violation (P.A. 171, Sec. 26). For November of 1992 the PPPMD shows one prosecution of a violation resulting in a \$200 fine (Investigation Log FY 92). The majority of enforcements were in the form of warning letters.

The PPPMD does not carry out research on the effects of herbicides or the hazards they pose in residential application. The divisions coordinator suggested that the research was probably done by another division (toxicology) within the agricultural department (Interview: Mr. Rowe, 1992). They do have a cooperative agreement with the EPA for pesticide enforcement however compliance monitoring of residential herbicide application is non-existent.

The PPPMD's schedule of inspections reveal that 85 non-agricultural planned use inspections were assigned by the EPA in 1991. Forty percent (41) of these inspections were made on turf locations. However, no planned inspections have been made at residential areas and the coordinator admits that it is not feasible for the division to

carry out planned inspections at residential sites (Interview: Mr. Rowe, 1992).

The division has 50 inspectors who must make 85 planned inspections per year at agricultural sites and 85 planned inspections at non-agricultural sites. Golf courses, schools, turf and tree farms are common picked non-agricultural sites. To monitor the application of herbicides on residential lawns the division relies on follow-up investigations of complaints (Interview: Mr. Rowe, 1992). When a complaint is filed with the state a thorough investigation is made. Certification of the applicator is checked, records analyzed, and equipment and methods of application reviewed. Just as with planned inspections, the applicator is forewarned about the pending investigation and the coordinator admitted that true behavior is quite often not what is assessed (Interview, 1992).

Enforcement activities include cease and desist orders, prosecutions, informal hearings, warning letters, and advisory letters. For the month of November, 1991, PMD issued one prosecution and six warning letters (Investigation Log FY 92). The majority of warnings regarded improper application of a pesticide and underscores the need for stricter monitoring measures. The group charged with making recommendations on pesticide application regulation is the Michigan Pesticide Advisory Committee who concur with this need (1989 Annual Report). The committee profiled violations from complaints received by the state in FY 92 for pesticide application. A broad based observation made by the committee on complaint data compiled

revealed that most frequently, violations of Act 171 involved general use pesticides in the hands of untrained applicators.

Even so, homeowners applying general herbicides to their lawns are exempt from certification and training provisions and commercial applicators applying general pesticides to residential lawns are not monitored in their application. Furthermore the requirement that commercial lawncare services maintain records on general pesticide applications for one year is not followed up. Such records are not analyzed unless a formal complaint has been made and investigated. The PPPMD coordinator points out that oftentimes the information maintained is found to be lacking or useless (Interview, 1992).

Another provision of the Pesticide Compliance Monitoring and Program cooperative agreement offered by the EPA is the development of plans for the implementation of special pesticide initiatives (Catalog of Federal Domestic Assistance 1991). Pesticide initiatives are new projects for the protection of groundwater from pesticide contamination and the development of water protection programs. The Michigan PPPMD has no plan for groundwater testing in residential areas. When asked about such testing the PPPMD coordinator stated that the main concern is with groundwater contamination in agricultural areas (Interview, 1992). Yet even in agricultural areas the division only collects samples. They do not test them. To the best of his knowledge another department (Public Health) does groundwater testing but recent budget cuts are expected to eliminate most of that.

To date no evaluation has been carried out as to the effectiveness of the only regulation in place for herbicide lawn application: the training program. It has not been done by the PPPMD or the Michigan Pesticide Advisory Committee. Even though the training program affirms methods and techniques are important in minimizing or preventing hazards of and exposure to herbicide effects, no measure has been made as to whether the standards of competency are reflected in applicator performance.

CONCLUSIONS

There are many gaps in the current structure of pesticide regulation and they exist at all levels of government. The gap in pesticide regulation at the federal level is a large one. Pesticides classified as general use are not regulated in the residential or the agricultural context by the EPA. The product's labeling is relied on to mitigate all hazards associated with it. No one is required to be trained in its use. Furthermore, the standard of safety for these pesticides is different depending on its use and the environment in which it is applied. Data required to be submitted for registration of general use pesticides is allowed to be less in amount and kind than for restricted pesticides. The human hazard criteria used to place a pesticide in the restricted use category is set much higher for agricultural application than residential application and so a lower standard of safety is applied to the residential community. The federal process has allowed herbicides such as 2,4-D to slip by regulation and has allowed the welfare of the general public to be placed at risk to the hazards these herbicides pose.

The gaps in regulation of lawncare herbicides at the state level are many. Like the federal law, homeowners applying herbicides to

their own premises are exempt from regulation. Unlike federal regulation, the state mandates that commercial applicators must be trained and certified in order to apply general herbicides to residential lawns. But the PPPMD does not carry out planned inspections of residential site application, groundwater testing for herbicide contamination, or evaluations of training program effects on lawncare herbicide applications. The state legislation does not require the department to establish re-entry periods for lawn application, posting of safety measures needed, or notification of hazards throughout the area where the application is to take place in the context of residential herbicide application.

RECOMMENDATIONS

Federal and state legislative changes are needed to close the gaps in residential herbicide regulation. Changes are also needed in state implementation procedures to properly carry out intent of the regulation. At the federal level, the standards of safety applied to the classification of pesticides for residential use should be upgraded to equal the standard applied to agricultural use. An amendment in FIFRA is needed to place general use application of pesticides within its authority, including the use of general pesticides by persons applying them on their own premises.

At the state level, implementation of continual evaluation of the certification program is required to assure that standards of competency are met. The PPPMD's inspection schedule should accommodate the inclusion of residential application of herbicides. It should be the responsibility of the enforcement division to integrate groundwater testing results and research of hazards associated with residential herbicide application.

The state is currently reacting to herbicide misuse and abuse with its enforcement arrangement of responding only when a formal complaint has been filed. Prevention is of utmost importance in the

dangers herbicides pose. State legislative amendments are needed to include notification and posting requirements for lawn applications, a plan to minimize pesticide drift, a requirement for risk information to be provided to residents, and ongoing inspection of commercial applicator records to assure compliance. In addition, rigorous groundwater testing is needed to determine the extent of drinking water contamination caused by pesticide applications.

The Michigan Department of Agriculture has filed with the Secretary of State a February proposal to include additional rules to Act 171 making enforcement of residential herbicide use more in line with intent of the law (MDA, Regulation No. 637, Proposal 2-28-92). The provisions include a registry of persons requiring notification before application of pesticides to be maintained in the Department of Agriculture, a drift management plan utilized by applicators to minimize off-target drift, notification and posting requirements where commercial application includes broadcast, foliar, or space application of pesticides, and applicator service agreements for customers to include written risk/benefit information. The proposal also includes a rule for integrated pest management requiring all pesticide applicators spraying inside buildings to participate in a training program on the elements of integrated pest management which include site evaluation, consideration of all pest management methods, and recordkeeping.

These proposals bring regulation of herbicides closer to the inclusion of residential application. More steps are needed. Without

placing within the authority of the law, persons applying herbicides on their own premises the public continues to be at risk. Groundwater contamination, residue exposure, and non-target contamination will continue to occur. Without continual evaluation of the state certification program and on-site inspections of residential application, commercial herbicide treatments will continue to put the public in danger of hazards of overtreatment, drift contamination, and excessive exposure to chemicals.

Local authorities may be able to fill in some of the gaps. It does not require a change in policy to have lawn herbicides upgraded to enough importance so that local governments can enforce precautions. In 1991, the Supreme Court ruled that local authorities may go beyond current legislation to enforce residential pesticide application (New York Times, 22 June 1991). One Michigan municipality has created an Environmental Advisory Committee to address the creation of a residential pesticide ordinance (City of Flushing, ms. 3-25-92).

Lawncare herbicides present hazards and we should all be specialists in their application. The public needs to be made aware of and have access to information regarding the risks herbicides pose. Closing the gaps in the regulation of lawncare herbicides will take more than the addition of a planned use inspection at a residential site. The establishment of a comprehensive monitoring program within the state is necessary to integrate herbicide use enforcement with the hazards and effects herbicide use pose. More research is needed on

such a program and on the means for states to carry out effective implementation of lawncare herbicide application.

The result of adopting the previous recommendations would be a pesticide program with a coherent structure of regulation. Pesticides would be classified according to threshold levels of hazard criteria that determine and correctly set an equal standard of safety for pesticide use. Classification of a pesticide in a specific category would be made by safety or hazard criteria rather than convenience of use. The provisions of the regulation would encompass all groups of applicators including homeowners.

Pesticide regulation that has a consistent structure of implementation would include a comprehensive monitoring program. Licensed applicator behavior would be evaluated to assure that standards of competency were met. Rigorous groundwater testing and research on the long term effects of pesticide use would be determined with results reported to the monitoring division. And where labeling instructions are relied upon to mitigate hazards associated with pesticide use, the pesticide program would include the creation of operational definitions that clearly disclose the meaning of label warnings. Such a structure of regulation would result in consistent control of pesticide use and close the gaps in herbicide regulation that currently exist.

REFERENCES

- Aspelin, A.L., Grube, A.H., and Kibler, V. (1991). Pesticide industry sales and usage: 1989 market estimates. Washington, D.C.: EPA Office of Pesticide Programs.
- Carson, R. (1962). Silent spring. Boston: Houghton Mifflin Co.
- Catalog of Federal Domestic Assistance. (1991). Washington, D.C.: U.S. Government Printing Office.
- 40 Code of Federal Regulations. § 150-189 (1991).
- Greenhouse, L. (1991, June 22). Justices rule localities may impose pesticide rules stiffer than U.S. law. New York Times, p. 9.
- Hays, H.M., Tayrone, R.E., Cantor, K.P., Jessen, C.R., McCurnin, D.M., and Richardson, R.C. (1991). Case-control study of canine malignant lymphoma: Positive association with dog owner's use of 2,4-Dichlorophenoxyacetic acid herbicides. Journal of National Cancer Institute, 83, 1226-1231.
- Hoar, S.K., Blair, A., Holmes, F.F., Boysen, C.D., Robel, R.J., Hoover, R., and Fraumeni, J.F. Jr. (1986). Agricultural herbicide use and risk of lymphoma and soft tissue sarcoma. Journal of American Medical Association, 256, 1141-1147.

- Landis, J.N., and Rosenbaum, R.R. (1991). Commercial and private pesticide applicator core manual (rev. ed.). Lansing: Michigan State University.
- McEwen, F.L., and Stephenson, G.R. (1979). The use and significance of pesticides in the environment. New York: John Wiley & Sons.
- Michigan Department of Agriculture. (1992). Pesticide enforcement and investigation log. Lansing, MI: Pesticide and Plant Pest Management Division.
- Michigan Department of Agriculture. (1992). Regulation no. 637, pesticide use (proposal 2-28). Lansing, MI: Pesticide and Plant Pest Management Division.
- Michigan Pesticide Control Act, P.A. 1976, No. 171 (1976).
- Mitchell, R.L. (1989). 1989 Annual report. Lansing, MI: Michigan Pesticide Advisory Committee.
- Pesticide Control Act Analysis (H.B. 5310). (1976). Lansing, MI: House of Representatives' Committee on Agriculture.
- Reuber, M.D. (1983). Carcinogenicity and toxicity of 2,4-dichlorophenoxyacetic acid. Science Total Environment, 31, 203-218.
- Rowe, B. (1992, April 2). Coordinator, Pesticide and Plant Pest Management Division, Michigan Department of Agriculture. Personal Interview.
- Sater, R.J. (1990). EPA's pesticides-in-groundwater strategy: Agency action in the face of congressional inaction. Ecology Law Quarterly, 17, 143-177.

- Schreider, K. (1991, May 10). Senate panel says lawn chemicals harm many. New York Times, sec. A, p. 32.
- Segerson, K. (1990). Liability for groundwater contamination from pesticides. Journal of Environmental Economics and Management, 19, 227-243.
- Siminski, D. (1992, March 18). Director, Grounds and Maintenance, Durand Area Schools. Personal Interview.
- Trend Facts Research Creative Group, Inc. (1990). 1988 Michigan turfgrass industry report. Farmington Hills, MI: Trend Facts Research Creative Group, Inc.
- 7 U.S. Code. § 136 (1980).
- U.S. Environmental Protection Agency. (1992). National pesticide survey: Update and summary of phase III results (EPA 570/9-91-021). Washington, D.C.: Office of Pesticides and Toxic Substances.
- U.S. Environmental Protection Agency. (1988). Pesticide fact handbook. New Jersey: Noyes Data Corp.
- Yeary, R.A. (1986). Urinary excretion of 2,4-D in commercial lawn specialists. Applied Industrial Hygiene, 1, 199-211.
- Zahm, S.H., Weisenburger, D.D., Babbitt, P.A., Saal, R.C., Vaught, J.B., Cantor, K.P., and Blair, A. (1990). A case-control study of non-Hodgkin's lymphoma and the herbicide 2,4-dichlorophenoxyacetic acid in eastern Nebraska. Epidemiology, 1, 349-356.

Zaki, M.H., Moran, D., and Harris, D. (1982). Pesticides in groundwater: The aldicarb story in Suffolk County, N.Y. American Journal of Public Health, 72, 1391-1395.