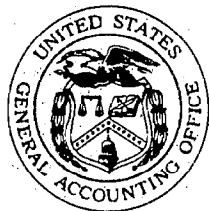


Report to the Chairman, Subcommittee
on Toxic Substances, Research and
Development, Committee on
Environment and Public Works, U.S.
Senate

April 1993

LAWN CARE PESTICIDES

Reregistration Falls Further Behind and Exposure Effects Are Uncertain





United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

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April 6, 1993

The Honorable Harry Reid
Chairman, Subcommittee on Toxic
Substances, Research and Development
Committee on Environment
and Public Works
United States Senate

Dear Mr. Chairman:

As requested, this report discusses the status of EPA's reregistration of widely used lawn care pesticides and the chronic health problems such pesticides may pose. It also updates the case studies of two pesticides, 2,4-D and Diazinon, which were included in our report entitled Lawn Care Pesticides: Risks Remain Uncertain While Prohibited Safety Claims Continue (GAO/RCED-90-134, Mar. 23, 1990).

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies to the Administrator, Environmental Protection Agency, and to other interested parties. We will also make copies available upon request.

This report was prepared under the direction of Richard L. Hembra, Director, Environmental Protection Issues, who may be reached at (202) 512-6111. Major contributors to this report are listed in appendix V.

Sincerely yours,

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

Homeowners and lawn services are applying increasing amounts of pesticides to create lawns free of weeds and pests. As with most pesticides, lawn care products could cause serious health problems and adverse ecological effects, and some could leach into groundwater—the source of much of the nation’s water supply. These pesticides are being applied without complete knowledge of their safety implications.

The Chairman, Subcommittee on Toxic Substances, Research and Development, Senate Committee on Environment and Public Works, requested that GAO (1) monitor the Environmental Protection Agency’s (EPA) progress in reregistering the most widely used lawn care pesticides, including 2,4-D and Diazinon, and (2) determine whether EPA has developed guidelines to assess the health effects of exposure to lawns treated with pesticides, particularly whether EPA has classified any as potential carcinogens and whether any may leach into the groundwater.

Background

Using 1991 survey data on consumer and professional use of lawn care pesticides, EPA identified 18 pesticides as major lawn care chemicals. These pesticides account for 90 percent of the lawn acre treatments and about 80 percent of the total quantity of chemicals applied to lawns. The majority of these pesticides are also used on agricultural crops. According to EPA, about 70 million pounds of pesticides were applied in 1991 to lawns and other turf sites, such as golf courses.

Reregistration is the process of bringing older registered pesticides into compliance with current data requirements and scientific standards. The Congress first directed EPA to obtain updated scientific data in the 1972 amendments to the Federal Insecticide, Fungicide, and Rodenticide Act. After delays in EPA’s efforts, the Congress amended the act in 1988 to provide resources to accelerate the progress of reregistration so that the process would be generally completed by 1997. GAO has a larger effort under way in which it is examining the progress of EPA’s pesticide reregistration program as a whole.

Results in Brief

EPA’s history of delays in reregistering lawn care pesticides continues. EPA’s most recent estimates—in December 1992—for obtaining required studies for 12 of the 18 major pesticides used in lawn care slipped from the agency’s March 1991 estimate, some by as much as 4 years. The progress on the remaining six pesticides could not be measured because there were no March 1991 estimates for these pesticides. These delays have occurred

because of problems in obtaining necessary pesticide data. For example, EPA required registrants—generally pesticide producers—to submit additional studies for Diazinon and 2,4-D, thereby delaying their dates for eligibility for reregistration by 50 and 26 months, respectively. Until reregistration is completed, the safety of the 18 pesticides will be questionable, while the approximately 2,100 lawn care products containing them will continue in widespread use.

Furthermore, even after reregistration, the safety of reregistered lawn care pesticides may still be uncertain. EPA has not yet developed guidelines to assess the health effects of human exposure to pesticides after they are applied to lawns. In light of increasing pesticide incident reports, EPA is reevaluating its long-held view that homeowners and their families are not at risk for health problems because of such exposure. In particular, EPA is concerned about these pesticides' persistence in the environment and potential effects on children, who may have more contact with treated lawns than adults. The agency will continue to reregister lawn care pesticides using available methodologies to assess exposure effects while it develops new post-application exposure testing and assessment guidelines. EPA's progress in developing such guidelines had been slowed by internal disagreements between two EPA offices regarding the scope and specifics of a research plan. The disagreements have now been resolved, and the agency estimates that the guidelines will be available in 1997.

EPA has also found 13 lawn care pesticides in groundwater and has identified four potential carcinogens among the 18 major lawn care pesticides.

Principal Findings

More Delays in Reregistering Lawn Care Pesticides

From March 1991 through December 1992—21 months—EPA's scheduled dates for receiving studies for lawn care pesticides slipped considerably. For example, in March 1991, EPA estimated that studies for nine lawn care pesticides would be received before 1994; but in December 1992, EPA said that only four of the nine would be completed by 1994. Due dates slipped for a variety of reasons, including the need for additional or repeated studies. After submission of the last required study, EPA estimates that it needs about 1 year to review the data and determine if any regulatory

actions—such as label changes—are needed; EPA needs an additional 1-1/2 years to reregister individual lawn care pesticide products.

In December 1992, EPA officials told GAO that EPA had decided not to wait for all studies to be completed on at least four lawn care pesticides before it decided on their reregistration eligibility. This decision was based on an evolving EPA strategy of making reregistration decisions when EPA determines that sufficient data are available to make informed judgments on a pesticide's safety; this strategy is expected to speed up reregistration decisions on the four pesticides by an average of 22 months. While GAO has not evaluated EPA's new strategy, EPA must approach early reregistrations cautiously so that doubts do not remain about the safety of pesticides.

For two widely used pesticides, 2,4-D and Diazinon, the last study due dates slipped by 26 and 50 months, respectively, during the 21-month period. EPA's principal concern with 2,4-D—carcinogenicity—surfaced in a 1986 National Cancer Institute study showing that a group of phenoxy pesticides, including 2,4-D, increased cancer risks among farmers. In 1989, EPA decided to defer consideration of regulatory action on 2,4-D until the Institute completed two additional studies, which occurred by March 1992; EPA also required additional animal cancer studies from 2,4-D registrants, which were due in 1993. EPA plans to convene a panel of experts in April 1993 to review the National Cancer Institute studies and other available carcinogenicity data on 2,4-D and to report to EPA on whether the data support initiation of an EPA Special Review—an intensive and systematic evaluation of the risks and benefits of 2,4-D. In September 1992, EPA required the 2,4-D registrants to repeat the animal cancer studies and granted the registrants a 26-month extension to 1995. EPA told GAO that it plans to decide on reregistration eligibility in 1995, following the completion of the animal cancer studies.

EPA has several concerns with Diazinon, including acute toxicity to birds, potential human health effects, and leaching into the groundwater. EPA canceled the pesticide's use on golf courses and sod farms in 1986 because of bird kills. Although the agency had similar concerns with Diazinon's use on all other grassy sites, it deferred action until it could review additional site-specific data. Diazinon was included in an analysis of a pilot group of 14 pesticides used on turf. The risk/benefit analysis is to be completed in 1993. Several potential human health hazards from Diazinon remain unknown, including neurotoxicity and ocular risks. EPA recently required an additional groundwater study that will add 50 months to the date of the

last study submission. However, EPA told GAO that it may decide on reregistration without this study.

Risks of Exposure to Lawn Care Pesticides Are Uncertain

EPA has identified potential health problems for all of the major lawn care pesticides—carcinogenicity, reproductive and developmental effects, and neurotoxicity. EPA had considered homeowners and their children at low risk from these effects because it assumed that exposure to lawn care pesticides was minimal. However, because of congressional scrutiny of alleged pesticide poisonings, the agency is reconsidering whether to include exposure to lawn care pesticides in its risk assessment. Some EPA officials stated that children who have greater contact with treated areas may receive more exposure than previously thought.

EPA is currently developing fully validated testing and assessment guidelines for exposure to lawn use chemicals. Until EPA issues the guidelines—now scheduled for 1997—it plans to require pesticide registrants to obtain lawn care exposure data, as needed, using available methodologies. EPA has required registrants of two pesticides for which it has specific toxicological concerns to submit exposure data by late 1994 to determine if label or use restrictions are necessary. Four other lawn care pesticides do not require such risk assessments. EPA has not yet determined whether exposure data are needed for the remaining 12 pesticides because it has not yet either received or reviewed relevant toxicological test data.

EPA officials believe that lawn care risk assessments conducted with the available methodologies err on the side of caution. However, because these methodologies are not yet validated for testing exposure to lawn care products, uncertainty may be associated with data collected using these methodologies. The officials said EPA may need to reexamine these assessments following completion of the new guidelines in fiscal year 1997.

EPA has found 13 of the 18 major lawn care pesticides in groundwater and is considering making groundwater leaching a basis for restricted-use status. It has also identified 4 pesticides as potential carcinogens, while data are insufficient to draw conclusions on at least 11 others.

Recommendation

Because of uncertainty about the risks posed by lawn care pesticides, we recommend that the Administrator, EPA, fully explore the health effects of

post-application exposure to lawn care pesticides in the agency's risk assessment process prior to reregistering pesticides for lawn uses and place a high priority on developing the testing and assessment guidelines for post-application exposure.

Agency Comments

GAO discussed the factual information contained in a draft of this report with EPA's Deputy Assistant Administrator, Office of Prevention, Pesticides and Toxic Substances, and his staff. These officials generally agreed with the facts presented, and their views have been incorporated into the report where appropriate. As requested, GAO did not obtain written agency comments on this report.

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Abbreviations

DCI	data call-in
EPA	Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FTC	Federal Trade Commission
GAO	General Accounting Office
LCPAC	Lawn Care Pesticides Advisory Committee
LEL	lowest effect level
NCI	National Cancer Institute
NOEL	No Observed Effect Level
OPP	Office of Pesticide Programs
RED	Reregistration Eligibility Document
RfD	reference dose

Introduction

Lawn care pesticides are chemicals or biological substances designed to kill or control unwanted species of plants, insects, and animals. In addition to residential lawns, these pesticides are also used in gardens, parks, and golf courses. Most of the pesticides used on lawns are also used on food crops. Because lawn care pesticides are inherently toxic, they have the potential to create serious problems for human health and the environment.

The use of pesticides on lawns is both widespread and increasing. According to the Environmental Protection Agency (EPA), approximately 40 percent of the nation's private lawns are treated with pesticides. Sales of lawn care pesticides (at the manufacturer's level) in the United States have increased at a rate of 5 percent each year—from \$700 million in 1988 to about \$900 million in 1992. EPA estimates that approximately 70 million pounds of pesticides are applied to all turf sites across the country. Homeowners apply about 32 million pounds to their lawns, and the remaining 38 million pounds are applied by commercial firms, golf course applicators, grounds maintenance personnel, and others.

Given the amount of usage, and the potential for a large segment of the U.S. population to receive at least some exposure to these chemicals, concerns have been raised about possible human health problems that might be linked to exposure to the pesticides. These problems include cancer and birth defects. More immediately, such chemicals may cause headaches, skin rashes, and eye irritation. Application of certain lawn care pesticides are also harmful to the environment and can poison fish, birds, and other wildlife, and pets. They can also contaminate the groundwater, which supplies 50 percent of the nation's drinking water.

Major Lawn Care Pesticides and Their Characteristics

In 1991, EPA obtained new survey data on consumer and professional use of lawn care pesticides. From these data EPA estimates that 44 pesticides make up the majority of the pesticides applied for lawn care. Of these, 18 are considered major lawn care pesticides, accounting for more than 90 percent of the total lawn acre treatments and 80 percent of the total pounds applied for lawn care. Overall, herbicides account for approximately 70 percent of the total pounds applied to lawns, insecticides 22 percent, and fungicides 8 percent. The 18 major pesticides are used in about 4,000 products, 53 percent of which are for turf. (See app. I for more information on the 44 lawn care pesticides.)

Lawn care pesticides account for 70 million pounds of the total 1.1 billion pounds of conventional pesticides used annually in the United States.¹ Agriculture accounts for 76 percent of the pesticide usage; the remainder of the market is divided between industry/government (18 percent) and lawn care usage (6 percent). In fact, most lawn care pesticides are more fully utilized for treatment of food crops than for lawns. Fourteen of the 18 major lawn care pesticides are considered agricultural/high-volume use pesticides; 15 have home garden uses. According to EPA, the list of lawn care pesticides will continue to undergo minor changes with the addition of new chemicals, the loss of chemicals through reregistration or other EPA action, and alterations in use patterns of chemicals.

Health Risks of Lawn Care Pesticides Must Be Reassessed

Under the 1972 amendments to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), EPA is required to reregister older pesticides, including those used on lawns. Reregistration is the process of bringing older registered pesticides and their products into compliance with current data requirements and scientific standards and taking appropriate regulatory action on the basis of this new knowledge. The FIFRA amendments of 1988 (known as FIFRA '88) provided resources to accelerate the progress of reregistering all older pesticides and established milestones so that reregistration is generally completed within 9 years—by 1997. Of the 44 lawn care pesticides identified in EPA's recent survey, 2 (both minor) are not subject to reregistration because they were originally registered after November 1, 1984. All of the 18 major lawn care pesticides, and their 4,000 registered products, need to be reassessed. These products can continue to be sold while the reassessment is taking place.

The kinds of data needed to assess lawn care pesticides fall into three categories: (1) toxicity data, generally from laboratory studies, to identify possible adverse health effects; (2) environmental fate and ecological effects data, which identify the fate of the chemical in the environment after application and its possible effects on nontarget species; and (3) exposure data, which assess the frequency, extent, and routes of exposure for people, including subpopulations such as children. As with all studies submitted to EPA, registrants must develop data on lawn care pesticides in accordance with the agency's FIFRA Good Laboratory Practice Regulations to ensure their quality and integrity.

Many of these studies are voluminous; for example, a 4-year cancer study may be several thousand pages and require weeks for scientific staff to

¹Conventional pesticides include all pesticides except wood preservatives, disinfectants, and sulfur.

review. It is not uncommon for the total data set on a pesticide registered for food use to include 80 to 100 studies. This amount of data requires a massive review and tracking effort.

EPA requests studies through a "data call-in" (DCI) process. The DCI process assists in collecting missing information on long-term health effects and certain other studies that may take up to 4 years to complete. Each study has a due date. Once all of the studies are received and all the requirements are met, EPA needs 1 year to conduct a comprehensive evaluation of the data and make a reregistration decision. This decision is in the form of a *Reregistration Eligibility Document (RED)* on each pesticide. This document contains an assessment of all the scientific data as well as any regulatory actions EPA deems necessary. If the pesticide's last study due date changes, the RED date will likewise be adjusted. In issuing a RED, EPA essentially has determined that the chemical does not pose any unreasonable risk when used under its established terms and conditions. EPA estimates that reregistration of individual pesticide products will take 1 to 1-1/2 years to complete after it has issued a pesticide's RED. EPA officials indicated that reregistration is not absolutely final. Any pesticide may be reexamined after reregistration if new concerns or new ways to address ongoing concerns are identified.

Objectives, Scope, and Methodology

The Chairman, Subcommittee on Toxic Substances, Environmental Oversight, Research and Development, Senate Committee on Environment and Public Works, asked us to review the progress of EPA's efforts to reregister the major lawn care pesticides. In March 1990 and again in May 1991,² we reported to the Chairman that EPA had not made substantial progress in reregistering these pesticides. For this review, we were asked to determine the reregistration status of the most commonly used lawn care pesticides and EPA's progress in assessing their health risks. As requested, we also obtained information on whether any of the 18 pesticides have been classified as carcinogens or may leach into the groundwater; we updated the case studies of two widely used pesticides—2,4-D and Diazinon—that were included in our March 1990 report; and we determined whether EPA had developed guidelines to assess exposure effects.

In the same letter, the Chairman also asked GAO to examine lawn care pesticide enforcement and notification efforts. While not the focus of this

²Lawn Care Pesticides: Risks Remain Uncertain While Prohibited Safety Claims Continue (GAO/RCED-90-134, Mar. 23, 1990); Pesticides: EPA and State Efforts to Ensure Safe Use of Lawn Care Pesticides (GAO/T-RCED-91-50, May 9, 1991).

report, actions that EPA has taken in response to GAO recommendations made in other reports on these issues are listed in appendix II.

Our prior reports listed 34 widely used lawn care pesticides, as identified by EPA. In 1991, however, the agency obtained new survey data of consumer and professional use of lawn care pesticides. EPA used these new data to arrive at a new list of 44 lawn care pesticides, of which 18 are major lawn care pesticides because they represent more than 90 percent of the total lawn care treatments in the United States.

There are several differences in EPA's most recent and previous lists. Some chemicals on the earlier list do not appear on the current list. Also, a number of pesticides have been added that were not on the previous list. Since the agency did not know what criteria were used to develop the earlier list, it was not able to explain the differences between the two lists. According to EPA, a shift in the pesticide market may have occurred because of reregistration and changing use patterns or the availability of new, more comprehensive usage data. We also obtained a listing of the most commonly used pesticides by lawn care companies from the Professional Lawn Care Association of America, the trade association that represents most of the commercial lawn care firms. This list was substantially similar to EPA's current list.

To assess reregistration status, we compared EPA's study submission dates from March 1991 to December 1992, a 21-month period. The March 1991 date reflects the status we reported for our May 1991 testimony. To determine the current reregistration status of the 18 lawn care pesticides and the cause of schedule slippage, we met with officials in EPA's Office of Pesticide Program's Special Review and Reregistration Division. We reviewed relevant data and status reports, Federal Register notices, policy pamphlets, procedural manuals, and other pertinent information. We also examined the results of the reregistration program, such as the number of reregistration decisions made and the agency's decision to revise data submission estimates. However, we did not evaluate the justification for EPA's decisions. We also obtained and discussed views about implementation problems with responsible agency officials.

To determine the Special Review status of the 18 pesticides, we met with officials from the Special Review and Reregistration Division, Special Review Branch. In addition, we consulted the Division's March 1992 Report on the Status of Pesticides in Reregistration and Special Review.

To update the 2,4-D and Diazinon case studies, we interviewed responsible individuals from branches within the Office of Pesticide Programs with knowledge of those specific pesticides.

To ascertain the overall health risks associated with the pesticides, we interviewed responsible officials from three branches of the Health Effects Division—the Toxicology Branch, the Science Analysis and Coordination Branch, and the Occupational and Residential Exposure Branch. We also talked with officials from the Office of the Administrator. Additionally, we reviewed and analyzed numerous documents, including tracking reports, pesticide fact sheets, and other reference material.

To identify the potential groundwater contaminants among the 18 pesticides, we interviewed officials from the Office of Pesticide Program's Environmental Fate and Effects Division. We also reviewed and analyzed data provided by the Division's Environmental Fate and Groundwater Branch and the Special Review and Reregistration Division, Reregistration Branch.

Our work was conducted between September 1991 and December 1992 in accordance with generally accepted government auditing standards. As agreed, we did not obtain written agency comments on a draft of this report. However, EPA's Deputy Assistant Administrator, Office of Prevention, Pesticides and Toxic Substances, and his staff reviewed and commented on the factual material in the report and generally agreed with the facts as presented. Their comments have been incorporated where appropriate.

Reregistration of Lawn Care Pesticides Encountering More Delays

EPA continues to fall behind its schedule to reregister the 18 major lawn care pesticides. In the meantime, the pesticides continue to be applied in large amounts without complete knowledge of their safety. Since March 1991, EPA's scheduled study completion dates for many of the 18 major lawn care pesticides have slipped significantly, some by as much as 4 years. As of December 1992, EPA estimated that the first of the 18 lawn care pesticides will be ready for reregistration in fiscal year 1994 and the last in 1997, except for one for which no date can yet be determined. These dates reflect EPA's current practice of making reregistration decisions on the basis of a substantially, not fully, complete data base. In addition, six pesticides have received or are receiving Special Reviews—intensive and systematic evaluations of the risks and benefits of pesticides—because of health or environmental concerns, including two of the most widely used lawn care pesticides, 2,4-D and Diazinon.

Study Submission Delays Affect Lawn Care Pesticides' Reregistration

In the 21 months from March 1991 through December 1992, last study due dates for many of the 18 lawn care pesticides slipped considerably because of delays in data collection. For the 12 pesticides for which slippage could be measured, 8 fell behind in their data collection activities by 6 months or more, with 3 experiencing close to 4-year delays. Of the remaining four pesticides, one slipped by 1 month, two remained the same, and one improved by 9 months. (See table 2.1.)

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Table 2.1: Comparison of Last Study Due Dates for 18 Major Lawn Care Pesticides

Major lawn care pesticides (18)	Last study due dates as of		Slippage (months)
	3/91	12/92	
2,4-D	10/93	12/95	26
Atrazine	10/93	8/94	10
Benfluralin (Benefin)	3/95	4/95	1
Carbaryl	5/95	5/95	0
Chlorothalonil	^a	7/95	
Chlorpyrifos	^a	9/94	
Dacthal (DCPA)	8/92	8/96	48
Diazinon	7/92	9/96	50
Dicamba	^a	1/96	
Glyphosate	11/92	5/93	6
Iprodione	^a	8/93	
Isfenphos (Oftanol)	5/92	5/93	12
MCPA	11/91	6/95	43
MCPP	4/92	^b	8
MSMA	^a	12/94	
Oryzalin	3/93	3/93	0
Pendimethalin	10/94	1/94	+9
Trichlorfon	^a	10/94	

^aIn Mar. 1991, EPA was either in the process of developing a data collection instrument or waiting for Office of Management and Budget approval of the paperwork for the pesticide, and therefore a last study due date had not been established. Subsequently, data call-ins (DCIs) were issued.

^bEPA does not currently have an established last study due date for this chemical because of unresolved testing issues.

According to EPA officials, lawn care pesticides' last study due dates fell behind for a variety of reasons, including the need for higher-level studies, the need to repeat rejected studies, time extensions, and resolution of testing concerns about derivatives. For example, EPA requested additional groundwater studies for Diazinon and Dacthal, thereby delaying their data completion dates by 50 and 48 months, respectively. Repeat animal testing studies were required for 2,4-D, which, coupled with an approved request for additional time, delayed the last study due date by 26 months. Last study due dates were extended 10 and 43 months for Atrazine and MCPA, respectively, because of testing issues about derivatives of these chemicals.

These dates also reflect EPA's current practice of making reregistration decisions on the basis of a substantially (compared with a fully) complete data base. EPA has concluded that all of the studies originally required for reregistration may no longer be needed for a given pesticide if a sufficient body of data exists to make a reregistration determination. In certain cases, such as when data on a similar pesticide can be used, study requirements will be dropped altogether. In other cases, EPA will still require the study but not wait for its arrival to make a reregistration decision. According to EPA, this practice was changed in order to accelerate the reregistration process. We have not evaluated EPA's strategy to speed up reregistration.

Table 2.1 shows last study due dates for the 18 major pesticides. It reflects accelerated dates for four pesticides based on the decision to reregister pesticides using a substantially complete data base. For the first, 2,4-D, the table indicates that the last study due date slipped by 26 months. This slippage was an improvement over estimates we prepared in June 1992, which showed that the last study due was 47 months behind the March 1991 date. The improvement of 21 months occurred because EPA determined that it no longer needed a crop residue study to make a reregistration decision. Similarly, table 2.1 shows that the last study due date for Isofenphos had slipped by 12 months. The estimated slippage for Isofenphos was 36 months in our June 1992 estimate. In this case, EPA determined that it did not need spray drift studies due in 1995 to make a reregistration decision, and the last study due date consequently moved forward. Two other pesticides, Pendimethalin and Glyphosate, improved by 28 and 12 months, respectively, since June 1992, for similar reasons.

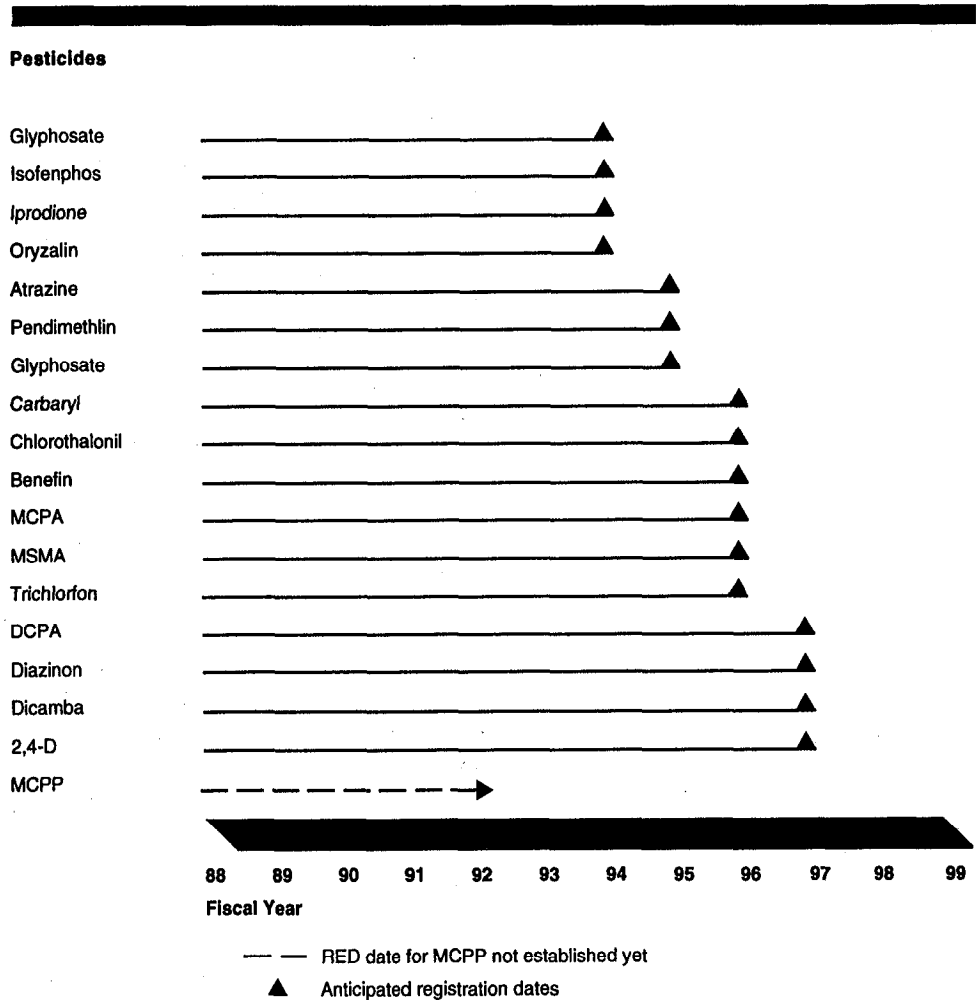
One of the 18 pesticides—Glyphosate—is currently in RED preparation. Although EPA had earlier rejected a number of the registrant's environmental fate studies, it determined that the data base for Glyphosate was sufficiently complete without the studies. EPA officials told us that they may not require the registrants to repeat the rejected studies.

Figure 2.1 shows decision dates for reregistration eligibility for the pesticides using last study due dates plus 12 months, which is EPA's minimum estimate of the time it takes to issue a decision following receipt of the final study. The figure indicates that all the pesticides could be reregistered by the end of fiscal year 1997, with the largest number occurring in fiscal year 1996. The one exception is MCPP, for which a date cannot be determined because of unresolved testing issues. EPA officials told us that because EPA changed its policy—making eligibility decisions

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on the basis of a substantially complete data base—it is possible that additional pesticides could be reregistered earlier than now scheduled. For example, EPA officials said that EPA might not wait for a 1996 groundwater study to make a reregistration decision on Diazinon. Likewise, the agency might make a decision about Atrazine before a cancer study on a metabolite is submitted. EPA officials reiterated that the agency can take action on a chemical at any time, even after a pesticide is reregistered, if new data present a concern.

Figure 2.1: EPA's Timetable for Reregistration Decisions of Major Lawn Care Pesticides



Six Pesticides Have Undergone Special Review for Health or Environmental Concerns

Pre-Special and Special Reviews are triggered when EPA has reason to believe that use of the pesticide may result in unreasonable adverse effects on people or the environment. In pre-Special Review, EPA staff review and validate the scientific studies that raised the specific concern; pre-Special Reviews may or may not lead to formal Special Review. Special Review is an intensive and systematic evaluation of the risks and benefits of the pesticide. Both reviews can result in regulatory actions.

Six of the 18 major lawn care pesticides (33 percent) have been or are in pre-Special or Special Review for health and/or environmental concerns. Four reviews, for Carbaryl, Diazinon, MSMA, and Trichlorfon, were completed prior to 1987. Reviews of 2,4-D and Atrazine are presently under way. The concern for 2,4-D is carcinogenicity; for Atrazine the concerns are carcinogenicity, cardiac effects, and groundwater contamination. None of the reviews was triggered specifically by lawn care concerns, although lawn use could be affected by outcomes of the reviews. (See app. III for details regarding the six reviews.)

In our 1990 report, we discussed in greater detail two widely used pesticides, 2,4-D and Diazinon, which were or had been in pre-Special Review and Special Review. Discussed below is information on their Special Review status and their overall reregistration progress.

2,4-D: Study Submission Delays Prevent Determination of Carcinogenicity Risk

The pesticide 2,4-D is in pre-Special Review because of evidence of increased cancer risk among farmers handling similar types of pesticides. The pesticide is widely used for controlling broadleaf weeds on many food and non-food crops. The pesticide was first registered in 1948, and up to 60 million pounds are currently used annually in 574 registered products. Of this total, about 10 million pounds per year (about 17 percent) are used on residential lawns. Of the 574 total products, 441 have lawn or turf uses.

Epidemiological Studies Delayed

EPA still has not determined the carcinogenicity risk of 2,4-D. As we previously reported, EPA issued a preliminary notification of Special Review for 2,4-D in September 1986 on the basis of evidence of increased cancer risk among farmers handling similar types of herbicides, called phenoxys. After further review, EPA concluded that the available human and animal data were inadequate to assess the potential cancer risk of 2,4-D. Therefore, in 1988, EPA decided not to initiate a Special Review of this pesticide. However, EPA's concerns about 2,4-D and carcinogenicity remained, and the agency decided in 1989 to defer a decision on Special Review until two epidemiological studies in process at the National

Cancer Institute (NCI) were completed and then reviewed by an outside panel of experts. The Special Review decision was expected to be made by the summer of 1990. By May 1991, this date had slipped to late 1991 because of a delay in study completion.

The final NCI study did not reach EPA until March 1992, fully 2 years after the originally anticipated due date.¹ EPA will convene a panel of outside science experts to review the NCI studies and all other existing data regarding 2,4-D and cancer. The panel will report to EPA on whether the accumulated body of evidence supports initiation of Special Review. As of December 1992, the anticipated meeting was set for April 1993.

Animal Cancer Studies Delayed: EPA Considers Suspending 2,4-D Use

Further complicating the question of 2,4-D and cancer is a lack of acceptable animal data on carcinogenicity. Since 2,4-D is primarily a food-use pesticide, rat and mouse carcinogenicity studies are required for reregistration. The first rat and mouse studies were rejected by EPA because the laboratory animals were given insufficient dosages. New studies were called for in July 1989 with a due date of October 1993.

The registrants requested an extension of the study due date to June 1995 to reflect the projected completion date. EPA did not believe the registrant's reasons for delay were justified; it denied the request and indicated that it was contemplating suspending 2,4-D use until the studies were received.

Because of concern about the possible link between 2,4-D and cancer, EPA has been considering if and what interim measures to take to reduce risk while the cancer concern is being studied. An interdisciplinary internal team, meeting since November 1991, developed a list of possible measures. However, the agency was uncertain it could impose regulatory changes on 2,4-D, since regulatory action is predicated on cause and the link between 2,4-D and cancer is not yet an established fact. Therefore, EPA approached the 2,4-D registrants about "voluntarily" implementing certain risk reduction and education measures in return for avoidance of suspension and acceptance of later due dates for the animal cancer studies.

EPA and the registrants reached agreement on a risk reduction and user education plan in September 1992. Exposure reduction measures

¹One of the study authors indicated that the field work was completed on time but that delays were encountered in the compilation and analysis of the complex data generated by this study.

specifically related to turf use include a requirement for users to wear protective clothing and eyewear and to use a maximum of 2 pounds of product per acre per application, no more than 2 times per year per site. In addition, people and pets are not to enter treated areas until the spray has dried or dust has settled. The new exposure reduction measures for turf will be included on labels of products formulated after June 15, 1994, or sold by the registrant after January 1, 1995.

Diazinon: Risks to Birds Remain, and Some Human Health Effects Are Unknown

Diazinon was previously in Special Review because of the acute toxicity risk it posed to birds. Diazinon is the most widely used, homeowner-applied pesticide on residential lawns. Other home uses include gardens and indoor pest control. Diazinon was first registered in 1956, and approximately 4 million pounds per year (30 percent of total Diazinon use) are currently applied to commercial and residential turf. Of 612 registered products containing Diazinon, 267 have lawn or turf uses.

Diazinon Turf Use Remains Despite Threats to Birds

We reported in May 1991 that EPA had initiated a Special Review of Diazinon's use on golf courses and sod farms in 1986 because of acute toxicity risks to birds. As a result of the review, those two uses were canceled. However, Diazinon continues to be used on all other turf, despite its toxicity to birds and aquatic species. EPA's earlier concern was based on laboratory data on acute and dietary toxicity, exposure data, field studies, and reported bird-kill incidents on sod farms and golf courses treated with Diazinon. The agency concluded that use of Diazinon on sod farms and golf courses resulted in unreasonable adverse effects to birds and canceled those uses entirely in September 1986.² The cancellation was challenged by the registrants.

In June 1989, an appeals court suspended EPA's decision because EPA had not applied the correct legal standard and required EPA to review its decision. In July 1990, EPA restated its decision to cancel sod farm and golf course uses of Diazinon because of unreasonable adverse effects to birds and waterfowl. The registrants requested that the hearings be reopened; however, their petition was denied, and the cancellation remains in effect.

AS EPA has noted, golf course and sod farm uses accounted for only 5 percent of Diazinon's use on turf. The agency has consistently stated that

²The 1988 Registration Standard for Diazinon also restricted all commercial outdoor uses (e.g., agricultural crops, ornamentals, and turf) to certified applicators only because of the known toxicity to birds and aquatic species. In 1989, the agency exempted home lawns and exterior foundation treatments from this restriction.

it has concerns about Diazinon's use on other turf sites as well. In 1985, the agency stated that the concern about the risk of Diazinon to birds was not limited to golf courses and sod farms. The agency believed that it did not have sufficient data to evaluate all of the sites for which Diazinon was registered but planned to require such data as part of the reregistration process. Following review of those data, the agency would decide whether to initiate a Special Review on any or all of the other turf sites. In the 1988 Diazinon Standard, the agency indicated that the use of Diazinon on other grassy sites, such as lawns, athletic fields, and parks, also posed a significant threat to birds. Nonetheless, EPA stated that it was deferring a decision about initiating a Special Review for these uses until a further review of the data was completed.

Turf Cluster Analysis May Result in Regulatory Action

The agency decided not to initiate a Special Review for other turf uses of Diazinon. Instead, in February 1992, EPA announced that Diazinon would be included in a pilot turf cluster analysis. Cluster analysis is an approach to regulating a group of chemicals on one site (or for one use) so that all the risks are considered and weighed against all the relative benefits of the chemicals in the group. It allows EPA to simultaneously examine both the risks and benefits of all major alternatives used on a specific site and then to develop an optimal regulatory strategy, rather than reviewing the chemicals independently. It is intended to ensure that only the safest products remain on the market for a given use.

Of the 14 pesticides in the turf cluster analysis, 5 are among the 18 major lawn use pesticides: Carbaryl, Chlorpyrifos, Diazinon, Isophenfos, and Trichlorfon. The risk/benefit analyses are expected to be completed in 1993 and may result in future regulatory action regarding Diazinon's use on turf.

Human Health: Neurotoxicity and Ocular Effects Not Known

Several potential human health hazards from Diazinon remain unknown. Although Diazinon is non-oncogenic and does not affect human development or reproduction, research indicates that the organophosphate group of chemicals (which includes Diazinon) may pose neurotoxic and/or ocular risks of some concern. As a result, EPA is requiring new neurotoxicity studies and ocular studies for organophosphates. These studies will not hold up the reregistration process for Diazinon or other affected chemicals. However, this requirement does not preclude EPA from taking regulatory action following receipt of the studies, if the study results indicate a need. Because the

study protocols are still under development, these studies will not be submitted until September 1993 at the earliest.

High Number of Home Poisonings Reported for Diazinon

The uncertainty about health risks is of concern because of the high number of home poisonings reported for Diazinon. Pre-1985 data, the most current available, indicate that between 61 and 91 percent of hospitalized Diazinon poisonings are nonoccupational. In part the numbers reflect Diazinon's status as a widely used pesticide in and around the home. EPA has not been able to determine if the number of incidents is disproportionate to the amount of the pesticide used. The agency has attempted to reduce the number of incidents through additional precautionary labeling statements for homeowners.

Diazinon Can Leach Into Groundwater

Laboratory data indicate that Diazinon can also leach into groundwater, and in fact, Diazinon has been detected in both ground and surface water. This is a concern because of Diazinon's acute toxicity to birds and aquatic species and the unknown human health risks related to neurotoxicity and eyes. EPA is requiring a 4-year, small-scale groundwater study of Diazinon in order to ascertain the conditions under which it may pose a contamination threat. The study is due in September 1996. However, in December 1992, EPA officials told us that the groundwater study may not be needed for a decision on reregistration.

Conclusion

Since we last reported on the status of lawn care pesticides in our May 1991 testimony, the reregistration timetable for some of these pesticides has slipped significantly, in some cases by up to 4 years. Timely reregistrations of pesticides are important because the process ensures that the widespread use of any registered pesticide will not cause unreasonable adverse effects to people or the environment. Without up-to-date scientific data, EPA cannot determine whether pesticides pose unreasonable risks and cannot provide the Congress and the American public with assurances that lawn care pesticides are safe.

EPA's evolving strategy of making reregistration decisions on the basis of a substantially complete data base will likely serve to accelerate the reregistration process. While we have not evaluated this approach, we believe that EPA must proceed cautiously with early reregistrations so that doubts do not remain about the safety of pesticides because of EPA's incomplete data base. Since GAO has an effort under way in which it is

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Reregistration of Lawn Care Pesticides
Encountering More Delays

examining the progress of EPA's pesticide reregistration program as a whole, we are making no recommendations regarding slippages in the lawn care pesticide program at this time.

Human Health Risks Associated With Lawn Use Remain Uncertain

In the past, EPA did little to assess the risks of pesticides after they were applied on lawns because it assumed that homeowners were unlikely to have much exposure to these pesticides. EPA is now reevaluating the issue of lawn care exposure, because of both congressional and public scrutiny and concerns about the persistence of these pesticides in the environment and the amount of exposure received by children. For lawn care use, EPA is primarily concerned about health effects that can occur from one-time or short-term exposure, such as neurotoxicity and developmental problems. Although other serious health effects—cancer, reproductive problems, and chronic toxicity—have been identified for these pesticides, EPA believes that those effects may not be relevant to lawn care use because they are associated with long-term exposure, which is not presumed to occur with lawn use. EPA is working to develop standardized guidelines for post-application exposure testing and assessment by 1997.

In the meantime, EPA has identified 2 of the 18 pesticides undergoing reregistration as candidates for lawn care risk assessments because of toxicity concerns. (See app. IV for a discussion of risk assessment.) EPA plans to conduct these risk assessments using currently available testing methodologies. Although EPA officials believe these assessments will err on the side of caution, the agency may need to revisit them following completion of the new guidelines in fiscal year 1997.

EPA Recognizes Need to Consider Health Risks of Lawn Care Pesticides

EPA has historically operated under the assumption that homeowners are at low risk for health problems resulting from the use of lawn care pesticides. Risk is determined by both toxicity and exposure. Toxicity identifies the type and degree of hazardous effects a pesticide may cause; exposure identifies how much of a pesticide is absorbed. Both factors are needed to make a risk assessment. EPA has assumed that exposure to lawn care pesticides after application is minimal. For example, EPA officials said that even intensively managed lawns generally receive only a maximum of five pesticide applications per year. The agency also assumed that pesticide applicators received more pesticide exposure than people exposed after application. If any applicator concerns arose that required attention, then the public concern was “a priori” addressed through the actions taken to minimize the applicator risk. For these reasons, EPA did not require much data on post-application lawn care exposure, nor perform post-application lawn care risk assessments.

EPA is now looking into the health risk from residential lawn care pesticides. EPA officials told us that this is due in part to increased scrutiny

by the Congress and increased public concern. Some EPA officials also stated that assumptions about low exposure to lawn care chemicals need to be examined. In particular, they mentioned uncertainty about the persistence of lawn care pesticides in the environment and the amount of exposure received by children who, because of greater contact with treated areas, may receive more exposure than previously thought. Other EPA officials believe that this risk is probably quite low. However, many of those we spoke to at EPA agreed that it is important to obtain data on lawn care exposure in certain cases where toxicity is a concern, if only to know with more certainty that risk is indeed minimal.

EPA does not have testing and assessment guidelines specifically for lawn use. Agency officials told us they rely on a variety of methodologies developed for other purposes that can be adapted to the measurement and assessment of post-application lawn care exposure. For example, methodologies developed to measure pesticide residues on agricultural crops and pesticide applicators' dermal and inhalation exposure can be modified to accommodate lawn care situations. However, because EPA lacks detailed information about how people, including babies and children, actually behave on lawns, it must make some assumptions about the amount of exposure people receive. EPA officials stated that whenever assumptions are used in the risk model, the agency makes a reasonable worst-case estimate.

Although EPA officials believe that the current risk assessments for post-application lawn use exposure err on the side of caution, EPA is working on better testing and assessment guidelines for all types of residential exposure to toxics, including lawn use pesticides. The agency hopes to publish interim guidelines in fiscal year 1995 and final guidelines in fiscal year 1997. Officials recognize the need to develop standardized protocols and testing guidelines for monitoring and assessing post-application exposure. To develop the guidelines, research is needed in several areas, including fully validated sampling and analytical methodologies for monitoring pesticide product residues and approaches for estimating human exposures to these chemicals.

EPA has taken steps to get the necessary research under way, but progress has been slowed by internal disagreement between the Office of Prevention, Pesticides and Toxic Substances and the Office of Research and Development regarding the scope and specifics of a research plan. For approximately 2 years, these Offices have exchanged draft research strategies. Finally, on December 1, 1992, a joint comprehensive draft

strategy was published. It included a conceptual outline that could serve as the basis of an interim guideline for post-application monitoring and assessment. This draft strategy was evaluated at a public workshop in mid-December, during which scientific experts were invited to provide peer review comments and discuss the appropriate roles for EPA, other federal and state agencies, industry, and academia to play in research implementation. Office of Research and Development officials originally estimated that the research would start in early 1993, with interim guidelines developed in fiscal year 1995 and final guidelines slated for fiscal year 1997. However, EPA officials subsequently informed us that meeting these deadlines is contingent on the availability of EPA funding and personnel as well as on the oversight of senior agency management in both Offices.

On the basis of toxicological and exposure concerns, EPA has identified a need for lawn care risk assessments for 2 of the 18 pesticides. These pesticides will be evaluated using currently available methodologies to assess residential exposure. Of the remaining 16 pesticides, 4 do not require risk assessments. A decision has not been made on the other 12 because relevant toxicological data have not yet been received or reviewed.

For one of the two pesticides for which EPA has requested lawn exposure data,—Dacthal—EPA performed a risk assessment several years ago because of concerns that an impurity in the manufacturing process could cause chronic health problems. That analysis, using estimates for lawn exposure, indicated that there might be an unreasonable health risk to children playing on Dacthal-treated lawns. To better refine the risk assessment, EPA then requested that the registrant conduct post-application exposure studies on Dacthal. EPA also requested exposure data for Chlorpyrifos because of acute toxicity concerns. The Chlorpyrifos study is due in late 1994. EPA will use the results of the risk assessments to determine if changes in the use of lawn care pesticides are necessary to minimize exposure. EPA officials advised us that they might reevaluate these risk assessments as needed after development of the new guidelines.

Potential Human Health and Environmental Effects Identified

The first step in assessing risk is determining what harm a pesticide can cause. EPA has identified some of the potential human health problems of the 18 lawn care pesticides, including carcinogenicity, reproductive effects, developmental effects, and neurotoxicity. EPA has also identified

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10 pesticides that may leach into groundwater and threaten the water supply.

Toxic Effects From Lawn
Care Use Uncertain

Because pesticides are inherently toxic, EPA officials told us that at some dose almost all pesticides will produce one or more adverse effects in the laboratory animals to which they are exposed. EPA is amassing substantial toxicological information about the 18 lawn care pesticides. Table 3.1 summarizes EPA's current information about the cancerous effects for each pesticide produced in test animals and other toxic effects produced by the smallest dose of the pesticide that produced an effect. To date, the agency has identified four potential carcinogens: Atrazine, Chlorothalonil, Oryzalin, and Pendimethalin.

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Table 3.1: Cancerous Effects and Smallest Dose Noncancerous Effects of 18 Pesticides

Pesticide	Cancerous Effect ^b	Smallest dose noncancerous effect ^a			
		Chronic toxicity (e.g., liver)	Reproductive health	Developmental health	Neurotoxicity
2,4-D	Incomplete	X			
Atrazine	Possible carcinogen		X		
Benefin	Incomplete	X			
Carbaryl	Incomplete	X			
Chlorothalonil	Probable carcinogen	X			
Chlorpyrifos	Indications negative				X
Dacthal	Incomplete	X			
Diazinon	Incomplete				X
Dicamba	Indications negative			X	
Glyphosate	Not carcinogenic			X	
Iprodione	Incomplete	X			
Isofenphos	Not required	^c			
MCPA	Indications negative	X			
MCPP	Not required	X			
MSMA	Inconclusive	^c			
Oryzalin	Possible carcinogen	X			
Pendimethalin	Possible carcinogen	X			
Trichlorfon	Inconclusive				X
Total		10	1	2	3

^aThe smallest dose noncancerous effect is the effect produced in test animals by the lowest dose that caused an effect. The effect could change if an outstanding study is received that indicates different effects occurring at a lower dose.

^b If the pesticide has been formally classified for carcinogenicity, it will be designated as a probable or possible carcinogen or noncarcinogenic. Other terms are interpreted as follows: Incomplete—Required studies not yet completed or reviewed. Indications positive/negative—Required studies have been received and preliminarily, but not formally, reviewed. Not required—Cancer studies not required. Inconclusive—Study results conflict or are indefinite.

^cNoncancerous risk endpoints not yet established.

EPA is primarily concerned about those effects that are understood to result from one-time or short-term exposure to a substance, such as skin and eye irritation or damage, certain types of neurotoxicity, and developmental toxicity. Other effects, such as cancer and reproductive problems, are thought to result from longer-term exposure. Even though EPA is reevaluating how much exposure people get from pesticides on

lawns, it does not think the exposure is sufficient to cause such long-term effects as cancer.

Incident Data on Pesticide Poisonings Are Inconclusive

In addition to laboratory data on toxicology, EPA has incident data on pesticide poisonings that reveal a wide range of health effects, from mild headaches to permanent disability from nerve or organ damage. Some individuals have testified to the Congress about poisoning incidents stemming specifically from exposure to pesticides used on lawns. However, EPA cannot draw conclusions about the lawn-use dangers of specific pesticides because most of the incident information is incomplete. For example, reports may not indicate the amount of the pesticide exposed to or through what use or route (e.g., indoor use, lawn use, inhalation) the exposure occurred. EPA is close to completing a survey of occupational poisoning incidents in California. This survey examined the types and severity of symptoms caused by pesticide product poisonings and will help EPA learn more about the dangers of these chemicals.

Lawn Care Pesticides May Contaminate Groundwater

Ten of the 18 pesticides have been identified in preliminary laboratory tests as having the potential to leach into the groundwater. Groundwater contamination by toxic pesticides could pose health risks to humans and/or wildlife. Pesticides can enter the groundwater directly—through spills or improper disposal—or indirectly—through leaching. Table 3.2 indicates which pesticides have been detected in groundwater and which pesticides may leach. EPA assesses the implications of groundwater leaching through a series of tiered studies. The first tier of testing consists of a battery of laboratory tests plus one field-dissipation test. Depending on test results, pesticide use and application patterns, and/or reports of the pesticide found in groundwater, higher-level (tier II) studies may be required. As shown in table 3.2, EPA currently is requiring tier II groundwater monitoring studies on 4 of the 18 pesticides. EPA is also making groundwater leaching a basis for restricted use status. Restricted use means that the pesticide can only be used by certified applicators. Of the 18 major lawn use pesticides, one—Atrazine—already has some restrictions because of groundwater concerns and 4 others are candidates for restricted-use status.

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**Table 3.2: Groundwater Status of the
18 Lawn Care Pesticides**

Pesticide	Detected in groundwater^a	Tier I, lab data indicate leaching^b	Tier II, groundwater monitoring study required^c
2,4-D ^d	Yes	No	No
Atrazine ^d	Yes	Yes	No
Benefin	No	Not completed	No
Carbaryl	Yes	Yes	No
Chlorothalonil	Yes	No	Yes—due 7/95
Chlorpyrifos	Yes	Not completed	No
Dacthal (DCPA) ^d	Yes	No	Yes—protocol in review
Diazinon ^d	Yes	Yes	Yes—data call-in pending
Dicamba ^d	Yes	Yes	Yes—data call-in pending
Glyphosate	Yes	No	No
Iprodione	No	Yes—in unique cases	No
Isophenfos	Yes	Yes—in unique cases	No
MCPA	Yes	Possible—data inconclusive	No
MCPP	No	Yes	No
MSMA	No information	Not completed	No
Oryzalin	Yes	Yes	No
Pendimethalin	Yes	Not completed	No
Trichlorfon	No	Yes—in unique cases	No

^aIndicates if pesticide has ever been detected in groundwater.

^bResults are for lab tests only.

^cFour-year small- or large-scale field studies (Tier II) that examine the leaching characteristics of the pesticide in a variety of soil conditions in which the pesticide may be used.

^dRestricted use or candidate for restricted use due to groundwater concerns.

Conclusion

Until recently, EPA did little to assess the residential exposure and health risk from the use of pesticides on lawns because it assumed that exposure was very low. Within EPA, there is now some concern about exposure to lawn care pesticides because these pesticides might persist in the environment and children may receive more exposure than previously believed. To resolve these uncertainties, EPA has initiated an effort to

develop standardized testing and assessment guidelines for post-application exposure to lawn care pesticides. This effort has been progressing slowly over 2 years because of internal disagreements between two Offices within EPA. The disagreement was resolved with the publication of a draft research design in December 1992, and the agency is moving forward, although future progress is contingent on budgetary and personnel resources.

EPA believes the present risk assessments err on the side of caution. However, until the new guidelines for conducting post-application exposure studies and risk assessments are developed, EPA will not know for certain how much exposure is associated with lawn care use of pesticides and what the subsequent health risks really are, especially for children. The agency is currently requiring registrants of 2 of the 18 pesticides to obtain exposure data on lawn care pesticides using existing methodologies. The data are due by late 1994. EPA has determined that exposure data are not needed for 4 additional pesticides and has not yet made determinations on the remaining 12 major lawn pesticides.

Because of the potential for public exposure to these pesticides, it is important that EPA decide whether post-application risk assessments are necessary as soon as possible. When such assessments are necessary, they should be conducted using the best methodologies available at the time. However, a pesticide should not be reregistered for lawn uses unless EPA is confident that there is no health risk from exposure, especially to children. This may mean that some lawn care uses should not be reregistered until the standardized testing and assessment guidelines for post-application exposure are completed and used in the risk assessment.

EPA should move expeditiously to develop the standardized testing and assessment guidelines for post-application exposure so that risk assessments for lawn care use provide the public with adequate assurances about the safety of pesticides used on the nation's lawns.

Recommendations

Because of the uncertainty about the risks posed by lawn care pesticides, we recommend that the Administrator, EPA, fully explore the health effects of post-application exposure to lawn care pesticides in the agency's risk assessment process prior to reregistering pesticides for lawn uses, and that EPA place a high priority on developing the post-application exposure testing and assessment guidelines.

Major and Minor Lawn Care Pesticides and Their Characteristics

Table I.1: Characteristics of 18 Major Lawn Care Pesticides

18 major pesticides	Type	Total number of products ^a	Number of products with lawn uses ^b	Home garden uses ^c
2,4-D	H	574	441	Y
Atrazine ^d	H	164	94	N
Benfluralin (Benefin)	H	165	158	N
Carbaryl	I	505	188	Y
Chlorothalonil	F	101	29	Y
Chlorpyrifos	I	980	321	Y
Dacthal (DCPA)	H	90	73	Y
Diazinon ^d	I	612	267	Y
Dicamba	H	212	182	Y
Glyphosate	H	68	48	Y
Iprodione	F	21	7	Y
Isfenphos (Oftanol) ^d	I	45	39	Y
MCPA	H	94	59	Y
MCPP	H	46	46	N
MSMA	H	144	80	Y
Oryzalin	H	35	31	Y
Pendimethalin	H	43	24	Y
Trichlorfon	I	42	16	Y
Total		3,941	2,103	

Legend
H = Herbicide
I = Insecticide
F = Fungicide

^aThe total number of products currently registered with EPA that contain that pesticide.

^bThe total number of products for pesticides that have lawn uses on their label.

^cIndicates whether the pesticide can be used in or around the home garden.

^dIf a pesticide, or certain products that contain the pesticide, is classified as Restricted Use, the user (applicator and/or buyer of the product) must be registered as a certified applicator or work under the direct supervision of a certified applicator to use that product.

Actions Taken by EPA to Respond to GAO Recommendations Made in Prior Lawn Care Pesticide Reports

The Environmental Protection Agency (EPA) has undertaken several activities in response to recommendations in our March 1990 and September 1991 lawn care pesticide reports to the Chairman, Subcommittee on Toxic Substances, Environmental Oversight, Research and Development, Senate Committee on Environment and Public Works.¹

In our March 1990 report, we noted that neither the Federal Trade Commission (FTC) nor EPA was taking action against safety claims by pesticide applicators. Although FIFRA authorizes EPA to take enforcement action against advertising claims made by pesticide manufacturers and distributors, the authority does not extend to claims made by professional applicators such as lawn care companies. FTC, under its own legislative authority to protect consumers against false and deceptive advertising, can, however, take enforcement action against professional pesticide applicators as well as manufacturers and distributors. Because neither agency was acting against safety claims by pesticide applicators and because FTC preferred to defer to EPA for action in this area, we recommended that the Administrator, EPA, seek legislative authority under FIFRA for regulating such claims. EPA and FTC have since taken steps to improve coordination of their enforcement activities by developing a cooperative arrangement with established guidelines for referring safety claim advertisements between the agencies, depending on the nature of potential violations.

In March 1990, we also recommended that the Administrator, EPA, develop an enforcement strategy for monitoring the lawn care pesticide industry's compliance with FIFRA Section 12(a)(1)(B). This section prohibits claims made as part of a pesticide's distribution and sale that differ substantially from claims made as part of a pesticide's registration application. In addressing this recommendation, EPA developed an enforcement strategy that included (1) increased compliance monitoring by EPA regional offices and (2) the use of state resources—through enforcement cooperative agreements—to monitor compliance.

EPA's efforts have had some positive results. In 1991, according to EPA, the agency screened about 1,600 lawn care advertisements and identified 267 advertisements requiring further investigation and possible action. Of the 267 advertisements, 180 were product-related, 75 were service-related, and 12 were both product- and service-related. The product-related advertisements were forwarded to the EPA regions for follow-up

¹Lawn Care Pesticides: Risks Remain Uncertain While Prohibited Safety Claims Continue (GAO/RCED-90-134, Mar. 23, 1990) and Lawn Care Pesticides: EPA Needs to Assess State Notification Programs (GAO/RCED-91-208, Sept. 25, 1991).

**Appendix I
Major and Minor Lawn Care Pesticides and
Their Characteristics**

**Table I.2: Characteristics of 26 Minor
Lawn Care Pesticides**

26 minor pesticides	Type	Total number of products ^a	Number of products with lawn uses ^b	Home garden uses ^c
Acephate	I	71	8	Y
Anilazine	F	21	16	Y
Bendiocarb ^d	I	62	14	N
Benomyl	F	110	27	Y
Bensulide/Betasan	H	61	58	Y
Bentazon	H	10	1	Y
Chloroneb	F	12	5	N
Ethoprop ^d	I	20	4	N
Fenarimol	F,H	5	3	Y
Fosetyl-al	F	3	1	Y
Isazophos ^d	I	1	1	N
Malathion	I	490	84	Y
Maneb/Mancozeb	F	153	37	Y
Metalaxyl	F	68	13	Y
Oxadiazon	H	30	25	Y
PCNB	F	78	27	Y
Permethrin ^d	I	513	19	Y
Pronamide ^d	H	15	5	N
Propamocarb	F	1	1	Y
Propiconazole	F	14	2	Y
Propoxur	I	300	7	Y
Simazine	H	84	18	Y
Thiram	F	85	21	Y
Triadimefon (Bayleton)	F	25	20	Y
Triclopyr	H	10	5	Y
Trifluralin	H	160	56	Y
Total		2,402	478	

Legend
H = Herbicide
I = Insecticide
F = Fungicide

^aThe total number of products currently registered with EPA that contain that pesticide.

^bThe total number of products for pesticides that have lawn uses on their label.

^cIndicates whether the pesticide can be used in or around the home garden.

^dIf a pesticide, or certain products that contain the pesticide, is classified as Restricted Use, the user (applicator and/or buyer of the product) must be registered as a certified applicator or work under the direct supervision of a certified applicator to use that product.

**Appendix II
Actions Taken by EPA to Respond to GAO
Recommendations Made in Prior Lawn Care
Pesticide Reports**

investigations and action, while the service-related advertisements were sent to EPA regions to be referred to FTC regional offices—per the referral procedures adopted by EPA and FTC.

EPA expanded lawn care pesticide monitoring in 1992 by including pesticide use inspections under cooperative enforcement agreements with the states. Under these agreements, each state was to conduct at least 10 lawn care pesticide use inspections. During fiscal year 1992, the states conducted 760 lawn care use inspections and found violations during 257 (or 34 percent) of the inspections. Violations included spraying in adverse conditions (causing drift), lack of protective clothing, improper posting and notification of sprayed areas, unlicensed operators, and record keeping violations. As of September 1992, the states had taken or planned to take action (such as penalties and verbal or written warnings) in response to each of the violations. The states also reviewed 934 advertisements in fiscal year 1992 and, as a result, documented—as of September 1992—41 violations that were followed up with enforcement actions.

Our September 1991 report recommended that the Administrator, EPA, collect data on state lawn care notification programs,² analyze the data to the extent practical to determine the most effective programs, and provide the results to all states. EPA responded to our recommendation by collecting data on state lawn care posting and notification requirements. As of January 1993, EPA had compiled data on about half of the states having posting and notification requirements. After the data are collected on the remaining states, EPA plans to provide a summary of the programs to all states.

Additionally, EPA established a Lawn Care Pesticides Advisory Committee (LCPAC) to help identify and resolve lawn care issues such as pesticide safety claims in advertising. The committee, chartered under the Federal Advisory Committee Act, is comprised of a wide spectrum of organizations, including environmental/public interest groups, lawn care application and chemical industries, state regulatory agencies, state attorneys general, and other federal agencies. Some issues recently addressed by the committee include: (1) posting and notification, (2) registries for chemically sensitive people, (3) education and communication, and (4) advertising.

²Some states require commercial firms to provide public notification when lawn care pesticides are used. Primary notification methods are direct notification to customers, direct notification to neighbors upon request, and the posting of warning signs on treated lawns.

Special Review Status of Six Lawn Care Pesticides

Pesticide	Health/environmental concerns	Special Review status
2,4-D	Carcinogenicity	Pre-Special Review since 1986 ^a
Atrazine	Carcinogenicity, groundwater contamination	Pre Special Review since 1988 ^b
	cardiac effects	Pre-Special Review since 1989
Carbaryl	Carcinogenicity, mutagenicity, developmental toxicity	Pre-Special Review completed 1980 ^c
MSMA	Carcinogenicity, mutagenicity	Pre-Special Review completed 1983 ^d
Trichlorfon	Carcinogenicity, mutagenicity, developmental toxicity, reproduction	Pre-Special Review completed 1983 ^e
Diazinon	Avian hazard	Special Review completed 1986 ^f

^aA decision regarding Special Review is due after Apr. 1993. See ch. 2.

^bA Special Review decision is anticipated by Oct. 1993.

^cEPA required registrants to remedy existing data gaps and make label changes reducing exposure.

^dEPA determined that existing data were inadequate to require Special Review. Registrants were required to submit additional data, including an applicator study.

^eEPA determined that there was no definitive evidence of human health risks.

^fGolf course and sod farm use was canceled. See ch. 2.

The Risk Assessment Process

To determine if a pesticide poses human health risks following its application on a lawn, the pesticide needs to be assessed for (1) what harm the pesticide is capable of causing, (2) how much pesticide is needed to cause harm, and (3) how that amount compares to the amount people are actually exposed to. Risk assessment is a function of two factors—toxicity and exposure. Toxicity identifies the type and degree of hazardous effects a pesticide is capable of producing (e.g., nonfatal birth defects), whereas exposure identifies how much of a pesticide is absorbed. For example, if a pesticide capable of inducing cancer dissipates within hours after being sprayed on a lawn, then post-application exposure is minimal and the risk is low, even though the pesticide may have a high cancer risk when used another way, such as in food. Conversely, if exposure to a pesticide is high, but the pesticide has very little toxicity, the risk is also low.

Four steps are involved in the determination of risk:

- hazard identification, dose/response assessment, exposure assessment, and risk characterization

Hazard identification involves identifying the inherent toxicity of a pesticide, i.e., the types and degrees of harmful effects a pesticide may cause. This is done by evaluating laboratory studies conducted on animals. For example, lab studies attempt to determine if a pesticide irritates the eye, causes birth defects, or causes cancer.

The dose/response assessment involves determining the relationship between dose amounts and occurrence of effects. This is done through a series of short-term (acute) and long-term (chronic) toxicity testing on animals. An assumption is made that threshold dosages exist for some toxic effects, but not for cancer. For noncancerous risk endpoints (e.g., reproductive effects), lab animals are exposed to different doses of a pesticide, and EPA scientists determine both the highest level of exposure that did not cause effects—the No Observed Effect Level (NOEL)—and the lowest level of exposure at which effects were observed—the Lowest Effect Level (LEL). EPA then takes the NOEL, divides it by an uncertainty or safety factor (usually 100 or greater), and calculates a Reference Dose (RfD). At or below the RfD, it is assumed that daily exposure over a lifetime will not pose significant risks to health.

For cancer, EPA first classifies the pesticide for carcinogenicity potential and then, for certain classifications, calculates the risk of tumor incidence

expected to occur from low levels of the pesticide contained in the diet. The classification system consists of:

- A level carcinogen: known human carcinogen on the basis of epidemiological data;
- B1 level carcinogen: probable human carcinogen on the basis of laboratory animal and epidemiological data;
- B2 level carcinogen: probable human carcinogen on the basis of laboratory animal studies;
- C level carcinogen: possible human carcinogen on the basis of laboratory animal studies;
- D level carcinogen: not yet classifiable because of insufficient or inadequate data;
- E level carcinogen: evidence of noncarcinogenicity for humans.

All B and some C-level carcinogens receive a quantitative expression of the oncogenic potency of the pesticide (Q*). This number indicates the risk of cancer from exposure to the pesticide in the human diet. The agency uses a "negligible risk" standard to address the risk of cancer. EPA defines negligible risk to mean that the estimated cancer risk can be no greater than a risk of 1 in 1 million or less.

Exposure assessment consists of identifying the level, duration, and frequency of exposure as well as the route (e.g., through skin or diet). Exposure is difficult to measure because it is influenced by many factors, each of which, in turn, is influenced by other factors. For example, one factor in determining the level of exposure is knowing the residue that remains during or after treatment. Residue is influenced by the product's formulation, the climate, soil conditions, and even the rate of application. Another factor is the amount of residue that actually gets transferred to the body. That depends upon the type and frequency of activity at the treated area (e.g., walking across a lawn to pick up a newspaper, playing football in bare feet for several hours) as well as the type of clothing worn.

Risk characterization is estimated by integrating the above three factors. By combining estimates of likely or actual pesticide exposure with the toxicity of the pesticide, EPA can characterize the risks that it poses. However, even this is not exact for everyone, because individuals vary in their susceptibility to pesticides. In general, EPA uses a worst-case scenario when determining risk.

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