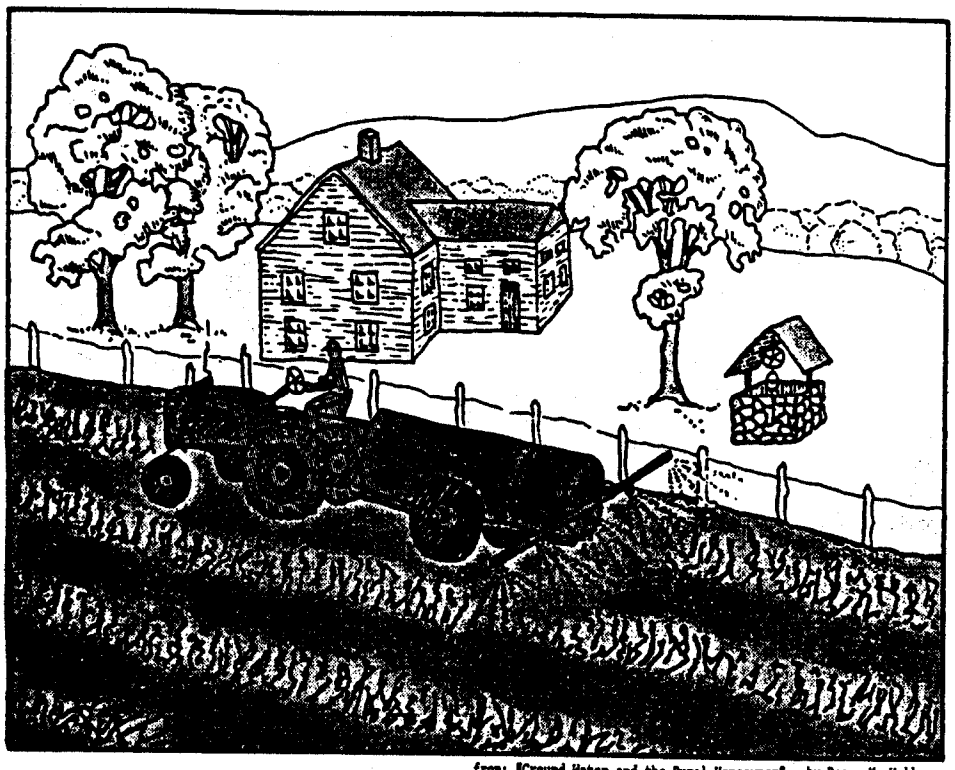
DC-WRRC Report No. 89

"AGRI-CHEMICALS AND GROUND WATER QUALITY: FUTURE DIRECTIONS"

1988 Annual Joint Seminar

25 February, 1988



from: "Ground Water and the Rural Homeowner" by Roger M. Waller

AMERICAN SOCIETY OF CIVIL ENGINEERS AMERICAN WATER RESOURCES ASSOCIATION

DC - WATER RESOURCES RESEARCH CENTER

DC-WRRC Report No. 89

PROCEEDINGS ON:

AGRI-CHEMICALS AND GROUND WATER QUALITY: FUTURE DIRECTIONS

Edited by:

Dr. M.H. Watt
A. Felix
M.T. Fronza

A Symposium
Co-sponsored by:

American Water Resources Association (AWRA)

American Society of Civil Engineers (ASCE)

Water Resources Research Center (WRRC)

February 24, 1988
Washington, D.C.

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PREFACE

The D.C. Water Resources Research Center of the University of the District of Columbia provides the District of Columbia and the region with research support to identify water problems and to contribute to their solutions. In addition to its research activities, the Center has a technology transfer/information dissemination program designed to increase the communication of technical and scientific knowledge and to promote a general understanding of the water resource problems.

This seminar, entitled "Agricultural Chemicals and Ground Water Quality: Future Directions" was organized under the technology transfer program in coordination with the American Society of Civil Engineers (ASCE) and the American Water Resources Association (AWRA). A brief description of the ASCE, the AWRA, and the DC-WRRC are provided in the last pages of these proceedings.

In recent years, the use of pesticides to control agricultural growth has improved the productivity of agriculture to a significant degree. The benefits derived from the use of pesticides and chemicals for general economic growth are tremendous; however, this product poses serious risks to the environment especially to the ground water.

The seminar, therefore, aimed at providing an understanding of the impact of agricultural chemicals on the ground water. Various high level officials and experts were invited to share their views on the critical situation. The conference was likewise attended by more than a hundred participants consisting of representatives from government and private agencies, faculty and university researchers, students, and the general public.

The design and preparation of these proceedings were done by Angelita Felix and Maria T. Fronza of the DC-WRRC. We wish to congratulate them and thank them for their innovativeness and dedication in the production of these proceedings. We also wish to thank the authors and resource persons for their papers as well as various other persons who took time to review these proceedings. We would like particularly to thank Mr. James Hannaham of the DC-WRRC for his coordinative efforts and valuable suggestions. Finally, we wish to acknowledge the cooperation and assistance of the House of Congress Documents section and the Environmental Protection Agency (EPA) Public Affairs Office, in particular, for providing us very important materials that were used in the appendices of the proceedings.

It is important to note, however, that due to technical difficulties such as poor acoustics and other similar problems, we have not been able to provide all the materials that were presented in the seminar. We wish to apologize for that and for other errors that may be found in this report.
Dr. M.H. Watt Director, DC-WRRC

Welcome remarks

by

Dr. William Hyman
Acting Dean
College of Life Science
University of the District of Columbia

As part of this university, we find that each time we're asked to comment, or say anything before a group of more than two or three people, we need to take advantage of the opportunity of trying to make some converts, to try to see if we can do some proselytizing so to speak, to begin to build more and more a network of ambassadors of goodwill for our university. And so as part of my responsibility, on behalf of Dr. Rafael Cortada, the President, in addition to welcoming you to our campus, I would ask that you look us over while you're here because we'd like to recruit you as part of that team of ambassadors of goodwill, to pass what we think is the best bargain in the area, for one who is seeking a good and solid education.

And so it is with welcome remarks. There is so much to say when you're faced with this kind of an audience that it reminds me of a story I heard about a minister that was invited to do a trial sermon. If his trial sermon went over well, he was told he would get the job for the church as the minister.

But the church as way down in the rural area in the country. And so the minister prepared all night long, and trimmed the four-hour speech back to about three-and-a-half hours, showed up at the church bright and early, about 30minutes early, and at eleven o'clock, only one farmer showed up. That farmer sat down on the front row.

And the young minister, sitting there with his speech and his preparation, said: "Do you think that we ought to wait a few minutes?" And the farmer said: "I think so." And so they waited 15 more minutes, but nobody showed up.

So the young minister looked at the farmer and said: "What do you think we ought to do?"

And the farmer said: "Well, I tell you. If I called my cows in to feed them and only one came in, I think I'd feed that one." And so, for the next three hours and a half, the young minister laid it on him. When he finished, he asked the farmer: "What do you think?" And the farmer said: "Well, if I called my cows in and only one came in, I think I'd feed him. But I wouldn't feed him the whole bale."

And that's the way it is with welcome remarks. You expect me to tell you something about the university, but you don't want the whole bale. You're here about a very serious subject, but as dean, I find that I'm so involved with the minutiae of the institution, minutiae may be a strong term, about the budget, personnel matters, grievances of students and faculty, and many, many meetings one of which is going to happen to me in about 15 minutes that I seldom get an opportunity to sit down and do what you're doing and that is, to get more of the substantive side of the institution, to look intellectually at a matter that's as important as the preservation of the quality of the ground water.

I know for a fact, in talking with our good friend Dr. M. Watt - the director of the DC Water Resources Research Center - a person whom I always refer to as highly energized, stays "on-the

go" all the time, always has something in mind that contributes to his Center's goals, a very fine person and one that we think an awful lot of, that the careful management of ground water is extremely important, especially since I understand that it's the primary supply for water for some 50% of the country. And so, anytime anyone tells me that they're going to sit down and take a look at the impact on the quality of that kind of resource, I'd like to sit here with you and hear what you have to say. However, if I do that, then I think what would happen is that this kind of session would not be possible because the 9 o'clock meeting is about the supplementary budget and so I think I'm going to have to scat right out, but I hope very much that this kind of sessions will occur even more frequently than they are. I understand that this is the second annual joint seminar, but so much is riding on the kinds of decisions and the kind of quality input that you have on this kind of subject that I will encourage you to have more and more frequent meetings and to think first of UDC as your primary resource for getting you together for these sessions.

We're kind of the new kid on the block when it comes to universities and colleges even though our roots go back to more than a hundred years when you think of DCTC (DC Teacher's College) and just a quick and capsulized history for those of you who may not be aware.

This institution is the product of the consolidation of three former institutions: DCTC, an old *institution* that has been around for a long time, the DC Teacher's College; Washington

Technical Institute, a very new institution that came about at the same time that the third institution, Federal City College, came about, were finally merged together to form the University of the District of Columbia (UDC) in 1978. And so, although we're more than eight years old, we're still kind of new and we're still not quite accepted among the universities and colleges as much as I think you would agree that we ought to be should you take advantage of my invitation to look us over.

If this meeting doesn't provide the opportunity for that, feel welcome to come back and look us over very carefully because we do know for a fact that the kind of quality that's in these walls is the kind of quality that you would like to be a part of.

My office is just above your head, the name is William Hyman and as Dean of the College of Life Sciences, I welcome you on behalf of the President, and invite you to come back again and again and again.

Thank you very much.

Welcome

by

Mark Magler

Vice President National Capital Sector
American Water Resource Association

Good morning.

I'm Mark Magler, the Vice President of the National Capital Sector of the AWRA. This is the Agri-chemicals and Ground Water Quality seminar of 1988 co-sponsored by the National Capital Sector of the AWRA; the ASCE Water Resources National Management Committee, National Capital Sector; and the DC-Water Resources Research Center. We have two panels for you this morning, with coffee break in between, and we have assembled a group of researchers, practitioners, and policymakers that I am sure will shed light on the problem that faces us with agrochemicals and ground water quality.

Our first speaker in this morning's panel is Robert Long. Secretary Ling of USDA appointed Robert Long, Deputy Asst. Secretary for Science and Education at USDA in 1986. Mr. Long was a naval aviator in 1986. He earned his degree in Economics from Wabash College in 1948 and received a degree in business from the University of California in Los Angeles. In 1976, he received an honorary doctorate in Science from Colorado State University.

Mr. Long began his career in 1949 as president of the Irvine Company Agricultural Operations. He later became senior vice president of Agriculture at the Bank of America in San Francisco. From 1973 to 1977, Mr. Long served as Assistant Secretary of Agriculture for Conservation, Research and Education

at USDA. In this capacity, he was chief administrative officer for the Forest Service, Soil Conservation Service, and the-National Agricultural Library. In 1977, Mr. Long became a partner in the Agribusiness group. He also served a two-year term as president of the Council of California Growers. He sits on many committees and boards with the Federation for American Agriculture and the Board of Directors for the American Forestry Association. Let us welcome Mr. Long.

AMERICAN SOCIETY OF CIVIL ENGINEERS
AMERICAN WATER RESOURCES ASSOCIATION
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1988 ANNUAL JOINT SEMINAR

"Agri-chemicals and Ground Water Quality: Future Directions"

February 25, 1988
8:30 am - 12:00 noon
University of the District of Columbia
Van Ness Campus Bldg. 44 Room A-03

AGENDA/PROGRAM

Moderator	Ken Rubin President, NCS, AWRA
Welcome Address	Rafael L. Cortada President, UDC
"Agri-chemicals and Ground Water Quality: Problems and Issues" Deputy Asst. Secretary Science & Educ., USDA	Robert W. Long
"Agri-chemicals and Ground Water Quality: Research and Legislation"	Skip Stiles \ Staff Director House Agric. Subcom. U.S. House of Repres.
"Agri-chemicals and Ground Water Quality: A Farmer's Experience"	Dr. John Nicholi Farmer/Educator

BREAK 10:00 to 10:30 AM

Moderator	Nancy Lopez Chair, Water Resources Committee, NCS, ASCE
Remarks on: Agri-chemicals and Ground Water Quality	Wayne N. Marchant Princ. Deputy Asst. Secretary Water & Science, USDI
"Agri-chemicals and Ground Water Quality: A Strategy"	Director Gerald Kotas National Pesticide Survey, EPA

"The Impact of Pesticides on
Ground Water Quality" ..... Dr. Charles S. Helling USDA Agriculture Research Service
Closing Remarks ..... Dr. M.H. Watt Director, DC-WRRC

ADJOURN 12:00 noon

Agri-chemicals and Ground Water Quality: Problems and Issues

By

Robert W. Long
Deputy Assistant Secretary
Science and Education
Department of Agriculture

I always find it interesting to hear other biographies, sometimes my own, not always. And once you get misquoted in the bio-review, you always think, should it be corrected or should you just let it ride? It's a small matter, so I think I'll just let it ride.

You may wonder what was different in the 1973-1977 era, as I had considerable involvement with many agencies in the Department. I thought we might have been a little more efficient then. There are now two assistant secretaries doing the same job that I did and I didn't find it too difficult at the time.

There are varying conditions as to how that now applies and. I assume Orville Bentley and George Dunlop won't quite agree. It's nice to be back in Washington. You know, we like to think of ourselves as problem solvers, and if anybody tells me we don't have big problems, let me lay out a few points. The problem solver's side is always a lot more difficult. It takes more time, thoughtfulness, effort, coordination and so on. I'm not going to talk too much about Congress because Skip is going to talk about it. He knows a lot more about what's going on up there than I do. But I do know something about what's happening in the Department.

I don't read The Washington Post too often, particularly

their editorials. I usually get a little upset when I do. But I read one the other day, (I think it was just last week) entitled: "Paper Report". It doesn't tell you what we're talking about. Let me just read you the first line "This is a civilization that uses poisons to produce food. "I thought to myself, "here we go again". Not chemicals, not agricultural materials.

I guess you could argue that in a technical sense that statement is not totally wrong. They are poisons, but as we use them today, chemicals are more beneficial than a toxic problem. The campaign against chemicals has been going on since an employee of the Department wrote a book called "Silent Spring", something like 25 or 26 years or so ago. The fact is that we're not poisoning our society. Still here, 25 years or so later, we came right back to where we were. Now we're not going to deny any sense of the word that agriculture and agricultural uses of chemicals aren't among the problems that we're facing these days. We will gain nothing by talking or pointing to other chemical users and saying, "Well, they're part of the contamination process." They are. That brings us little in terms of our own area of concern. And one of the things that we're trying to do in the Department is to reorient our programs to address the problem. In the past, we've addressed the problem in a fractured way. Because really, when we think of the Department of Agriculture, it's an organization designed to support the commodity system.

Our research has been primarily designed to improve quality,

quantity, marketing, and everything in the system are oriented that way. That's what the Department is really all about.

When they took EPA out of the Department and set it up as an independent agency in 1969, it was because others had said, "How can people oriented to the commodity system be concerned about contamination as it may relate to the use of chemicals?" Not entirely true, but there was enough truth in it.

Anyway, what I think we really need to talk about is the realities of our own situation today. What can or should we do about it? Are there solutions, and so forth.

Congress, of course, reacts, in its own way, as only it can, by passing laws, which govern, regulate or otherwise attempt to mitigate the effects of environmental contamination. We've got a ton of laws on this issue. Much of it is needed, but not all. Examples of recent legislation are the Clean Water Act, Safe Drinking Water Act, Endangered Species Act, etc. What do we do about it? We need to talk about some things that are wrong.

EPA has tried to recognize that there is a balance of benefits and risks for chemicals. There is a public out there that isn't really knowledgeable about how chemicals are used, or even why they are used. They have a benefit, which if the use of chemicals in its fullest form were withdrawn, say, if you banned them all, wouldn't it is a fascinating experience for our country? We are so used to clean food, we no longer have to worry about insects and their larvae or the old story of worms in the apple, and so forth. We have trained the public to look for good, high quality, clean looking fruits and vegetables. Could we maintain such a quality process if we remove chemicals from the

system? The answer, I think, will be no. However, that doesn't get to the whole issue. That's just part of it. We don't want to further alarm the public. Without looking to alarm at these issues, however, we instead are going to try to do some educating.

One of the biggest factors in an educational process is explaining the use of nitrogen, chlordane, and so on. Now you may know this, but we've got to remind the public. Somehow, we have got to do something about the fact that we are probably contaminating the ground water system in our society more than we should. So there's a big, big educational job that needs to be done.

One of the problems we have to learn more about is how truly injurious chemical residues are to human health. We do not know what causes tumors and cancers -- is it use of organic materials that we ingest or are exposed to? It's tragic that

medical research has been unable, after spending billions each year, to come to task with this issue. In the meantime, what does EPA, or any regulatory agency do, given responsibility for human health, which, incidentally, the Department of Agriculture does not have. They're going to err on the safe side, of course, the conservative side. They're going to overreach to avoid being short on protection. They need more information to effectively regulate chemicals.

So now we've come into the arena of ground water. I can't tell you how it got there, but I do want to remind you that until seven or eight years ago, we didn't think organic compounds could

reach ground water. We had seen, because of its mobility in the soil, nitrates in water supplies for quite a few years earlier. We're familiar with that part. And we have been researching ways to mitigate and reduce the impact of nitrogen.

But not organic chemicals, not pesticides in underground aquifers until now. So this development has alarmed the public even more. And that's what The Post article was talking about.

What is EPA doing about this? I hope there will be somebody here who will talk to you about their efforts. We're not at war with EPA, although there's been at times past a battle between the Department of Agriculture and EPA. But it's a matter of approach. They are a regulatory agency. We are an agency that tries to develop cooperation, provide education, provide a better understanding. We have not done our job well. EPA hasn't done a poor job on their side, although they may be doing less than what environmentally concerned people think they should, but they nevertheless have done a pretty good job. But one of the realities about chemicals in agriculture, and more significant in terms of its impact than the regulatory process, is the fact that the insects and the plants have been developing a resistance to chemicals. Chemicals used to last, when they were first marketed, 15, 18 years, some of them still in use after 25 years or more. Today, chemicals that are currently introduced are lasting only five to seven years, some less. They're very expensive to develop and very expensive to the farmer -- and they're not doing the job. Resistance to chemicals is increasing in plants and animals. If we had DDT today probably it would not be used at all. It wouldn't be effective. That's a bigger problem than over-regulation.

We've been looking at the problem in the Department and asking, "What can we do? What are our alternatives?"

Our first estimate as to what it would cost just for the research side alone is $50 million a year. Now, have the farmers overused chemicals? Yes, they have. There are some arguments there. In fact, the Fertilizer Institute was very unhappy with us on the release that we put out just a couple of weeks ago on low-input agriculture.

Now, today we are talking about trying to encourage the low input agriculture concept. It's not the organic part. It's just the lower use of all input materials. And in the last analysis, what we want to do is to help the farmer, the producer, make a profit, cutting back on his chemicals if he can. We'll urge them to go in that direction.

We know that commercial agriculture is using too much. We have good evidence of that. The Fertilizer Institute was very upset with us because we said excessive use. We should have used another term. Maybe nobody else reacted as they did, but it shows that there are many constituents out there.

We also feel it is an important process we bring about a better educational system. We have to encourage them to use less fertilizer. They are doing it. Now, they're doing it probably than they are for contamination and Not that they're unconcerned. And chemicals are a major part of the productive process. They need them.

That's an issue for us to consider how among our producers. They are more for economic reasons environmental concerns. Fundamentally, they are in business. And chemicals are a major part of the productive process. They need them.

Science needs to do more to bring us into focus in terms of these problems in the country. We're not spending nearly enough on research. Once again, remember, the Department of Agriculture is the main Federal agency in support of agriculture. It has concentrated on production yields, quality, marketing and the like. I'm sure we spend more time on a continuing effort to reduce the impact of pests and weeds in our food production process. We've spent little or no time in trying to find out how to use chemicals at lower levels.

There is great promise in biotechnology. We have hopes (many of us think of a 12-year deadline in terms of answers) that we may come up with some answers. In the meantime, we have got to reduce the amount of chemicals that are being used. We have to increase our research and the Department has to reorient programs. We're going to try. You see, many of you who know the Department know that all these agencies, ASCS, ES, etc., have their separate missions when you have a thread like chemical use, agricultural chemical use, going through all these agencies. It is hard for them to put together a program that can effectively address the issue. We're going to try to find out what kind of strategy we need that will support producers. We put together a working group and we have given them until the first of June to come up with some answers for the Department.

That doesn't mean we're going to merge the agencies to do that. We're going to find ways so that the agencies can move effectively together. Then work with the whole system in a more effective way.

So we're trying, and I hope effectively, to move in that

direction. In the meantime, I feel that among other things, we're got to start talking about the benefits, about the importance of the issue of chemical use in our food supply and get people thinking about what the real or imagined risks really are. We know there are risks in the use of chemicals. We know minute amounts are there in some areas. We know there are a lot of chemical residues in the soil that probably will reach the ground water system. But we don't know what the cumulative effect is on humans, the drinking water that has certain parts per billion or parts per trillion -- this is an area that badly needs more work.

I have said a lot of things in these sheets, sheets that I haven't really used. And I suppose that I should conclude, but maybe we'll have time to talk together a little bit later. I should remind you that we have tried, as a Department and as a system, to integrate best management practice programs, to increasingly encourage farmers to consider what we call low-input agriculture, and we're working with private industry and the states to develop research in the use of new bio-controls.

Those things are important. What we haven't done so far is to try to get interested parties in the country who are oriented to ground water to sit down at the same table and talk about this issue.

Agricultural chemicals are one of our best opportunities. We need to put our house in order. We need to make an effort. We've got to get over the problem of always talking about the tools we use in producing our food. Somehow, there must be a better way to discuss the reality of our living. We're not afraid of it. But we can't do anything, that's for sure.

Agri-chemicals and Ground Water Quality:
Research and Legislation

By

Skip Stiles
Staff Director
House Agriculture Sub-committee
on
Department Operations, Research, and Foreign Agriculture
U.S. House of Representatives

Let me preface my remarks with a couple of underlying assumptions in Congress. The first is that perception is reality. If the public thinks the sky is green, then the Congress will quickly pass the National Green Sky Month. We don't necessarily operate continuously in the world of scientific fact and proof. The other thing, as Bob mentioned, is that the Congress legislates. As Mark Twain once said: "If your only tool is a hammer, you tend to see all your problems as nails." For us, our tool is legislation, so we do legislate, sometimes, too quickly, and in wrong directions but that seems to be the way the Constitution set it up, so that's what we try to do.

Let me give you a little background on what we've been up to in the House Agriculture Committee and how we view this issue. I will discuss the underlying assumptions that Chairman, Congressman Brown has used to guide our inquiries into this area of agricultural operations in water quality. First, the agricultural production operations and rural residents has the highest dependence in ground water use. That means that the agricultural operations and rural residents, who are the natural constituency in our committee, are the ones most greatly affected

by the issue regarding water quality. We also are finding that agricultural sources of ground water contamination are among the most pervasive. We're finding nitrates, pretty much wherever we look now, as well as pesticides. I think we're now up to 35 different pesticides in 23 states, although Gerry Kotas from Environmental Protection Agency (EPA) can correct me on that.

This concern is widespread geographically. It affects every state and frequently', we're getting finds in every country, not necessarily at unhealthful levels. But since we've never looked for them before, we have no baseline, we have no trend data, so every find is significant. It's the phenomenon of, "If you put more cops in the street, you tend to have an arrest rate that goes up." It doesn't mean the crime rate is up, it means the arrest rate is up. We're right at the front end of a lot of testing which we should have been doing over the years on contamination of ground water and we're reacting to this morecrime-kind-of-a-situation.

The agricultural sources of ground water contamination are increasing the public's concern. A quick literature search finds some journal articles reporting agricultural chemicals, fertilizers, and pesticides, showing up in the ground water as far back as in the sixties. But the modern level of concern didn't really start until EDB was found in ground water and, more recently, aldicarb, or temic, beginning in 1979, was found in large concentrations in ground water in Long Island and Florida. That's really driven the modern level of concern on agricultural chemicals and ground water.

We are using the assumption that regulation will occur in

this area and it will come sometime soon, probably during the next two to five years. Congress is not yet ready to move in a major way with a ground water-specific, regulatory bill. But they probably will be as more testing is done, as the realization of the problem becomes more pervasive across the country.

What we're trying to do in the Agriculture Committee is to get ahead of that regulation. Any major issue develops and is shaped like a bell curve in terms of the public interest and the activity on it. We're right now getting up on the vertical part of the curve, in the ground water area. Usually about halfway up that steep curve, you begin to see significant legislative activity. What we're trying to do is to prepare our committee and the agricultural production sector for the eventuality of that regulation. We hope the agriculture sector will be ready for it when it comes and will position itself to avoid some overly stringent regulatory measures, that will be driven by increased public concern absent a reaction from the farm sector.

Now, we have problems in the House of Representatives, well, we have problems in Congress, period, but in the House of Representatives, we have eleven different committees that have jurisdiction over the issue of ground water quality in one way or another. We've also counted 13 different federal agencies, so there are problems in the executive branch as well. But we have a major jurisdictional problem, when we begin to look at the ground water quality. We on the Agriculture Committee don't have a lot of handles on this issue. We have the Federal Insecticide, Rodenticide, Fungicide Act (FIFRA) on paper but a lot of the

regulatory activity in ground water quality is going to be driven by the steps taken under the Clean Water Act, Safe Drinking Water Act and some of the other statutes of that kind. We expect that what will happen is regulation will "ratchet" into agriculture because these regulatory statutes are written in such a way that when there's a find, there's a regulatory reaction. If you're developing state plans under the Safe Drinking Water Act, there's a whole series of prescribed action and so regulation will move into agriculture. It's our hope that we can develop a research and education system that is legitimate, that is facing the problem so that when the regulation runs into agriculture, instead of a regulator saying, "here's your water quality standard, and by the way, here are your choices," the regulator will come in and say, "here are your standards and give me a farm plan in 30 days in order to meet it because I know that you've been working on the problem."

The problem the Agriculture sector faces is that it has been too successful in exempting itself from past regulations. I know there are many who differ with this view especially when you look at pesticides. But remember the non-point source debates of the 1970s, under the Clean Water Act, and the feedlot operators who managed to get themselves exempted from some of the non-point source requirements? There's now a price to be paid for that because this area is coming under scrutiny with great speed, driven by this public concern for ground water quality. Quite frankly, the. Agriculture sector is not geared to deal with the concern. If you look specifically at one of the input industries, namely, the fertilizer industry, they don't have a regulatory

home. The pesticide industry has a track record and they know pretty much what the make-up is under FIFRA and EPA. The fertilizer industry has no regulatory home and they're concerned right now that as they get swept up in the regulatory network, they may get thrown into the pesticide program which they consider too Draconian. This whole area is one where the agriculture production sector is not prepared to deal with at this point because of its past successes in exempting itself from regulation.

There is also another difficulty in dealing with this issue aside from fractured federal jurisdiction and unprepared production sector and that is, the states have pre-eminence on ground water. This is not like surface water where the Federal government goes in and does it. In the ground water, the case law and statutory history in this area is very clear. The states do have pre-eminence on ground water. You go to the state of Texas, the state doesn't even have pre-eminence there, it's the individual. So it's a very complicated situation to address because by and large, the actions have got to occur at the state level.

What we've been trying to do in Congress is to get some of the research and monitoring work done. There's a major research and monitoring bill that came out of the House in December, H.R. 791 that puts in place a big program at U.S.G.S. of about $188 million a year. Actually, it's money they're already spending which we're finally authorizing and tying it up in a package. Also, there's a provision in there for EPA research demonstration

program. That comes to about $27 million.

We on the House Agriculture Committee managed to obtain jurisdiction over that bill and we put in a title at the end of it, dealing specifically with agriculture. One provision calls upon the Department of Agriculture, in an unrealistic time frame, to put together a comprehensive plan and strategy for dealing with water quality. Our focus is water quality, not just ground water quality, because we're trying to push this issue to address hydrologic realities. The last part of that bill is a Best Management Practice task force for agricultural nitrogen, which is something that the fertilizer industry sought to put in place to look at agricultural operations and fertilizers. This is an attempt on their part to become players in the water debate, and not in a negative way. They're trying their darnedest to get ahead of this issue and they are to be complimented for.

The Senate has this bill now and they held hearings on it on Tuesday with one more day of hearings in a week. I expect the Senate version of this water research and monitoring bill to come back to a House-Senate conference sometime within the next couple of months. There are other research bills knocking around and I think that this bill, H.R. 791, and the Senate version will become a major effort. I expect it to be enacted this year.

Regarding regulatory bills, there are some pesticide specific regulatory provisions in both the House and Senate amendments to FIFRA. The Senate bill has a much higher standard, involves all ground water not just the current potential drinking ground water, is a much more stringent bill than the House version. Whether or not we get a FIFRA bill this year, I don't

know. We've been trying for ten years and we haven't had a whole lot of success, but you never know.

We have also moved ahead on the House Agriculture Committee by requesting the Office of Technology Assessment in Congress to do a major assessment on agricultural operations on water quality. This was approved Monday, and will run 12 to 18 months. I don't know if you're familiar with the OTA process but they usually bring together an advisory committee of people from various sectors with varying viewpoints so that all of the biases balance out. We usually get a pretty fair look at an issue when we ask OTA to do them. One of the reasons is that you can't influence an OTA study like you can some others.

The work that they're doing will set the road map for how EPA and USDA are going to be dealing with pesticides in ground water. I'll let someone else talk about the details of that.

In the near future, we will see EPA test a ground water strategy with a specific regulatory action on a chemical, probably aldicarb.

Most of the action right now on the regulatory arena is taking place at the state level. California has probably the most stringent ground water clause, followed by Wisconsin. In Wisconsin, the action is driven by concerns about aldicarb. Nebraska has a very fully developed state regulatory system, which is based upon dividing the state into natural resource districts, and regulating, by those geographic areas.

Other states are just moving into it. Texas has a new law that's affecting agriculture. Some states are moving on

individual chemicals. Massachusetts is moving on alachlor specifically; New York is moving on one or two chemicals; some states are not moving on regulations but are sort. of laying the groundwork. Iowa is a classic example. The state of Iowa has a very large research and education program going on, funded initially by Exxon oil overcharge money and it will continue to be funded by a tax on fertilizer and pesticide sales as well as permits for underground storage tanks. This money is being brought back into the university up and some research centers that are set up on specific problems.

The rest of the country is all over the place with ground water activities. It's very difficult to sort of get a clear fix on where the various states are. We're trying to develop a database within the Agriculture Committee, but we're not having a whole lot of success.

So, in conclusion, we hope that, at the end of the year, after all these hearings, to develop a general policy guideline, perhaps a piece of legislation that we will put to USDA, asking a number of very specific questions about what they are doing, require a report back to Congress in 10 months, hoping that this will continue the pressure on the agricultural production sectors, and on the Department. We hope as well to keep the issue in front of the Agriculture Committees so that we can continue to move along in this anticipatory, non-regulatory approach that we're taking. With that, I'll close and you ask for questions.

Agri-chemicals and Ground Water Quality:
A Farmer's Experience*

By

Dr. John Nicholi
Farmer / Educator

Thank you very kindly. For a minute there, I thought that my friend and I would have to give this talk on the Beltway, somewhere between Colesville Road and Connecticut Avenue when the traffic stopped.

Your program chairman did write to me about a month ago and asked me to send him some information about myself, which I forgot about, and so, I never did. So, my apologies.

Basically, your introduction of me is correct. I'm the fourth generation born and raised on the farm, which I am currently operating. I would just like to give you a brief background on something which has nothing to do with pesticides or with ground water, but which might be the most interesting thing that you'll hear today.

My great, great grandfather was a schoolteacher in Stuttgart, Germany and he knew how to blow glass. So he came to this country as an indentured servant in 1851 and worked for the Potts Glass company in Baltimore. He made enough money so that in 1862, he bought this farm in which we now live on and operate, for $950.32.

*The following talk by Dr. John Nicholi, farmer-educator, is based on the actual tape transcript taken during the seminar.

I own 68 acres; my mother owns the land on the other side of the road, which is about 38 to 40 acres. And just as a matter of pure interest, these are some of the things that happened from 1862. For the $954-package, I have been offered as much as $60,000.00 an acre for the farm which I now live on.

And there have been a great deal of changes that have taken place since then. I think it would be interesting to note, likewise, that there have been a lot of changes in agriculture from the time this farm was first purchased in 1862. It was purchased by my great, great grandfather as some place to live on and a place to retire. His son took it over in 1908 and to make a living, he started growing fruits and vegetables, which, back in those days, was called a truck farm. My family owned a stall in the market, which, I am sure some of you are familiar with in downtown Baltimore. This market still exists. There are a lot of people that have places of business there and in the summertime, everything is raised on this farm. Aboard a horse and wagon, the produce is sold back at the stall in the Lexington market in Baltimore.

Lexington market is shut down in the wintertime, except for the fish and seafood, which are sold there. When my father took over the farm in the late 20s, it was becoming more and more difficult to make a living with this kind of produce because of the influx of produce and goods that were coming from Florida and California and which were primarily shipped in by train. So he went out of the produce business and in 1928, he went into the dairy business; hence, it was a dairy farm from 1928-1965.

In 1965, he had a labor problem. He got tired of milking

cows twice a day, seven days a week and so forth. He sold the dairy cows and went into the crop business raising corn,soybeans and wheat, and that was all right until the bottom dropped out of the grain market in the early 70s. Thus in 1975, I left the university life and came back and took over the farm. I realized real quickly that I could not make a living renting additional land and being a small grain farmer, I therefore decided to go into what we now call a "pick your own" operation. We now have 30 acres of "pick your own strawberries" and raise about 3 or 4 acres of other kinds of produce and we sell a lot of corn. I used to raise all this crop myself but it's more economical for me to go up into Caroll county and let somebody else raise it and I'll buy it from them at wholesale price and bring it down and sell it. In addition to this, we have a chicken house on the farm, which I doubled when I came back in 1975, with almost 12,000 laying hens and we also have an egg operation. To the best of my knowledge, I am the only egg producer in the state of Maryland that owns this chicken house, sells his own chickens, buys his grain wherever he wants, grades all the eggs and sells them all. To the best of my knowledge, I'm the only one who does that.

Now, I could probably give you a much more interesting talk that will cause you all to laugh and chuckle quite a bit if I spent my twenty minutes talking with you this morning about my problems spreading chicken manure in an urban community. Instead, I'll talk to you about herbicides, insecticides and other pesticides that we use and some of the problems that we

have with them. Since that was not what I was asked to do, I'll refrain from doing that, but you must remember that in Howard County, we do have farmland preservation. We also have farmland conservation.

Basically, as far as I am concerned, and I'll be doing myself an injustice if I don't tell you this, that's the biggest joke that has ever been perpetuated on the taxpayer because it may have been okay had that farm land conservation in our area been introduced 40 or 50 years ago; but now, it's too late and with great big problems in Washington DC and Baltimore City, that are basically 30 miles apart, the two beltways are probably 20 miles apart. They are going to grow and develop and people have to have a place to live. I am sure that I am not the first person to tell you that animal agriculture and urbanization cannot co-exist. Just go down the road some afternoon at 4 PM where the bugging smell of chicken manure is all over the road and you'll find out what I mean real quickly.

So, from now on, I'm going to talk primarily about what we do in our 30-acres of strawberries. Again, bigness is not always the best, but we probably have more acres of strawberries grown for commercial production than anybody else in the state of Maryland.

And as I said, it's totally a "pick your own" operations, --- in order for this to operate successfully, if we're going to have all of the strawberries picked, it will take about 25 to 30,000 people coming to our farm for several weeks and that it's really something to do. But we've never been able to get that many people there, so we raise a lot of strawberries, birds eat

the rest, its a form of fertilization.

The most frequent question that we get asked in our operation when 'people come in, is: "Do you spray your strawberries?" Well, I'm in the strawberry business. If I were still in the corn and soybean-wheat business, we could not exist without the pressures that are put upon us if we did not have herbicides, insecticides and fungicides. I mean I don't know how many acres of strawberries we would have to raise in order to have what I have now for people to pick if I could not spray them well right to prevent dry rot and fungus and the like.

Now on our particular farm, we use most of the regular type of pesticides, herbicides and fungicides such as mythylate, malathione, etc. Most of these we use several times a year, at times to control weeds, or to control ground rot and fungus diseases. Compared to corn, we use about three times the amount of herbicides per year on an acre of strawberry as we would in producing an acre of corn.

Our farm is totally under the soil conservation plan. And in the summertime, we don't have to worry too much about what happens and what goes out of these ponds because for the past 3 years, it has been so dry that we haven't had any water running out, both of the ponds just about dry and not enough water to make the fish live. So that to the best of our ability, with the help of the soil conservation service, everything in our farm, you get a gully-washed rain, which goes into these 2 ponds, goes past the river, and then into the Chesapeake Bay.

I did not think about the design of these ponds. I put them

where I wanted them because of their convenience, but it just so happens that everything around the farm drains to both ponds and I have always been concerned that the amount of herbicides and insecticides that we use may someday cause somebody else's trouble. I've always said that when the fish start dying, it would probably be a sign that I have used too much pesticides and herbicides and maybe, the ground is becoming unsaturated. And in using these things, those of us who are farmers, have to become some sort of a practical chemist or scientist or what-have-you because you have to realize that some of these sprays were contact sprays.

Some of them are systemic, some post-emergent, and some of them use an ionic sticker with them, some of them use and oil-emergent sticker and every one of them is different. When you're working with a delicate crop like strawberries, you don't want to put any sticker in because you do not want to increase the strength of the spray in any way for fear that you may kill them, so it does become kind of complicated. And so it's very easy for me and farmers in general to easily make statements that are away from corrections.

That kind reminds me of a little short story about the lady who walked into a butcher shop. When she walked in, the butcher told her that he was sold out of everything except for beef tongue and then she says, "I don't want any tongue. I can't eat that. That's been inside a cow's mouth. Give me some eggs instead."

As I said before, I don't think that we can operate in modern production agriculture without the use of pesticides. And I don't really know where we would be.

I may not know the

agricultural background you might have but you must remember that there are less than 2 million people involved in U.S. production agriculture. And that we pay less for our food, we buy based on our income, more than any other country in the world.

Figure this out: last year, 1987, we dropped about 15 percent in our disposable income, making something like 84.80%. The next closest to us is Australia, and they spent 23% of their disposable income for food. So somebody in this country is doing a good job.

My main job here is to talk to you about some of the problems that we encounter in using these pesticides. Some of the examples are not all from my farm and are not all my ideas. I did take the time to contact five of what I consider fairly large grain operators in the city areas. The smallest operator that I talked to farms about 1,700 acres. I contacted some who are probably the largest farmers in the state of Maryland farming some 8,500 acres and last year, they raised some 1,500 acres of string beans for a cannery in Pennsylvania. I'm discussing them not necessarily in any order since the last one may be the most important, etc.

Most of the herbicides and pesticides come in one of three ways: paper bags, plastic containers, metal containers. But I'd just like to talk about the plastic bags. Most of these plastic bags are very difficult to open; some are lined with tin foil. They must be using superglue because if you don't have a penknife, and you try to tear them open, all of their contents may spill out and you get it in your hands. That's why you are

supposed to be wearing rubber gloves, and you're supposed to be wearing masks. I've had more spills in using plastic bags than any other type of containers. On all of these plastic bags, whether they are hazardous chemicals or whether they are non-hazardous chemicals, there is a statement that reads: "Dispose of properly. I really wish that somebody in the EPA would discuss that word "properly." It may end up with a description of something that really means nothing to us. Anyway, what do we do with these plastic bags?

It is illegal in my county to burn trash but I burn them anyhow. Since most of these products come in a paper bag, once I'm done with them, I throw them in the trash and burn them up. And I've often thought, "What am I doing by burning these chemicals up and putting them up in the air?" Of course, I'm not the only one who does this. Everybody else I talked to usually disposes of these paper bags in the same manner. Now you can't rinse these paper bags out like one on a metal or plastic container that will say: "Rinse three times with plain clear water, then dispose of properly." Notice that word properly again. Maybe we will have a definition of that this morning.

So for those of us who buy products that come in paper bags, disposal is a problem. We know that we're not supposed to burn them up but to the best of my knowledge, there's not a hazardous waste dump in the state of Maryland. Technically, however, I'm supposed to load these hazardous waste material in my trunk, get a permit put on the side of it, and once a year drive to the nearest waste dump to get rid of these things. But I don't know of anybody who does that. And if you happen to have a product

that keeps over the winter, if it picks a little dampness and gets caked or hardened, then it's even that much more difficult to get rid of.

If you ask me, with my problems and experience, I think that the economical and feasible way to do it is to see that all of these chemicals that come in paper bags, be converted into granular form, put in a plastic container such as those made by the Du Pont companies that are easy to pour out, wash up these plastic containers three times and then do something with them to get rid of them.

Since we use a lot of these insecticides mostly malathione and others, we spray strawberries with them anywhere from 4 to 6 quarts per acre and we spray them 6 times a year. Multiply 6 times 30 and then multiply that times 46 quarts. We have a pretty large amount or quantity. If you buy malathione and the like in small quantities, you don't get them in plastic jugs but I buy them in 5-gallon containers in metal. And this is what happened to me once. I had a 5-gallon container left over. It was sitting in a corner of an old barn where I stored my chemicals, with a bag of fertilizers sitting about two feet away. At one time, some of the fertilizer leaked out and it got down to touch the bottom of the metal container. It got rusty and next spring, I sent a hired hand to get it and when he picked it up, the bottom stayed to the floor with the top of the can and handle in his hand, and I had 5 gallons of this chemical spilled everywhere and I had to clean up the mess. I talked to other farmers about it and I found out that this had happened to a lot

of them. I just don't know how to get around it. If you keep these containers from one year to the next, you can have problems with them.

Now what are the things that we have problems with? Here is my experience. It is after we use these chemicals, when we wash out the paint, and wash out the plastic bags that set before you. It says in here: Dispose of properly. Since some of these them on the land. Well, I do have a section in my barn, which is about one-third as big as this room stocked up with containers that I myself don't know what to do with. What I sometimes do since I live in the urban area, is that when I put the garbage out, when the garbage man comes on certain mornings, I'd take the 5-gallon container, an empty 5-gallon one, and put it in the bottom of the garbage bag, put some paper trash on top of this, and when the garbage man comes along, he dumps it into the garbage truck. Once in there he throws it into the dump. So there are ways to get around them but we're not supposed to do that. Now we just got a sanitary landfill in Howard county. We just got a new permit. When this sanitary landfill first opened out some 10 to 15 years ago, they were supposed to dig down within 25 feet of the ground water, that's as far as they were permitted to.

There are other problems that continue to bother me about the landfill in Howard County and its proximity to the farm area. The problem occurs if a leak should come from somewhere near the farm. What are they going to do about it with all the garbage that may contain some of these containers of pesticide?

and herbicide waste considered hazardous waste?

Before my time runs out, I would like to discuss with you some products that we buy and then someone discovers that we should never have made this product to begin with. We had some of this problem about 25 years ago where every farmer in the U.S. had this particular product that was eventually discontinued. I still have some of this chemical left over from my father's farm and I don't know what to do with it. I also have some chlordane, which I had mistakenly stocked up on the advice of a chemicals salesman. Afraid that the price of these chemicals would go up, I foolishly stocked up a three-year supply only to find out later that they could no longer be used if the crops that you spray them on are for human consumption. At a meeting in Little Rock of the National Association of Soil Conservation District, I asked one of the gentlemen who was fairly high up in the EPA what I should do with this stocked-up chemical *including* my chlordane and he said, "I'm only employed to enforce the law, not to interpret it."

So this is one of the problems that we have when we deal with government agencies. And even the various people that I
talked with, mostly farmers, were: what to do with containers that says: "Dispose of properly," and what to do with stocked-up chemicals that have been discontinued. In short, hazardous waste disposal.

So these are the problems. And I do think that most farmers are *conscientious* about the use of these chemicals and the spills that we have had are really accidental. But we do need some

answers and this is very hard for us to deal with. In a nutshell, then, these are some of our problems.

If you have any questions, I shall try to answer them. Thank you.

Remarks

By

Wayne N. Marchant
Principal Deputy Assistant Secretary
Water and Science
U.S. Department of the Interior

I would like to commend the National Capital Sections of the ASCE and AWRA for your work in bringing people together each year to discuss water resources issues of national concern.

This year's theme, Agri-Chemicals and Ground-Water Quality, is both important and timely. The Interior Department is deeply involved in both irrigation drainage water quality and we have developed response to our recognition of the ground water quality issues. In both cases, relatively new programs in importance of these areas. In order to describe our activities to you, let me first describe the nature of the Department's involvement with agricultural water quality. Our role stems primarily from three major missions. Of course, you are all familiar with the first of these: the Department's responsibilities to provide irrigation water for large areas the West through the Bureau of Reclamation and the Bureau of Indian Affairs. Second, the Department is responsible, through the U.S. Geological Survey (USGS), for assessing the quality and quantity of the Nation's water resources. Third, the Department is responsible, under a wide variety of mandates, for conserving, enhancing, managing, and protecting public lands, fish and wildlife, and other natural resources. Because agricultural chemicals and other constituents in drainage from farm lands can

threaten our natural resources; the Interior Department is vitally concerned with the impacts of agricultural activities.

Admittedly, under some conditions, these responsibilities of the Department may appear to be contradictory or even to be mutually exclusive. I think the situation at the Kesterson National Wildlife Refuge in California's San Joaquin Valley is a good example of this tension between competing missions. The responsibilities of the Bureau of Reclamation and the Fish and Wildlife Service sometimes do conflict. I suppose some might say that such conflict is healthy, and that may be true, but I assure you that it is not always good for my health!

Despite the obvious challenges that grow out of the Department's competing legal responsibilities, I believe we have put together over the last two years a sound effective program to deal with irrigation drainage water quality problems, including problems from both agricultural chemicals and naturally occurring constituents. At the present time, we have work underway at areas in 13 Western States to identify, evaluate and respond to irrigation-induced water quality problems. In each case, our teams are both interdisciplinary and interagency in nature, consisting of scientists and engineers from the USGS, FWS and BOR. A number of State and local representatives, the National Academy of sciences, and others are also involved.

Although I would enjoy discussing this program further with you this morning, I want to spend my allotted time on another issue.Our Irrigation Drainage Program has been discussed at a number of technical and professional conferences over the last couple of years and I know that some of you are familiar with it.

For those of you that would like to know more about it, Jon Deason, who is the Interior Department's Irrigation Drainage Program Coordinator, can provide you with papers describing it and I'm sure he would be pleased to answer any questions about it that you might have.

Instead, I would like to give you an overview of the types of results we are getting from our most advanced irrigation drainage effort, the San Joaquin Valley Drainage Program in California. As many of you know, that program is not just a Federal effort but is truly a Federal/State partnership. Two California State agencies, the Department of Water Resources and the Department of Fish and Game, and three Federal agencies, the Bureau of Reclamation, U.S. Geological Survey, and the Fish and Wildlife Service, are working together as a team to investigate all aspects of irrigation drainage water quality problems. In addition, many others are working directly with our San Joaquin Valley Drainage Program people, including county health officials, growers, field geologists, laboratory researchers, water district managers, and legislative and policy analysts.

I think you would agree that the process of gathering together multiple disciplines and multiple interests and focusing their collective attention is absolutely essential if we are to have any chance of real success in solving problems as complex as those we face in the irrigation drainage area. That is because solutions to these problems will not be just engineered solutions any more than they will be strictly economic or institutional solutions. The large geographic areas, numerous political

jurisdictions, and multiplicity of economic, environmental, and social systems affected by these problems dictate that the solutions must be acceptable technically, economically, *environmentally,* socially, and, of course, politically.

Considerable progress along each of these dimensions is being made in the San Joaquin Valley Drainage Program. Much of what we are learning clearly will be transferable to other areas of the country that may have similar problems. I would like to describe some of these very different types of solutions for you to illustrate what I am talking about.

Many people seeking solutions to irrigation drainage *contamination* problems think immediately of wastewater treatment technologies. Of course that is an important area. In the last couple of years we have examined numerous treatment processes to remove dissolved solids, notably including selenium, and a variety of other constituents from water. These processes include such things as ion exchange, reverse osmosis, iron hydroxide precipitation, and iron filing absorption. Although most of the treatment processes we have looked at are on the expensive side, we have experienced very promising results with several microbiological processes. These include microalgal and bacterial processes developed by the Lawrence Berkeley Laboratory and others to remove selenium from water. Also, a fungal process developed by the University of California at Riverside to remove selenium from soil by volatilization shows promise.

However, treatment processes, as important as they are, represent only a relatively small fraction of our efforts to find solutions to toxic drainage problems. We have found, for

example, that numerous opportunities exist on individual farms and water districts to reduce the volume of drainage water by improving on-farm water management. Techniques here include scheduling of irrigation applications using evaportransipiration data, re-circulating tail water and subsurface drainage water, sprinkler and drip systems, use of surge control systems in furrow irrigation, use of sprinklers for pre-irrigation and seed germination, and so on.

Another important area of endeavor involves management of shallow ground water on a district or regional basis rather than on an individual farm basis. If we can maintain water tables in irrigated areas at depths of 10 feet or so, for example, we can greatly diminish the need for on-farm drains in some areas. Conjunctive use of ground water and surface water supplies in a way that controls water table levels while managing salt balances and leaching requirements could go a long way toward solving irrigation drainage problems in many areas of the West. obviously, though, this approach requires good data, good ground water models, and effective monitoring systems.

Yet another promising area involves drainage water reuse. Theoretically, at least, drainage water can be reclaimed for a wide variety of uses such as power production from salt gradient solar ponds, aquaculture, power plant cooling, and the like. Some of these are beginning to appear feasible on a scale large enough to have some potential impact. For example, the use of agricultural drainage water for silviculture may be feasible. This involves cultivation of salt tolerant trees to reduce the

volume of drainage water discharged and to produce tree biomass as a potentially marketable commodity. Our San Joaquin Valley Drainage Program currently is providing funds for research involving agro forestry plots, planted in 1985-86. These plots are managed by individual farmers and are being monitored by the California Department of Food and Agriculture and the U.S. Soil Conservation Service.

Of course, identification of new disposal paths will also continue to be important as we move forward in solving drainage problems. Such alternatives as regional evaporation ponds, deep well injection, and ocean disposal are worthy of investigation, despite the political or sociological sensitivities often associated with them. Our primary challenges in the area of disposal involve finding environmentally acceptable ways of using the available disposal routes and educating the public about the true nature of any hazards that the use of such routes may present.

Certain institutional changes could play a significant role in solving agricultural drainage and related problems. Here I mean changes to laws, regulations, policies, markets, or legal entities in order to facilitate overall solutions. Examples of such changes that have promise include water transfers, tiered or block water pricing, drainage charges, expansion of local or regional authorities, and so on.

Water transfers could contribute to conservation by allowing the sale of conserved water if effective incentives can be developed. In recent years several States have moved forward to facilitate water transfers. Arizona, for example, has become

better known for its water ranches than its "dude ranches." But a number of legal questions and issues remain regarding transfers of water rights. Tiered water pricing and/or drainage fees could also serve as incentives for water conservation and encourage economic use of water. However, in many areas, more information is needed before accurate estimates of reduced water use can be made.

Another promising approach to reducing impacts from agricultural chemicals involves educational programs to encourage farmers to move from production maximization to an "optimizing" approach. Evidence indicates that, in some cases, it is possible to reduce agricultural chemical applications and increase profits when losses from minor infestations or reduced production are offset by savings from reduced pesticide or fertilizer applications.

Other concepts such as the use of on-farm best management practices, environmental audits, and improved operation of application equipment also hold out promise for reducing impacts on ground water from agriculture chemicals.

I hope that from this description of various solution oriented activities we are pursuing in the Department, in conjunction with State and local entities, you can see that a lot is going on. Obviously, as I mentioned previously, this major challenge cannot be addressed unilaterally but requires all groups to pull together. One of the reasons I appreciate this chance to address the ASCE and AWRA is that I believe forums like this facilitate progress through coordination as we address these issues together.

Let me turn now to the other half of the equation and discuss ground water issues. Jim Ziglar, the Assistant Secretary for Water and Science and my boss, currently represents the Department of the Interior on an Administration-wide task force on ground water chaired by the Office of Management and Budget. We have been reviewing all of the ground water-related legislation currently under consideration on the Hill and developing an Administration position on those bills. Because this task force includes representatives from such diverse departments as Agriculture, Defense, and Energy, as well as the Environmental Protection Agency, we have had a few challenges, but we are making headway. We are going to be an active part of the decision-making process on the Hill. *Although* we have not yet reached a final Administration position on the bills that are under active consideration, we are leaning toward a Federal research program and away from a Federal regulatory program. I think that is good news for the States.

I believe that the Federal Government does have a role in ground water management. It is unrealistic to expect the individual States to carry out the kind of research necessary to define health effects or to determine the fate and transport of constituents, for example. Also, the Federal Government already has the largest and most experienced cadre of ground water professionals in the Nation. We ought to be willing to share our expertise with the States in meeting their individual resources needs. Through the Federal/State Cooperative Program of the U.S. Geological Survey we have been able to offer such service in the

past and I believe that our future efforts ought to follow this kind of a Federal/State partnership.

Our view is that new ground water legislation is not really necessary. The key Federal agencies with the expertise and the mission responsibilities related to ground water science and management (primarily the USGS, USDA, and EPA) already have the authority to do the kind of work that is needed. This includes: basic research in hydrogeology, and fate and transport of contaminants; resources assessments at local, regional, and national scales; research and development of methods of preventing, managing, cleaning up, and monitoring ground water; technical assistance; and information dissemination. Through the task force we have determined that Federal expenditures for these kinds of scientific and technical efforts were about $215 million in fiscal year 1987 (this does not include regulatory or clean-up activities). Of this total, $122 million was in DOI.

I believe that Congress should be mindful of the existing capabilities and missions of the various agencies and not expand the authority of any one agency, giving it lead-agency or coordinator status over the work of the other agencies. Coordination of Federal agency efforts is important, but it should be the responsibility of the President and not of the head of any one agency. Consistent with this view about coordination, the Federal Coordination Council for Science, Engineering, and Technology (FCCSET), an entity of the Executive Office of the President, has recently created a subcommittee on ground water to help in this vital task of coordination.

The Congress also should recognize the need to avoid creation of conflicting or competing Federal agency programs. The establishment of technical assistance or research institute or grant programs in several agencies is a sure fire way to do this, particularly when they each have different cost-sharing formulas. If you look at the array of formulas present in the bills under consideration in the Senate you can find proposed Federal shares of 50, 60, 75, and 100 percent. If legislation produces such a collection of programs the result will be that, rather than the technical community getting down to business, we will see State agencies and universities shopping for the best "deal" and the Federal agencies competing with each other for the State dollars.

As to agricultural threats to ground water resources, our view at the DOI is that there are no particular management measures that are so clearly needed that it would be appropriate to create new regulations mandating their use. Farmers, ranchers, and foresters need answers to a whole host of questions about the best ways to protect ground water resources, consistent with profitable food and fiber production. These answers can be provided through diligent research and technology transfer efforts, focused largely in USDA, but with significant involvement of USGS, EPA, other agencies, and the private sector.

Of course, we recognize that there will be many difficulties as we continue to address the tough issues surrounding the impacts of agricultural chemicals on ground water. However, we have no choice but to meet them head-on. Irrigated agriculture is vital to our Nation's economy. We must find ways to ensure its continued viability and growth, in spite of problems we

encounter. Organizations like the ASCE and AWRA are important partners in this endeavor. Despite the complexity of the challenge, I am confident that, together, we can do it.

Agri-chemicals and Ground Water Quality:
A Strategy
by

Gerald F. Kotas Director, National Pesticide
Survey Environmental Protection Agency (EPA)

Thank you very much for giving me the opportunity to speak to you this morning. I really appreciate it. The American Society of Civil Engineers (ASCE), the American Water Resources Association (AWRA), and the DC-Water Resources Research Center (DC-WRRC) are to be commended for having this presentation. I think the previous speakers really highlighted the issues. The issue on agricultural chemicals and ground water quality is very timely.

During the break, I had the chance to talk with Dr. Nicholi on some of the issues he brought up- which I thought were especially interesting from a very practical point of view. As he pointed out this *morning,* in terms of the pesticide disposal problem, EPA faces some really difficult challenges. Large volumes of chemicals like EDB, storage of that particular product, and then finding an appropriate means of disposal that is simple and inexpensive immediately come to mind. It is a very great challenge for the agency and also an issue as you pointed out before that is now being looked into.

At the local level, it is hard to find any specific answer, too, but there are a few things going on of which you may already be aware. I also think that there are efforts going on at the

county level and at the state level. Sometimes, they have a voluntary collection of small quantities, things that go under the category of hazardous waste. And I think that we have to look more creatively at those kinds of programs and others, to see how we can better support farmers and other local citizens who have small quantities or even moderate quantities of these particular products or chemicals, because, without that kind of a response at that level, supported at the federal level, we can see some disastrous misuse, as Dr. Nicholi pointed out. And people ought to be commended for trying to do their best. I think that without that kind of help, maybe it could be some training program or a state and county program, the answers are not that simple.

There are a number of things that I'd like to show you this morning but time is very limited. The activities, in terms of agricultural chemicals and ground water, are many within the EPA such as in terms of getting new leaching studies, information on leaching of pesticides, and new monitoring studies. On the training side, working with the Department of Agriculture on applicator training, we're trying to improve the training base for people who apply some of the more approved chemicals. In terms of the regulatory side, there are things going on as well such as denying new registration based upon ground water legislation, chemicals, and special review.

What I'd like to do, however, this morning, is to focus attention on two major activities. First, there is the National Survey of Pesticides in Drinking Water Wells. The second is the agricultural chemicals and ground water strategy. I'd like to

share some information on that as well. It's being released today in proposal form, February 25, 1988.

In both areas, I think it demonstrates the priority within the agency for the issue of agricultural chemicals and ground water, and our real, sincere interest in trying to move out front get a better handle on the occurrence of pesticides in the environment, and more specifically, in drinking water wells and ground water.

Let's go over these slides to quickly give you, first, an overview of our survey project. Very briefly, to give you a brief background of the project, we had a pilot study in three states. We'd like to tell you a bit about the outcome of that one and then, a picture of where we're going.

As was pointed out earlier, Skip Stiles talked about some of the very early findings of the state for a few of the specific chemicals that I think awakened' the nation to possible problems (maybe specifically, maybe not), and that started a lot of activity at the state level, especially on monitoring. The agency started a planning and designing effort to basically develop this kind of national statistical monitoring survey for pesticides and drinking water.

More specifically, in 1985, we had a picture of the occurrence in wells of some 17 pesticides in 23 states. You may have seen those numbers. Two years later, based upon monitoring data that we were able to collect from the states, this had risen to something like 45 to 50 pesticides in something like the order of 30 to 35 states. Now there are more states actively involved

in the work that we're doing in this particular project in a number of areas. I think this will help to set a standard for some of the monitoring and help them move forward.

The specific goals that EPA has for this project are twofold. The first is to develop some precise estimates and levels of occurrence in two populations of wells: community system wells and rural, domestic or private wells. We'd like to determine the nature and extent of occurrence not only nationally, but also especially within the pilot well area of this project that we think are of significant interest such as areas of high hydrogeological vulnerability, in areas of particular crop-type or high pesticide usage area.

The second goal is to begin, on a national basis, to examine potential relationships that might be there between this occurrence and factors like hydro geological vulnerability, cropping patterns and pesticide usage. Again, we don't think that one study in the national level is going to be dependent and necessary to nail down all these associations. We think, however, that it will be a major contribution to examine the issue.

Firstly, on outputs --- we see several things hopefully coming out from the project, several of which we have already seen. Now, to get back to the first goal in terms of better defining the occurrence of pesticide *contaminations* of the two populations of wells I mentioned. Secondly is to begin to examine the relationships of that occurrence, and, thirdly and very importantly, decisions are made early in the planning process for this project to do two things. One, after we

determine the number and specific names of the pesticides that we felt had the greatest leaching potential, we then turned to our chemist and went through an analytical methods development process that would allow us to sample and test for the full range of what we consider to be leaching pesticides.

In the matter of testing for something like 90 to 100 different pesticides, 60 or 70 fall into our category of leachers.

We also made a decision early in the process, to develop health numbers for those particular pesticides which we felt had a high potential to leach and so we went to a very major effort to develop 62 new health advisory documents and the new methods are now available and ready for use in this project and for other work.

The two offices within the agency that are sponsoring this project are the Office of Drinking Water and the Office of Pesticide Programs and as you can imagine, each have their own specific requirements and needs for some of the data coming out. So that means for all these data, there's something here for drinking water in terms of new candidates for maximum contaminant levels, better monitoring requirements without asking all the community systems across the country to monitor for the same things, and better handling and treatment requirements.

On the pesticide side of the program, we again are looking to develop better overall planning and priority setting across ranges of pesticides, more specific and better tailored range for monitoring requirements, better labeling and registration

decisions once we have a more consistent national database, and improved technical systems available to the states.

In terms of design, just to give you a flavor of how we've been proceeding, again, our challenge is to be able to define occurrence in two very different populations of wells. In a sense, we have two surveys within a survey. It requires different procedures in order to be able to do this.

In the first case, we are trying to describe occurrence of pesticide residues in the thirteen million private domestic wells across the country. There are no records or no national data systems that record all such wells, so we're going to do some rather burdensome statistical steps to be able to achieve this. on the community system side, we are describing the contamination with particular pesticides in wells, 51,000 community water systems (CWS) that have at least one ground water well. Graphically, what this looks like is something like this.

We started with all 3,100 counties in the country. We stratified these counties on the basis of ground water vulnerability and pesticide usage; that is, we had a relative picture of whether a county is more vulnerable or less, and also whether the pesticide usage was high, moderate, or low, or uncommon. We then, on the right side of the diagram, use that information to apply it to our listing of all community water systems in the country, and then from that list, ultimately, we are selecting a sub-set. Then, finally, a set of wells that represent all community water system wells nationally with a slight overemphasis in that random selection in the areas of higher vulnerability.

On the domestic wells side, as I said before, this is a little bit more complex (because of the nature of the population) to be able to do this precisely. So we're starting again with 3,100 counties, stratified with the two major premise of vulnerability and pesticide usage; from that, we've selected 90 counties nationally; again, with an overemphasis or statistical over sampling of those counties we think will be more informative for this type of study. These areas of higher vulnerability and higher use of pesticides are a stratified random selection. Now within those counties, we are developing much more detailed information on the vulnerability, using a model to map each county level on cropping patterns and pesticide usage from folks like the county extension agent, Agriculture Stabilization and Conservation Service (ASCS) agent, and others. Using available information within the county, we select a random sample of about 9 private drinking water wells in each county; with a slight over sampling of that portion of the county that we find to be vulnerable and cropped, but not every cropped and vulnerable areas. We're looking at the entire area; with just a slight statistical over sampling of those areas that we think will provide more information. The collecting of water sample from those wells is the final step.

I just want to show you an example of what one of our county drastic maps look like. This is a map of Clark county, Mississippi. Once our hydro geologists have finished gathering data from the states, from U.S.G.S., from other available researches in the area, hydro geologic factors, soil factors, and

conductivity of the aquifer, these things are pooled together. They're weighted in a map like this, which shows areas that have similar hydro geologic factors. This particular map is produced by the U.S.G.S. for us, using their geologic information system.

Earlier, I mentioned the health advisories. I just emphasized that 62 are being produced, 50 of those are in draft form, and are for public comment. We've gone through several peer reviews. Our science advisory channel in the agency will now be looking at those on an issues basis.

Another important point for this project since communications is so keen is in this area, is that we are also producing a non-technical version if you will, of health advisory documents, a version of the health document that we'll be able to transmit to, say, the homeowner or the farmer, to the county officials, and non-health scientists in order to better understand the significance of the health numbers, and how they were generated, and then, to be able to better come to personal judgments on the findings in that particular well against the bill of health information, much of which comes from the animal stations familiar with the health number generation.

Again, on analytical methods, we are going to be using eight analytical methods in every well that we sample, six of those will deal specifically with the project. We will be using an existing method for EDB, and DBCP plus a couple of other pesticides. We'll also be running a test for nitrates. Those new methods have been peer-reviewed and we're going through several validation steps. We're also looking at long-term methods validation efforts with other organizations.

The importance of communications probably cannot be overstated. We've been taking this extremely seriously and we've been putting a lot of resources into it. We see two major objectives here, and we're seeing some of the fruits of that. One is a better understanding of a project that is designed and planned and what we hope to get out of it. Also, for different constituencies like other government agencies, states, local units of government, farmers, homeowners, as well as the media, to have them in a better position to more correctly interpret results and acquire a better understanding of the results throughout the course and at the end of the project.

The role of the states is keying the project in the areas of communication; in terms of sampling, the state water supply agencies will be taking samples from the community water systems. They will also be responsible for the notification of results. We've been working directly, not only with the water supply agencies in the states, but also with the agricultural agencies. Also, there will be a role for a variety of levels, with a follow-up with the systems being provided by the EPA.

I mentioned the county role several times. It's extremely important because they are the front line of many issues plaguing the system. The homeowner, the farmer, often comes to their county agents; so, we're trying to directly involve the county level officials in the health side and the county officials in the process.

Industry too has a great deal of interest in the project. They are anxious to see a consistent set of data develop. They

have been very anxious to review the project proceedings and we have been getting some of that technical review from them and I think the project has benefited from them. The environmental community also has been tracking the project very closely and we appreciate their review.

A pilot study was conducted in three states: California, Minnesota and Mississippi. We took a large number of samples from 48 wells. Our objective in the pilot was to field test the implementation of the project. It was not a mini statistical survey, so we aren't going to be talking about the analytical results because that was not the intent of the pilot. We evaluated all the key aspects of the project.

Just to give you a picture of what this looks like in the field. Here's a slide, which shows a community system in Mississippi where we are taking the first sample.

Where are we going in the future? We are gearing up. We're making some changes as a result of the pilot. We had a very successful run and a relatively few number of changes but important ones. We have awarded our contracts including five contract labs dedicated to the project.

And we are actually talking to other agencies like USGS and USDA about how we may be able to cooperate within the federal agencies to see the kind of work others have done. We expect to start sampling this spring. We will see the controlling factor in terms of time in the project. It is the number of samples and the number of wells that can be analyzed by our analytical laboratories, and that flow rate right now is in the order of 30 samples per week, which dictates that sampling 1,500 wells will

take something on the order of 12 to 15 months. We are looking to complete the sampling work by the end of 1989 and, hopefully, a draft report coming out in 1990 will look at the national results.

Now, if I may shift gears very quickly. In over 18 minutes, I wanted to try to share with you something about the agricultural chemicals and ground water strategy. The two programs work together, the agricultural chemicals and ground water strategy is the policy strategy, the strategy effort within the agency to provide direction to a number of different program areas. The pesticide survey is the generator of protocols and data that will support not only the strategy but also the other regulatory efforts within the agency and elsewhere.

The agricultural chemicals and ground water strategy is timely because it has been released today in the proposal form. There's a press briefing this morning at 10 o'clock and there's another press briefing within the agency at 1:00 pm. The notice of availability of the agricultural chemicals and ground water strategy will be published in the Federal Register tomorrow. It will contain instructions for obtaining the copy, which I'll give you. It'll provide information for providing comments. There will be a 120-day comment period on strategy. When you request from the following address a copy of the strategy, you will also get a copy of the Federal Register notice sent with it. If you want to the place to write get a copy of the strategy, the following is or call:

Public Information Office
U.S. - E.P.A.
401 M St., S.W.
Washington, D.C. 20460

And while we're on the subject of materials and handouts, there are four handouts, different pieces of paper on the Pesticide Survey, which are on the table at the back. One is the Summary of the Project, another kind of summary of what we did on the pilot, and finally, we have a monthly update we send out to our mailing list (which now number close to a thousand). The last two updates are on the table.

If you would like to be on our mailing list, you could give the information directly to me or to Nancy and she'll hand it to me later.

I mentioned the state's activities. There are a lot of things going on at the state level in terms of monitoring research, use of notification permits, and creative use of new management techniques like buffer zones, management zones, and moratorium areas.

And just for the last minute or two, I wanted to summarize the essence of what the strategy sets so that you'll have a flavor of what's in there because it's very significant, I think, in terms of pesticide management. The goal for the strategy is to prevent unacceptable contamination. The unacceptable levels are defined in part on the value and use of the ground water. Again, it kind of keys back into classification, recognizing that across the country, not necessarily all groundwater is used the same or necessarily has the same value. The maximum contaminant levels, (MCLs) are the standard for ground water in terms of defining acceptable levels.

Again, with the focus on prevention, we want to reduce the likelihood of unacceptable levels and the need to predict efforts. So there's a very high emphasis on monitoring; that is, to establish things like trigger levels, and to manage the use at the state and local levels as well as to try to achieve a level that stays below this health action levels.

The other major thing I wanted to point out to you is a very strong emphasis on state management for opportunities to have the state lead in the management of specific pesticides. We are strongly emphasizing the need to have state-tailored programs, recognizing the tremendous variability across the country in local conditions and the fact that the state is in the best position to tailor the management of pesticides for that particular area, either for that state or area within the state.

Pesticides that have a ground water concern are the leaching pesticides (or those that have leaching potential). The strategy proposes to base our regulatory approach and our registration work on the appropriate state management plans. So again, we are really strongly encouraging the states to take a lead in the development of those management plans for specific pesticides. Examples will be: the federal label will refer users to state circulars, bulletins, extension agents, or whatever the communication process is that the state sets up for that pesticide chemical. The kicker in this is that the state chooses not to develop such a management plan; the fallback is for EPA to have to step in and try to manage that pesticide. We're, however, not in a position of being able to get to a point of detail that the state, the county and the sub-county area will be able to do.

There are other things I'd like to share with you but I know the time is short. I'd like to have some time for questions. So let me close with that. Thank you for your attention and the opportunity to meet with you.

The Impact of Pesticides on Ground Water Quality

By

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It's a pleasure to be here. Ever since I have been in Beltsville, which is twenty years this past summer, I have worked on the fate and transport of pesticides and particularly on aspects related to their leaching. And so, these are only two points that I shall discuss. The talks preceding mine are really very well linked to what I'll be talking about and what we are doing.

First, however, I must disagree with a previous speaker on one point. The statement was made that people were really unaware of leaching and ground water prior to the past 4 or 5 years. While having some truth, it is also a little misleading because people have recognized the potential for leaching for quite a long time. Furthermore, when USDA was in charge of registering pesticides, which was quite a few years ago (before EPA was created), that was definitely one of the requirements, to look at the pesticide leaching potential.

Well, with that aside, pesticides really are indispensable to modern American agriculture and have been since the close of World War II. Presently, we're putting out about a third of a billion pounds per year on American crops --- a big input. When people hear about pesticides, particularly about pesticides and

ground water, there's often a fairly negative reaction, *although* I guess, in general, that reactions to pesticides range from a very healthy respect, to outright hostility. But what we're trying to do is find out the answers so that decisions can be made on a very intelligent, rather than, on an emotional basis.

I'd like to cover very quickly this morning a little bit about how pesticides get down to ground water. This may be familiar for some of you. In addition, I will discuss briefly the Agricultural Research Service's "Strategic Plan for Ground Water -- Pesticides" which I have been very much involved in developing. I think this USDA Plan will be sent to Congress within a day.

I hope you'll indulge me in one thing: that is, from time to time, I'd like to talk a bit about some of my own research to illustrate a point. Also, during the course of this discussion, I'd like to point out some research issues that we need answers for, and perhaps some of the future directions we should take.

Ground water, as the source of drinking water, varies tremendously in terms of its importance. In Washington, DC, it is 0%; in other places, especially in rural areas, it's nearly a hundred percent. Relative use varies a lot, on a county-by-county. basis. Where I live, in suburban Maryland, and in Montgomery & Prince George's Counties, and in Metropolitan Baltimore, drinking water is derived from surface water. Ground water becomes the dominant source in Western Maryland or on Maryland's Eastern Shore.

Recently, I spoke in Little Rock, Arkansas, to the National Association of Conservation Districts on "Which? Why? Where? and

When?" a reference to identification of pesticides and ground water problems and understanding their causes. Part of the framework for this talk, on which pesticide or the extent of pesticide contamination is a little easier to handle. It's been touched on by many of today's speakers. This slide represents part of a list of the famous 17 or 18 pesticides connected with ground water, a list that Steward Cohen and his colleagues at the EPA came up with. You can see that some of the pesticides (all herbicides in this slide) were detected in numerous states. One of these, atrazine is a very important corn herbicide. You can see something about its use here, the heaviest being in the Corn Belt area, but with significant uses also in other regions. When detected in ground water at that time, about 3 or 4 years ago, it occurred almost entirely in the states that it was used heavily or near the east coast. Similarly, we can look at where some of these insecticides were found; aldicarb {Temik) comes to mind in particular. You can see that it was found in 15 states at that time. Aldicarb if you remember, was the compound that appeared in some California watermelons a couple of years ago, presumably due to an illegal use of the compound. Aldicarb has been used very heavily throughout the United States for quite a wide variety of compounds. It has been banned in certain areas such as Suffolk County, Long Island and, I believe, it's banned in the Central sands area, in Wisconsin. Elsewhere, there have been certain restrictions on how it is used in order to minimize the potential for ground water pollution.

We can look at the amount of pesticides applied nationwide

and get an idea of what compounds might be in ground water. These data are a few years old but alachlor, atrazine, metalachlor, cyanazine, butylate, and dicamba, as far as I know, all of these with the possible exception of butylate, have been found in ground water at least in one instance. We are, in our own research, looking closely at three of these chemicals.

Whether a chemical gets into ground water depends in part on its use pattern. As a generalization, compounds that are fairly applied, either directly to the corn for insect control or as a fungicide, or directly to the weed, as a post-emergent herbicide is less likely to leach into the ground water. On the other hand, compounds which are specifically sprayed onto the soil or even more importantly, before being incorporated into the soil, have a generally high probability of getting down into the ground water.

This slide is an example of a banded application of carbofuran applied during the corn planting. We actually use this treatment in our own field research, and there's just so much greater probability that this compound may move down.

Why are pesticides in ground water? Let's distinguish first non-point and point source contamination.

Point source? I think you've realized that situations like pesticide spills or well casings that are defective can cause point source contamination. This might also be back-siphoning into the well: for example, a farmer is filling his spray tank with water and the electricity goes off --- depending on whether there is an anti-siphoning device and on how the hose is placed, there is a potential for the tank mixture going back into the well.

That has actually occurred. And long term rinsing near the well is definitely a possibility for increase in pesticide residues.

The area that I am personally more involved with, as well as other researchers in the Agricultural Research Service, is non-point source contamination. We're talking about factors such as vulnerable soils (e.g., very sandy soils), more water-soluble compounds, adverse weather such as high rainfall (especially in cold weather), excessive irrigation, and high pesticide application rates. These are generally associated with a greater probability of pesticide movement.

I show the slide just to give you an idea of the various processes that are involved in pesticide fate from the time of application. The pesticide can be lost into the air by volatilization for some compounds, this may be appreciable. A certain amount is lost by runoff. Depending on the weather patterns, this loss probably rarely exceeds two or three percent of the applied pesticide dose.

Plants can remove some of the pesticide. Generally, I suspect that this does not exceed several percent of what was applied. Most pesticide absorbs to the soil. It also exists in an equilibrium between soil and solution phases where, in solution, the pesticide may be degraded. Degradation rate is likely to most rapid in this biologically active surface environment compared to that in subsoil or aquifers.

Finally, what we're particularly interested here this morning, I think, is that a certain portion of the pesticide may

leach down into the ground water. Ironically, I have estimated that probably rarely exceeds one or two percent and that is probably on the high side.

If one is to mathematically model these processes, he needs to know how important each of these components are. At least, that is the deterministic approach to modeling. Furthermore, he must consider the root zone, the intermediate vadose zone, and the saturated zone, all of which may affect the fate and transport of pesticide differently within each zone.

We know, of course, that water moves down more rapidly in a sandy soil than in a clay loam. Then it is not so surprising that pesticides will tend to move with the same trend, so that in a sandy soil, we tend to get greater leaching (all other things being equal) than in a finer-textured soil such as a loam.

Where are the pesticides in ground water? This slide shows a DRASTIC map of the United States. "DRASTIC" is an acronym that describes hydro geologic settings, inferring on them 'a relative ranking scheme for pesticide movement. I like it because it is a simple view of where vulnerability might exist. As an example of some of the DRASTIC factors, let's say that you have shallow depth to ground water, soils that are relatively permeable to water movement and high rainfall: the odds are --- that pesticides will move down more readily than in other scenarios. The red areas of the DRASTIC map are more vulnerable counties. You can see immediately that the Eastern Seaboard and all of Florida tend to be more vulnerable than most of the rest of the United States except for isolated areas such as central Minnesota, northern Wisconsin, and Nebraska.

The Economic Research Service, USDA, published a document in June 1987 on the magnitude and costs of ground water contamination from agricultural chemicals. It discussed the potential for chemicals to reach ground water and the projected costs of monitoring that zone. This slide, based on their work, shows the distribution of population using private wells in potentially contaminated areas. In this slide, yellow represents a high density of population in areas that are potentially vulnerable. Once again, we see a fairly high concentration of yellow in the eastern part of the U.S., especially along the seaboard and through the Corn Belt.

And finally, on the last map of this sort, I will show California. California, of all the states, probably has had the most pesticides in being detected in the ground water. Furthermore, it's also the state where the ground water issue really broke with the nematicide DBCP.

There were isolated cases of pesticide detections before, but when the California Department of Food and Agriculture found DBCP in many of the California wells, that ultimately, I think, was the major cause of DBCP's demise and (more importantly) the impetus for expanded emphasis on looking for pesticides in ground water.

Well, <u>what</u> pesticides are in ground water? This slide leads into that question. We know that soil is very heterogeneous across a field, similarly, water movement is not necessarily the same in one part of the field as it is in another part. This slide attempts to draw us into this concept of water moving down

much more rapidly in certain spots. And that leads us into the research issue of "macropore" or "preferential flow" flow. In soils, you have natural cracks, root channels, and earthworm holes. Under certain circumstances, when the soil is saturated, water no longer moves simply down uniformly through the soil by capillary flow, but rather begins to move down the larger pores that it normally would avoid. This is an attempt to visualize such transport. At the same time that water moves down the macropores, it's also decreasing relative movement of dissolved solutes into the soil aggregates.

Macropore flow has been suggested as one-way that pesticides can reach considerable depths in a much shorter time than they would otherwise. This is well illustrated, I think, by movement of a water-soluble dye; in this slide, you can see that the dye has bypassed much of the' soil matrix. This process depends a lot on the rainfall: if much rainfall is received at one time, the possibility of macropore flow increases.

Here are some data that we developed in our field plots taking the cumulative summer rainfall and factoring in the evapotranspiration that's been bringing the water back up, you get a net water input. We use this for modeling pesticide transport in soil.

This slide is an example of one natural macropore, photographed at our field site. That particular hole is due to ant activity, but earthworm activity is important in other soils.

To recapitulate some points I've tried to make, we know that soil, climate, pesticide characteristics, and agronomic management all have a role in affecting pesticide movement to

ground water. Our job, then, is to determine how we could modify factors in order to reduce the chances of excessive pesticide movement.

To quickly summarize soil aspects, it is my opinion that the depth to ground water, perhaps, is the most important factor correlated with whether or not the compound gets down there. Secondly, permeability, i.e., the relative ease of water drainage; and thirdly, soil organic matter content, because this is linked with absorption of most chemicals, are other major soil aspects related to leaching. We also have specialized situations in the U.S. where Karst soils exist. These are high limestone soils such as in Northeastern Iowa, Southeastern Minnesota, and parts of Kentucky; in these cases, fractured rock and sinkholes are common. The sinkholes are essentially like pipelines straight down into the ground water, so that's definitely a vulnerable situation.

With regard to the role of agronomic management practices, we can consider various things such as tillage, irrigation, and drainage. I will focus particularly on tillage because this is one of the top priority areas of ARS research.

What is the impact of conservation tillage on the potential? for movement? Conservation tillage is a practice that is being adopted rather widely. Soil conservation tillage was once projected to be used on as much as 90% of the crop land by the year 2000, although more recent estimates scale this back to 60 or 70 percent. Basically, it was developed to reduce soil erosion and it does a very effective job. There's a whole range of

practices that fall into this conservation tillage net. Moldboard plowing (not conservation tillage) is at the one extreme. But the other extreme is no-till, where you literally do not plow or disk the field, but rather drills the seed into the soil and directly through the crop residue, which is left over from the previous season. What we are trying to do in Beltsville is to compare those two practices side-by-side and see what is the effect on pesticide persistence and leaching.

Our field site is located in the Coastal Plain, which we know is potentially vulnerable. It also happens to be nearly adjacent to the fall line, which separates the Coastal Plain from the Piedmont region. Our field site is next to the Capital Beltway. On the major field, we established (alternately) duplicate plots no-till/conventional no-till/conventional tillage. We are about to start our third year of work at that site. We have added about 90 wells throughout this very relatively small (19-acre) site. With such wells, we've been monitoring for ground water contamination.

One of the things we have discovered is that there is a clay layer underneath most of the site. This particular schematic shows what might occur in the clay layer. Water moving downward is impeded by a textural discontinuity, which induces a lateral flow component. Because of this clay layer, we decided it would be wise to install one well which went just on top of the clay layer, and another well which went down through the clay layer: that's what .we have done throughout most of the site. Wells within a well pair are located two meters apart. We sample this ground water monthly.

Here, just briefly, are some of the results that we have found over the past 5 years in three field sites in Beltsville. This photograph, taken this winter, shows standing water on the field. We have noticed consistently that a lot of movement occurs at this time of the year, during the winter, when there isn't much evaporation or transpiration occurring. Water movement is probably relatively uniform.

Another thing we've noticed is that shortly after we, apply pesticides, we tend to get a residue peak within anywhere from, say, 2-3 weeks to 2 months. We interpret this as probable evidence of macropore flow. Thus, we seem to have this early transport, which then dies down, and later is seen again as a gradual buildup of residues in ground water for several months in late winter/early spring. It's fairly typical of what we've seen in our fields.

This slide depicts another very small continuous no-till field research site. During a study lasting from 1983-1985, we did find that some pesticides entered into the ground water. However, this unconfined ground water is very shallow, ranging in the summer from about 3-4 feet to perhaps 6-10 inches from the surface in winter. So we're talking about research on a very vulnerable site. Well, what did we find?

We found that atrazine always occurred in the ground water. But we also had used alachlor and cyanazine, two additional major corn herbicides. All three pesticides, by lab tests, have comparable mobility, but the latter two compounds were rarely seen in ground water. The reason is that they were breaking down

quickly within soil. So you have to couple the degradation with the mobility for complete interpretation and prediction of environmental fate.

In all of our field research, we also conduct very intensive soil core analysis because one cannot really answer all the questions with ground water data alone. You have to have the soil core date to more fully understand the processes of transport and transformation.

Finally, a few comments on the ARS Ground Water Plan. It is intended to be a solution-oriented plan. I've heard that word used before today, and that's a good adjective: we are trying to find solutions to solve the problem. It's a nationwide plan. We want any suggested measures to be cost-effective, since if farmers cannot use them, they are worth little.

And we're trying to focus ARS's research efforts on a fairly small number of pesticides. We are studying various management systems and how they might impact on the movement of pesticides down to ground water. For example, the earlier speaker's discussion on irrigation certainly relates very closely to ARS aims and objectives. Better management leads not only to more efficient use of water but also may avoid excessive leaching which might lead to pesticides in ground water.

Under the application *component* of the ARS Strategic Plan, we might look at new application methods in order to minimize contamination. Certainly, one of these could be formulations that minimize leaching, perhaps controlled release formulations. Modeling is also a very important component in terms of trying to understand and predict what's likely to happen, trying to model new management scenarios, effective tillage systems, or more effective

timing --- there are many options to be tested. Conservation tillage is an important part of the ARS Plan. We presently have research sites in 10 locations, each dealing with pesticides and conservation tillage. One Agency goal will be to coordinate results from the various locations to see what nationwide generalizations we can make about pesticides and tillage.

There have been some statements, probably premature, that conservation-tillage practices may be adversely impacting ground water. Our results as of today do not seem to support that conclusion. The two practices have had about the same effect on pesticide movement.

In ARS, we are also looking at the emerging technologies --- what's on the horizon. A major research need is created by the huge sampling demands of ground water-related efforts. For example, the EPA ground water monitoring studies involved a large number of analyses, as does our work and that of others. We need to find ways to speed up the analytical process. We'd also like simple laboratory systems to simulate what is going on out in the field. We would like to use biotechnology. It has been used very successfully in certain areas; perhaps it can be utilized to clean up water, which is already contaminated. We need to understand the chemistry of the pesticide molecule and how it might be changed to reduce the chances of leaching and, of course, we need to understand more about the processes themselves.

Lastly, I'd like to show a series of fairly successful approaches to waste disposal, as such pesticide waste is one source of contamination. Ultraviolet radiation, ozone, or microbiological decomposition all individually can break down some pesticides. Now, what happens if you combine all three together?

In our laboratory, Dr. Philip Kearney has done this quite successfully in a very simple system. He uses oxygenation and ultraviolet lights, passing the solution exposed to these conditions and the resulting exposure to ozone into a 55-gallon drum with soil. There, soil microorganisms do a pretty good job of further breaking down the molecules into relatively innocuous products. This system has been tested quite successfully. If not cheap enough to be used on each farm, at least it seems to be a system that will be relatively available to the farmer, probably via local pesticide dealers. We have great hopes for this. As just an example of a tested pesticide, alachlor untreated didn't degrade very fast; once oxygenated, however, degradation and release of C02 occurred very rapidly. So this looks like a very promising approach, for example, to the problems mentioned earlier.

Finally, on what I hope will be a bright note, I think pesticides will continue to be used as necessary in the future but, through a combination of greater care and some modified chemistry, we can minimize our ground water problems.

So, I leave it there. Thank you.

APPENDICES

100TH CONGRESS
1ST SESSION

H. R. 791

IN THE SENATE OF THE UNITED STATES

DECEMBER 4 (legislative day, DECEMBER 3), 1987

Received; read twice and referred to the Committee on Environment and Public Works

AN ACT

To authorize the water resources research activities of the United States Geological Survey, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—WATER RESOURCES AUTHORITY OF THE GEOLOGICAL SURVEY

SEC. 101. SHORT TITLE.

This title may be cited as the "Geological Survey Water Resources Organic Act".

SEC. 102. WATER RESOURCES AUTHORITY.

(a) IN GENERAL.—The Secretary of the Interior (hereinafter in this title referred to as the "Secretary"), acting

through the Geological Survey, is authorized to undertake research, investigations, appraisals, surveys, and related activities, of the Nation's water resources. The Secretary is authorized to undertake such activities in cooperation with other Federal, State, and local governments and agencies, and academic institutions. The Secretary is further authorized to disseminate the results of such research, investigations, appraisals, surveys, and related activities.

(b) REIMBURSEMENT.—The Secretary may undertake the activities described in subsection (a) with other Federal agencies or Federal permittees or licensees on a reimbursable basis, but only after execution of an agreement which outlines for whom such activities are being undertaken and the purpose, cost, and duration of the activities. The Secretary shall transmit on a yearly basis a summary of the agreements executed to the Committees on Appropriations and Interior and Insular Affairs of the House of Representatives and the Committees on Appropriations and Energy and Natural Resources of the Senate.

SEC. 103. AUTHORIZATION OF APPROPRIATIONS.

For the purpose of carrying out the water resource activities of the Secretary authorized by this Act, there is authorized to be appropriated $155,000,000 for fiscal year 1988, $158,000,000 for fiscal year 1989, and $160,000,000 for fiscal year 1990.

TITLE II—GROUND WATER RESEARCH

SEC. 201. SHORT TITLE.

This title may be cited as the "National Ground Water Research Act of 1987".

SEC. 202. FINDINGS.

The Congress finds the following:

(1) Ground water is a resource of immeasurable value, comprising 86 percent of the fresh water available for use in the United States.

(2) Ground water supplies approximately one-half of the Nation's population with drinking water and over one-half of the Nation's irrigation water.

(3) Ground water contamination has occurred in every State in the Nation and is being detected with increasing frequency.

(4) Sources of ground water contamination are diverse.

(5) Certain ground water contaminants are associated with adverse health, environmental, economic, and social impacts.

(6) Ground water and surface water are interconnected as related parts of the hydrologic cycle.

(7) While the Federal Government has certain responsibilities for the protection, maintenance, and remediation of ground water quality under existing laws, the primary responsibility for ground water protection, maintenance, and remediation is with States and local governments.

(8) Many States already have comprehensive ground water protection and management programs or are developing such programs.

(9) Although considerable scientific progress has been made in knowledge about ground water resources and ground water contamination, including the transport, transformation, and fate of ground water contaminants and the effects of ground water contamination on human health and the environment, there remain significant gaps in developing and making available needed scientific knowledge.

(10) Presently available technologies to detect, monitor, and mitigate ground water contamination are expensive and highly limited in utility.

(11) Shortages exist in skilled personnel trained in scientific disciplines relevant to the detection, assessment, prevention, and remediation of contaminated ground water resources.

(12) The scientific uncertainties, lack of adequate technologies, and shortage of skilled scientific personnel hinder the ability of Federal agencies or State and

local governments to develop and implement effective ground water management, protection, and remediation policies.

(13) The Nation's ground water quality data collection, analysis, and information dissemination programs and activities are insufficient.

(14) Access to information regarding national ground water quality conditions and trends is essential to improving management of the Nation's ground water resources.

(15) Federal research and development, technical assistance, and financial assistance should be available to support State ground water programs.

(16) Additional Federal research efforts in ground water are necessary to provide the States with adequate technical information and guidance upon which they can develop and implement comprehensive ground water management programs. One of the aims of these research efforts should be to develop risk assessment analyses that States can use to develop ground water standards, where appropriate.

(17) Current Federal programs of research and development with respect to ground water require improved coordination.

(18) The Federal Government lacks a clear and comprehensive statutory mandate to conduct ground water research.

(19) Ground water contamination should be prevented rather than relying on expensive clean up efforts.

(20) Greater efforts are necessary to prevent ground water contamination today and to preserve this valuable resource for current and future generations of Americans.

SEC. 203. DEFINITIONS.

As used in this title—

(1) ADMINISTRATOR.—The term "Administrator" means the Administrator of the Environmental Protection Agency.

(2) AGENCY.—The term "Agency" means the Environmental Protection Agency.

(3) ASSESSMENT.—The term "assessment", when used with respect to ground water or ground water resources, means a description of the location, hydrogeological properties, quantity, quality, and rates of depletion of such resources.

(4) FEDERAL AGENCY.—The term "Federal agency" means any department, agency, or other in-

1 strumentality of the Federal Government, including
2 any Government corporation.
3 (5) LOCAL GOVERNMENT.—The term "local gov-
4 ernment" means any city, town, borough, county,
5 parish, district, or other public body which is a political
6 subdivision of a State and which is created pursuant to
7 State law.
8 (6) NONPROFIT ORGANIZATION.—The term
9 "nonprofit organization" means any organization, asso-
10 ciation, or institution described in section 501(c)(3) of
11 the Internal Revenue Code of 1986 which is exempt
12 from taxation pursuant to the provisions of section
13 501(a) of such Code.
14 (7) PERSON.—The term "person" means an indi-
15 vidual, trust, firm, joint stock company, corporation
16 (including government corporation), partnership,
17 association, consortium, joint venture, State, local
18 government, commission, regional agency, interstate
19 agency, or Federal agency.
20 (8) SECRETARY.—The term "Secretary" means
21 the Secretary of the Interior.
22 (9) STATE.—The term "State" means any of the
23 several States, the District of Columbia, the Common-
24 wealth of Puerto Rico, the Virgin Islands, Guam,
25 American Samoa, the Commonwealth of the Northern

1 Mariana Islands, and federally recognized Indian
2 tribes.
3 SEC. 204. COORDINATION OF FEDERAL GROUND WATER
4 RESEARCH PROGRAMS.
5 (a) DUTIES OF THE PRESIDENT.—
6 (1) The President shall coordinate activities con-
7 ducted by Federal agencies to undertake assessment,
8 management, and protection of ground water resources
9 and to remedy ground water contamination and deple-
10 tion. The President shall also assist the States in the
11 conduct of such activities and shall disseminate infor-
12 mation concerning those activities to State and local
13 governments.
14 (2) The President shall establish within 90 days
15 from the date of enactment of this title, an Interagency
16 Ground Water Research Committee to provide for the
17 coordination of research, development, demonstration,
18 technology transfer, training, and information dissemi-
19 nation activities authorized in this title.
20 (b) INTERAGENCY GROUND WATER RESEARCH
21 COMMITTEE.—
22 (1) The President shall appoint the members of
23 the Interagency Ground Water Research Committee
24 from each Federal agency involved in ground water-re-
25 lated activities, including the Environmental Protection

Agency, the Department of the Interior, the Department of Agriculture, and the Department of Health and Human Services. The Committee shall be co-chaired by the Secretary and the Administrator. The Committee shall hold at least 2 public meetings per year.

(2) The Interagency Ground Water Research Committee shall—

(A) identify major research data needs and scientific uncertainties regarding ground water assessment, monitoring, protection, management, and remediation,

(B) recommend overall priorities and a coordinated research plan to the President and to Congress for addressing the data needs and scientific uncertainties identified,

(C) otherwise facilitate, through joint funding and other means, interagency cooperation and coordination on ground water research, development and demonstration programs,

(D) consult with State and local governments, environmental organizations, scientific and professional organizations, industry, academia and other appropriate institutions to determine the ground water research and information needs of

State and local governments and other persons who have responsibilities for protecting or managing ground water resources, and

(E) recommend priorities for the assessment of ground water resources based on the use of such resources and the likelihood of such resources being contaminated.

SEC. 205. NATIONAL GROUND WATER ASSESSMENT PROGRAM.

(a) DUTIES OF THE PRESIDENT AND SECRETARY.—The President shall designate the Secretary of the Interior as the lead official for the purposes of carrying out the activities authorized in this section. The Secretary shall carry out such activities in consultation and coordination with the members of the Interagency Ground Water Research Committee and such other agencies as the President may designate.

(b) ASSESSMENT REPORT.—The Secretary, in consultation with State and local government officials and other persons, shall prepare a report which includes each of the following:

(1) An evaluation of existing ground water quality and quantity information systems, including a description of geographic areas and categories of data where there is a lack of information on quality or quantity.

(2) An evaluation of the utility and adequacy of existing ground water data collection and monitoring

1 programs conducted by Federal agencies, State and
2 local governments, and other persons, including the
3 adequacy of such programs for projecting long-term
4 status and trends in ground water contamination and
5 depletion.

6 (3) An evaluation of the availability and accessi-
7 bility of existing ground water data to Federal agen-
8 cies, State and local governments, and other persons.

9 (4) Recommendations on actions to be taken to
10 better utilize existing information and recommendations
11 for the improved collection of data and information.

12 (c) REPORT AND SUPPLEMENTS.—The Secretary shall
13 complete a draft of the report under subsection (b) no later
14 than 270 days after the date of the enactment of this title.
15 The report shall then be made available for public comment
16 for a period of at least 45 days. The final report shall be
17 submitted to Congress and made available to the public no
18 later than 1 year after the date of the enactment of this title.
19 The report shall be updated every 2 years and supplements
20 to the report containing such updates shall be submitted to
21 Congress together with the report required under section
22 212.

23 (d) ESTABLISHMENT OF PROGRAM.—Within 2 years
24 after the date of the enactment of this title, the Secretary
25 shall establish and conduct a national ground water assess-

1 ment program. The purposes of the program shall be to de-
2 termine the location, hydrogeological properties, quantity,
3 quality, and rates of depletion of ground water resources in
4 the United States. The Secretary shall carry out the program
5 both directly through the Department of the Interior and in-
6 directly by providing assistance to other Federal agencies and
7 State and local governments. The Secretary shall ensure
8 access to the data and information gained under the program
9 to Federal, State, and local agencies and other persons. The
10 program shall meet each of the following requirements:

11 (1) The program shall assist State and local gov-
12 ernments in the assessment, management, protection,
13 and remediation of ground water resources and the
14 design of ground water monitoring programs.

15 (2) The program shall coordinate activities relat-
16 ing to ground water among Federal agencies and State
17 and local governments in order to avoid duplication of
18 efforts.

19 (3) The program shall provide information regard-
20 ing protocols and quality controls, recommend proto-
21 cols to be used where appropriate, and provide
22 guidance regarding the comparison of data collected
23 under different methods and quality assurance pro-
24 grams. Such recommended protocols (A) shall not be
25 construed as binding or retroactive, (B) shall not be

1 construed to apply to or impair the validity of any
2 other protocols in any enforcement proceeding, and (C)
3 shall not be construed to alter the authority of Federal
4 agencies and State and local governments to determine
5 where the use of such protocols is appropriate. The
6 Secretary shall develop the protocols in consultation
7 with the members of the Interagency Ground Water
8 Research Committee and provide public notice and so-
9 licit comment upon proposed protocols.

10 (4) The program shall encourage the use of exist-
11 ing Federal-State programs.

12 (5) The program shall assist Federal and State
13 agencies in meeting their data collection responsibilities
14 under title XIV of the Public Health Service Act (re-
15 lating to safe drinking water), the Comprehensive En-
16 vironmental Response, Compensation and Liability Act
17 of 1980, the Solid Waste Disposal Act, the Federal
18 Water Pollution Control Act, Federal Insecticide, Fun-
19 gicide, and Rodenticide Act, and other related statutes.

20 (6) The program shall improve the knowledge and
21 understanding of the nature, extent, and causes of (A)
22 ground water contamination (including contamination
23 on a site specific basis), and (B) ground water
24 depletion.

1 (7) The program shall provide information and
2 data which will complement the collection of surface
3 water quality data to provide integrated knowledge of
4 water quality conditions within specific hydrologic re-
5 gions and subregions. For this purpose, the Secretary
6 is authorized to obtain any ground or surface water
7 quality information in the possession of Federal agen-
8 cies, States, or subdivisions thereof, and shall maintain
9 the confidentiality of any such information and data in
10 accordance with the provisions of section 552 of title
11 5, United States Code, and section 1905 of title 18,
12 United States Code.

13 **SEC. 206. NATIONAL RESEARCH, DEVELOPMENT, AND DEMON-**
14 **STRATION PROGRAM FOR GROUND WATER**
15 **PROTECTION AND MANAGEMENT.**

16 (a) DUTIES OF THE PRESIDENT AND ADMINISTRA-
17 TOR.—The President shall designate the Administrator as
18 the lead official for the purposes of carrying out the activities
19 authorized in this section. The Administrator shall carry out
20 such activities in consultation and coordination with the
21 members of the Interagency Ground Water Research
22 Committee and such other agencies as the President may
23 designate.

24 (b) ESTABLISHMENT OF PROGRAM.—The Administra-
25 tor shall establish a research, development, and demonstra-

1 tion program for the protection, management, and remedi-
2 ation of ground water resources. Such program shall include
3 conducting research, experiments, demonstrations, surveys,
4 and studies relating to the sources, causes, effects, extent,
5 prevention, detection, remediation, monitoring, and mitiga-
6 tion of ground water contamination, and the development and
7 demonstration of effective, practical, and cost-efficient tech-
8 nologies for the prevention, detection, monitoring, remedi-
9 ation, and mitigation of ground water contamination. For the
10 purposes of this section, "technologies" includes processes,
11 practices, methods, and products.

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12 (c) DEMONSTRATION PROGRAM.—The Administrator
13 shall carry out a program to develop and demonstrate tech-
14 nologies which may be effective in controlling sources or po-
15 tential sources of ground water contaminants or in mitigating
16 ground water contamination. The Administrator shall devel-
17 op and publish a list of priority needs with respect to source
18 control technologies or mitigation technologies. The Admini-
19 strator may enter into contracts or cooperative agreements
20 with, or provide financial assistance in the form of grants to,
21 public agencies and authorities, nonprofit institutions and or-
22 ganizations, or other persons, for projects to demonstrate
23 such technologies, only if the Administrator makes each of
24 the following findings:

1 (1) The project involved will serve to demonstrate
2 a new or significantly improved technology or the
3 feasibility and cost effectiveness of an existing but
4 unproven technology.
5 (2) The project involved will not duplicate other
6 Federal, State, local, or commercial efforts to demon-
7 strate such technology.
8 (3) The demonstration of such technology will
9 comply with all other laws for the protection of human
10 health, welfare, and the environment.
11 (4) The project involved would meet a priority
12 need previously identified by the Administrator.
13 (5) The project involved is not an "alternative or
14 innovative treatment technology" eligible for demon-
15 stration assistance under section 311(b)(5) of the Com-
16 prehensive Environmental Response, Compensation
17 and Liability Act.
18 (d) DEMONSTRATION PROGRAM ELEMENTS.—The
19 demonstration program established by this section shall in-
20 clude solicitations for demonstration projects, selection of
21 suitable demonstration projects from among those proposed,
22 supervision of such demonstration projects, and evaluation of
23 the results of the demonstration projects which are conduct-
24 ed. The Administrator shall publish regulations to assure the

1 satisfactory implementation of each element of the program
2 established by this section.
3 (e) SOLICITATION FOR DEMONSTRATION PRO-
4 GRAMS.—Within 270 days after the date of the enactment of
5 this title, and no less often than every 12 months thereafter,
6 the Administrator shall publish a solicitation for proposals for
7 projects to demonstrate technologies which may be effective
8 in controlling sources or potential sources of contaminants or
9 in mitigating ground water contamination. The solicitation
10 shall prescribe the information to be included in each such
11 proposal which shall permit the Administrator to assess the
12 potential effectiveness and feasibility of the technology
13 proposed to be demonstrated.
14 (f) APPLICATIONS FOR DEMONSTRATION PROJECTS.—
15 Any person (including any public or private nonprofit entity)
16 may submit an application to the Administrator in response
17 to a solicitation under subsection (e). The application shall
18 contain a demonstration plan setting forth how and when the
19 proposed project is to be carried out and such other informa-
20 tion as the Administrator may require.
21 (g) DEMONSTRATION PROJECT SELECTION.—In se-
22 lecting technologies to be demonstrated, the Administrator
23 shall fully review the applications submitted and shall evalu-
24 ate each project on the basis of each of the following:

1 (1) The potential of the proposed technology effec-
2 tively to control or mitigate sources or potential
3 sources of contaminants, with emphasis upon those
4 sources of contaminants which present the greatest risk
5 to human health and the environment or the greatest
6 likelihood of ground water contamination and which
7 are not effectively controlled by existing technologies.
8 (2) The capability of the person or persons pro-
9 posing the project to complete successfully the demon-
10 stration as described in the application and the willing-
11 ness of such person to make the benefits of the tech-
12 nology widely available to the public in a timely
13 manner.
14 (3) The likelihood that the demonstrated tech-
15 nology would have significant application.
16 The Administrator shall select, request further information
17 on, or refuse to select a project for demonstration under this
18 section within 135 days after receiving the completed appli-
19 cation for such project. In the case of a refusal to select a
20 project, the Administrator shall notify the applicant within
21 such 135-day period of the reasons for the refusal. In each
22 12-month period the Administrator shall select at least 10
23 qualified demonstration projects for support according to the
24 provisions of this section.

(h) SUPERVISION AND TESTING.—Each demonstration project under this section shall be performed by the applicant, or by a person satisfactory to the applicant, under the supervision of the Administrator. The Administrator and the applicant shall enter into a written agreement granting the Administrator the responsibility and authority for testing procedures, quality control, monitoring, and other measurements necessary to determine and evaluate the results of the demonstration project. The Administrator may pay the costs of testing, monitoring, quality control, and other measurements required by the Administrator to determine and evaluate the results of a demonstration project and the limitations of subsection (i) shall not apply to such costs.

(i) COST SHARING.—The Administrator shall not provide any Federal assistance for any project under this section to any applicant unless such applicant can demonstrate that it cannot obtain appropriate private financing on reasonable terms and conditions sufficient to carry out such project without such Federal assistance. The total Federal funds for any project under this section shall not exceed 50 percent of the total cost of such project estimated at the time of the award of such assistance.

(j) DEMONSTRATION OF COMPLIANCE.—In making the required finding of compliance in subsection (c)(3), the Administrator shall, after notice and opportunity for public com-

ment, establish guidelines and procedures for issuing expedited demonstration permits or other regulatory approvals required to carry out such research or demonstration.

SEC. 207. GROUND WATER CONTAMINANT RISK ASSESSMENT ANALYSIS.

(a) DUTIES OF THE PRESIDENT AND ADMINISTRATOR.—The President shall designate the Administrator as the lead official for the purposes of carrying out the activities authorized in this section. The Administrator shall carry out such activities in consultation and coordination with the members of the Interagency Ground Water Research Committee and such other agencies as the President may designate.

(b) GROUND WATER RISK ASSESSMENT ANALYSES.—The Administrator shall conduct and publish a risk assessment analysis for significant ground water contaminants. Such risk assessment analysis shall use scientifically-sound methodologies to assess the risk to human health and the environment associated with a range of concentrations of the ground water contaminant.

(c) CONTENT OF ANALYSES.—Each risk assessment analysis shall include—

(1) the most recent scientific knowledge on the physical, chemical, biological, and radiological proper-

1 ties of the contaminant and its effects on human health
2 and the environment,
3 (2) an assessment of factors, including contami-
4 nant sources, variable aquifer conditions, and ground
5 water uses, which may influence the effect of the con-
6 taminant on human health and the environment,
7 (3) an assessment of the assumptions, scientific
8 uncertainties and data gaps contained in the risk as-
9 sessment analysis, and
10 (4) a comparison of the risks posed by such
11 contaminants to risks posed by other ground water
12 contaminants.
13 (d) FORMAT.—The Administrator shall establish and
14 use a standard format for the presentation of risk assessment
15 analyses to facilitate the use of such analyses by State and
16 local officials and the public.
17 (e) USE OF AVAILABLE DATA AND AUTHORITY TO
18 CONDUCT ADDITIONAL STUDIES.—In carrying out this sec-
19 tion, the Administrator shall use, to the fullest extent practi-
20 cable, existing data or analyses developed by other agencies,
21 including the Department of Health and Human Services.
22 The Administrator shall also consider data and analyses de-
23 veloped pursuant to the Federal Water Pollution Control
24 Act, title XIV of the Public Health Service Act (relating to
25 safe drinking water), the Toxic Substances Control Act, the

1 Comprehensive Environmental Response, Compensation and
2 Liability Act of 1980, the Superfund Amendments and Reau-
3 thorization Act of 1986, and the Federal Insecticide, Fungi-
4 cide, and Rodenticide Act. The Administrator may conduct
5 such additional studies under the authorities of such Acts to
6 gather data necessary to reduce scientific uncertainties in the
7 risk assessment analyses. Such additional studies may be
8 conducted in consultation with the Department of Health and
9 Human Services.
10 (f) TIMETABLE FOR PUBLICATION OF RISK ASSESS-
11 MENT ANALYSES.—The Administrator shall publish, with an
12 opportunity for public notice and comment, risk assessment
13 analyses for not less than 30 contaminants within 24 months
14 after the date of enactment of this title, and not less than 30
15 additional contaminants within 36 months after the date of
16 enactment of this title. The Administrator shall continue to
17 publish such analyses for additional contaminants at a rate
18 which is consistent with the needs of the State and local
19 governments in developing ground water quality standards.
20 (g) PERIODIC REVIEW AND REVISION.—The Adminis-
21 trator shall periodically review and revise, with an opportuni-
22 ty for public notice and comment, published risk assessment
23 analyses to ensure that they reflect developments in scientific
24 data relevant to the contaminant.

1 SEC. 208. TECHNICAL ASSISTANCE, TRAINING, AND TECHNOL-
2 OGY TRANSFER.

3 (a) DUTIES OF THE PRESIDENT, SECRETARY, AND AD-
4 MINISTRATOR.—The President shall designate the Secretary
5 as the lead official for the purposes of carrying out the activi-
6 ties authorized in this section relating to ground water as-
7 sessment and shall designate the Administrator as the lead
8 official for the purposes of carrying out the activities author-
9 ized in this section relating to source controls and mitigation
10 of ground water contamination and remediation of ground
11 water and health and environmental effects. The Secretary
12 and the Administrator shall carry out their activities in con-
13 sultation and coordination with the members of the Inter-
14 agency Ground Water Research Committee and such other
15 agencies as the President may designate.

16 (b) ASSISTANCE.—The Administrator and the Secre-
17 tary are each authorized and directed to establish a program
18 to provide technical assistance (1) between and among Feder-
19 al agencies, and (2) to State and local governments through
20 grants, loans, cooperative agreements, and contracts. Such
21 technical assistance shall assist in the conduct of activities
22 authorized under this title and in the collection, evaluation,
23 and analysis of ground water data and information to assist
24 such agencies and governments to undertake assessment,
25 management, monitoring, protection, and remediation of
26 ground water resources.

1 (c) RESEARCH AND SURVEYS.—Upon request by a
2 State or local government, the Administrator and the Secre-
3 tary (1) may each conduct research and make surveys con-
4 cerning any specific problem of ground water contamination
5 or depletion in cooperation with such government, and (2)
6 may each make recommendations concerning solutions to
7 such problem. The non-Federal share of the costs of such
8 research and surveys shall be 50 percent.

9 (d) TRAINING.—In the course of carrying out this title,
10 the Administrator and the Secretary are authorized to con-
11 duct training for personnel from Federal agencies, States,
12 local governments, nonprofit organizations, and other per-
13 sons, relating to the assessment, management, protection,
14 and remediation of ground water resources, and the causes,
15 effects, extent, prevention, detection, and mitigation of
16 ground water contamination and depletion. The Administra-
17 tor and the Secretary may establish reasonable fees for such
18 training provided to non-Federal personnel.

19 (e) TECHNOLOGY TRANSFER.—The Administrator and
20 the Secretary shall conduct a technology transfer program,
21 including the collection and dissemination of information
22 obtained by the activities authorized by this title. Such tech-
23 nology transfer shall be accomplished by publications, confer-
24 ences, and other appropriate means and shall ensure that
25 such information is available through the National Ground

1 Water Information Clearinghouse established under section
2 209.

3 (f) PUBLIC ACCESS.—Information obtained by the pro-
4 grams authorized by this title shall be made available to the
5 public, subject to the provisions of section 552 of title 5,
6 United States Code, and section 1905 of title 18, United
7 States Code, and to other government agencies in a manner
8 that will facilitate its dissemination, except that, upon a
9 showing satisfactory to the Administrator or the Secretary by
10 any person that records, reports, or information, or particular
11 parts thereof, to which the Administrator or Secretary has
12 access under this section, would, if made public, divulge
13 methods or processes entitled to protection as trade secrets of
14 such person, the Administrator or Secretary shall treat such
15 record, report, or information or particular portion thereof as
16 confidential in accordance with section 1905 of title 18,
17 United States Code.

18 **SEC. 209. NATIONAL GROUND WATER INFORMATION CLEAR-**
19 **INGHOUSE.**

20 (a) DUTIES OF THE PRESIDENT AND SECRETARY.—
21 The President shall designate the Secretary of the Interior as
22 the lead official for the purposes of carrying out the activities
23 authorized in this section. The Secretary shall carry out such
24 activities in consultation and coordination with the members

1 of the Interagency Ground Water Research Committee and
2 such other agencies as the President may designate.

3 (b) CLEARINGHOUSE.—The Secretary shall establish
4 and maintain a National Ground Water Information Clear-
5 inghouse. The Clearinghouse shall be used to disseminate in-
6 formation to Federal agencies, State and local governments,
7 and other persons on—

8 (1) ground water assessment, management,
9 protection, and remediation,

10 (2) remedies for ground water contamination and
11 depletion, and

12 (3) the relationship between ground water quality
13 and quantity and surface water quality and quantity.

14 **SEC. 210. ENVIRONMENTAL PROTECTION AGENCY GROUND**
15 **WATER RESEARCH CAPABILITY IMPROVE-**
16 **MENTS.**

17 (a) AUTHORITIES.—For the purposes of carrying out
18 this title, the Administrator is authorized—

19 (1) to enter into contracts or cooperative agree-
20 ments with, or make grants to, States, local govern-
21 ments, other appropriate public agencies and authori-
22 ties, nonprofit organizations, and other persons,

23 (2) subject to the provisions of the Public Build-
24 ings Act of 1959, to construct and equip such facilities
25 as may be necessary, and

(3) to use, on a reimbursable basis, facilities and personnel of existing Federal scientific laboratories and research centers.

(b) RESEARCH COMMITTEE.—The Administrator shall establish a media-specific research committee for ground water resources in addition to the media-specific research committees already established. The membership of the committee established pursuant to this subsection shall be broadly representative of the program and research concerns within the Environmental Protection Agency related to the protection, maintenance, and remediation of ground water resources.

(c) SCIENCE ADVISORY BOARD.—

(1) CONTINUING REVIEW.—In addition to such other duties as may be prescribed by the Administrator under this title, the Science Advisory Board established under the Environmental Research, Development, and Demonstration Act of 1978 (42 U.S.C. 4365) shall review on a continuing basis the ground water research programs of the Agency and submit periodic reports to Congress. The reports should include an evaluation of the progress made by the proposed research program of the Agency, the likelihood that the research program will provide the information needed for pending policy decisions or for State and local governments,

and the adequacy of resources to carry out the research program.

(2) COMMENT.—The Administrator shall request comments from the Science Advisory Board on the risk assessment analyses prepared by the Administrator under section 207. The Board shall respond, as it deems appropriate, within the time period applicable for the publication of the risk assessment analyses. This subsection shall under no circumstances be used to delay the final publication of ground water contaminant risk assessment analyses.

(d) FELLOWSHIPS.—The Administrator is authorized to establish and maintain research fellowships in the Agency and at public or nonprofit private educational institutions or research organizations for the purposes of this title.

(e) RESEARCH INSTITUTES.—

(1) GRANT PROGRAM.—The Administrator may make grants to institutions of higher learning or other research institutions (or consortia of such institutions) to establish and operate not more than 5 ground water research institutes in the United States.

(2) RESPONSIBILITIES OF THE INSTITUTES.—The responsibility of each ground water research institute established under this section shall include the conduct of research and training relating to the protec-

tion, maintenance, and remediation of ground water resources and the publication and dissemination of the results of such research.

(3) APPLICATIONS.—Any institution of higher learning or other research institution (or consortium of such institutions) interested in receiving a grant under this section shall submit to the Administrator an application in such form and containing such information as the Administrator may require by regulation.

(4) SELECTION CRITERIA.—The Administrator shall select recipients of grants under this section on the basis of the following criteria:

(A) Each research institute shall have available for carrying out this section demonstrated research resources.

(B) Each research institute shall have the capability to provide leadership in making national and regional contributions to the solution of both long range and immediate ground water contamination problems.

(C) Each research institute shall make a commitment to support ongoing ground water research programs with budgeted institutional funds.

(D) Each research institute shall have an interdisciplinary staff with demonstrated expertise in ground water management and research.

(5) AGENCY SHARE.—The grant or grants made by the Administrator under this section with respect to the establishment and operation of a ground water research institute shall not exceed 50 percent of the costs of establishing and operating such institute and of the related activities carried out by the grant recipient or recipients.

(6) LIMITATION ON USE OF FUNDS.—No funds made available to carry out this section shall be used for the acquisition of real property (including buildings) or the construction or substantial modification of any building.

(7) EQUITABLE DISTRIBUTION.—The Administrator shall equitably allocate the funds made available to carry out this section among the regions of the United States. One of the institutes shall be the National Center for Ground Water Research, a consortium between Oklahoma University, Oklahoma State University, and Rice University, except that paragraph (5) shall not apply to such Center.

(8) TECHNOLOGY TRANSFER.—Not less than 5 percent of the funds made available to carry out this

section for any fiscal year shall be available to carry out technology transfer activities.

(9) PROPOSED RESEARCH PROGRAM.—Prior to and as a condition of the receipt each year of funds appropriated to carry out this section, each research institute established under this section shall submit to the Administrator for approval a ground water research program that includes assurances, satisfactory to the Administrator, that such program was developed in consultation with the States, local governmental entities, and other agencies and institutions within the region having ground water protection or management responsibilities and with interested members of the public. Such program shall include plans to promote research, training, information dissemination, and other activities meeting the needs of the region and the Nation, and shall encourage regional cooperation among institutions in research into areas of ground water protection, maintenance, and remediation that have a regional or national character.

(10) REVIEW AND EVALUATION.—

(A) PROCEDURES.—The Administrator shall establish procedures for a careful and detailed evaluation of each research institute to determine whether the quality and relevance of its ground

water resources research and its effectiveness as an institution for planning, conducting, and arranging for such research warrants its continued support under this section in the national interest.

(B) EVALUATION.—The Administrator shall arrange for each of the research institutes supported under this section to be evaluated within two years after its establishment and to be reevaluated at intervals not to exceed five years. If, as a result of any such evaluation, the Administrator determines that a research institute does not qualify for further support under this section, then no further grants to such institute may be made until its qualification is reestablished to the satisfaction of the Administrator.

SEC. 211. MISCELLANEOUS PROVISIONS.

(a) WATER RESOURCE PROJECTS.—

(1) CONSIDERATION OF IMPACT ON GROUND WATER RESOURCES.—In the formulation and evaluation of water resource projects, the Secretary of the Army and the Secretary of the Interior shall consider the impact of the proposed project on ground water resources and the feasibility of measures to replenish and protect such resources.

(2) REVIEW OF EXISTING PROJECTS.—The Secretary of the Army is authorized to review the operation of water resources projects authorized for construction by the Secretary of the Army before the date of the enactment of this title and the Secretary of the Interior is authorized to review the operation of water resources projects authorized for construction by the Secretary of the Interior before such date. Such reviews shall be made to determine the need for and feasibility of modifications in the structures and operations of such projects for the purpose of replenishing and protecting ground water resources.

(b) INSTITUTE PRIORITIES.—Section 108 of the Water Resources Research Act of 1984 (Public Law 98-242; 98 Stat. 97, 98) is amended—

(1) in paragraph (6), by inserting ", contamination," after "Depletion", and

(2) in paragraph (8), by inserting "quality and quantity" after "water".

(c) STUDIES.—

(1) VOLATILE GROUND WATER CONTAMINANTS.—The Administrator, in cooperation with the State of New Jersey and appropriate local governments, shall study the feasibility of removal of volatile ground water contaminants in the New Jersey coastal

plain by induced air phase transport for the purpose of developing a plan for removal of such contaminants. The Administrator shall prepare a report on the results of such study, including recommendations for implementation of such plan.

(2) TRACE METAL LEACHING BY CORROSIVE GROUND WATER.—The Administrator, in cooperation with the State of New Jersey and appropriate local governments, shall study the problem of trace metal leaching by corrosive ground water at selected sites in the New Jersey coastal plain for the purpose of determining methods of reducing or controlling such problem. The Administrator shall prepare a report on the results of such study, including recommendations.

(3) GROUND WATER REPLENISHMENT AND CONTAMINATION.—The Administrator, in cooperation with the sanitation districts of Los Angeles County, California and regulatory agencies of the State of California, shall conduct a study of the feasibility of ground water replenishment with treated wastewater with particular emphasis on health effects related research recommended by the California State Scientific Advisory Panel on Groundwater Recharge. The Administrator shall prepare a report on the results of such studies.

(4) WATER POLLUTION RESULTING FROM CONTAMINATED GROUND WATER.—The Administrator, in cooperation with the State of New York and appropriate local governments, shall study the problem of pollution of the Buffalo River by contaminated ground water in Erie County, New York, for the purpose of determining methods of reducing or controlling such problem. The Administrator shall prepare a report on the results of such study, including recommendations.

(d) LAKE OKEECHOBEE ECOSYSTEM, FLORIDA.—

(1) RESEARCH PROGRAM.—

(A) IN GENERAL.—The Administrator, in cooperation with the Secretary of the Army, shall conduct a program of research at the Lake Okeechobee ecosystem on the relationship between surface and ground water quality and the management and control of aquatic plants. The Secretary of the Army shall provide such resources and services as may be necessary to assist the Administrator in conducting such program.

(B) PROGRAM REQUIREMENTS.—The program conducted under this paragraph shall—

(i) examine, interpret, and summarize existing data relating to surface and ground water quality and the management and

control of aquatic plants, and identify the location of major collections of such data,

(ii) examine the impact of existing methods for the management and control of aquatic plants on the Lake Okeechobee ecosystem,

(iii) conduct any research which the Administrator determines is necessary for the development of effective methods of management and control of aquatic plants and surface and ground water quality, and

(iv) be conducted in coordination with similar programs conducted by other Federal agencies.

(C) MANAGEMENT AND CONTROL METHODS.—Methods developed under this paragraph shall—

(i) be capable of application in a variety of combinations as separate components of systems for such management and control,

(ii) be adaptable for application, without a significant loss of accuracy and utility, to a wide variety of surface and ground water ecosystems and regions of the United States, and

(iii) be compatible with all aspects of each ecosystem to which they may be applied.

(D) OUTSIDE RESEARCH.—Subject to the availability of appropriations, the Administrator and the Secretary of the Army may each enter into contracts for the performance of research required for the development of methods under this paragraph.

(E) PROVISION OF INFORMATION TO STATE AND LOCAL GOVERNMENTS.—The Administrator shall provide information about methods developed under this paragraph to any official of State or local government upon receipt by the Administrator of a request submitted by the official.

(2) DEMONSTRATION PROJECT.—The Administrator shall conduct a project demonstrating methods developed under paragraph (1) at the Lake Okeechobee ecosystem. Such project shall—

(A) assess the utility of methods developed under paragraph (1) as components of a variety of comprehensive systems for the management and control of aquatic plants and surface and ground water quality, and

(B) identify any further research required to allow development of effective methods for the management and control of aquatic plants and surface and ground water quality.

(3) RECOMMENDATIONS OF THIRD PARTIES.—The Administrator shall solicit recommendations regarding activities under paragraphs (1) and (2) from—

(A) scientists other than those participating directly in activities under paragraphs (1) and (2), including scientists representative of the Federal, State, and local scientific communities, universities, and private industry, and

(B) management and operational personnel involved in the management and control of aquatic plants,

and shall utilize such recommendations in the development of methods under paragraph (1).

(4) COMPLETION OF RESEARCH AND DEMONSTRATION.—The Administrator shall complete the research program under paragraph (1) and demonstration project under paragraph (2) not later than 3 years after the date of the enactment of this title.

(5) PLAN FOR IMPLEMENTATION.—Not later than 180 days after the date of the enactment of this title, the Administrator and the Secretary of the Army

shall each transmit to the Congress a report outlining a plan for carrying out the functions of the Administrator or Secretary of the Army, as the case may be, with respect to the research program and demonstration project to be conducted under this subsection. Such reports shall each include a description of the cooperative measures to be undertaken by the Administrator or the Secretary of the Army, as the case may be.

(6) UTILIZATION BY DEPARTMENTS AND AGENCIES.—Any department or agency of the United States may utilize any recommendation contained in a report on the results of the research program and demonstration projects conducted under this subsection—

(A) if the recommendation may be utilized without interfering with any management or demonstration project already in progress, or

(B) after consultation with each person conducting such a management or demonstration project.

(7) LAKE OKEECHOBEE ECOSYSTEM DEFINED.—For the purposes of this subsection, the term "Lake Okeechobee ecosystem" means Lake Okeechobee, Florida, all rivers and streams entering into and carrying water away from such lake, the surrounding marsh

area, the associated 100-year flood plain, and associated ground water resources.

(c) AUTHORIZATION OF APPROPRIATION.—There is authorized to be appropriated to carry out this section $7,000,000 for fiscal years beginning after September 30, 1987. Upon request of the Secretary of the Army, the Administrator may transfer to the Secretary of the Army such funds as may be necessary for the Secretary of the Army to comply with the provisions of this section applicable to the Secretary of the Army.

SEC. 212. ANNUAL REPORT.

Not later than January 15, 1989, and each January 15 thereafter, the President shall prepare and submit to Congress an annual report on the activities carried out by the Administrator, the Secretary, the Interagency Ground Water Research Committee, other Federal agencies as appropriate, and State and local governments regarding ground water assessment, protection, management, and remediation activities under this title. The annual report shall contain a discussion of the ground water assessment and research findings to date, needs of the Federal Government and State and local governments, and an evaluation of the extent to which the programs authorized by this title are addressing those needs. The report shall also describe the ground water research and assessment programs for the agency members of the Inter-

agency Ground Water Research Committee for the succeeding 2 fiscal years.

SEC. 213. PEER REVIEW.

Except as otherwise provided in this title, studies, reports, and results of research conducted under this title shall be reported and adopted only after appropriate peer review.

SEC. 214. AUTHORIZATION OF APPROPRIATIONS.

(a) In addition to such sums as may be otherwise authorized, there are authorized to be appropriated to the Environmental Protection Agency for the purposes of carrying out the provisions of this title, other than section 211, $10,000,000 for fiscal year 1988, $12,000,000 for fiscal year 1989, and $14,000,000 for fiscal year 1990.

(b) Any contract authority provided in this title shall be available only in amounts provided in advance in appropriations Acts.

TITLE III—AGRICULTURAL PRODUCTION AND WATER USE

SEC. 301. SHORT TITLE.

This title may be cited as the "Agricultural Ground Water Management Act of 1987".

SEC. 302. FINDINGS.

The Congress finds that—

(1) ground and surface waters are interconnected and the quality and availability of these waters are of critical importance to our Nation,

(2) agriculture is the largest single consumer of water in rural America, with irrigation used on more than 41,000,000 acres,

(3) 95 percent of all rural residents in the United States are dependent upon ground water as a source of potable water,

(4) ground and surface water contamination from a number of sources, including contamination from agricultural operations, is a major national concern which can cause adverse social, economic, health, and environmental impacts,

(5) technology and education on soil and tissue testing, in managing both economic and environmental concerns of agriculture, deserve renewed emphasis by the Department of Agriculture in view of changing farmer needs,

(6) careful selection of the proper combination of agricultural practices and technologies, including proper water management, will help farmers reduce the effect of agricultural practices on water quality,

(7) efficient plant use of agricultural nitrogen is essential to maximize the farmer's return on invest-

1 ment and to minimize agricultural nitrogen losses from
2 erosion and leaching,
3 (8) least-cost production strategies continue to
4 offer the best long-term hope for sustaining American
5 agriculture,
6 (9) farmers must be fully informed to ensure that
7 agricultural operations are agronomically, economi-
8 cally, and environmentally sound, and
9 (10) present water quality and use data collection,
10 analysis, and information dissemination programs are
11 insufficient to provide farmers and decision makers
12 with the bases for formulating sound water quality and
13 use policies and programs.

14 **SEC. 303. AGRICULTURAL WATER QUALITY AND USE STUDY.**

15 (a) IN GENERAL.—The Secretary of Agriculture shall
16 conduct an investigation and analysis of the relationship be-
17 tween agricultural practices and water use and quality and
18 shall, within 90 days of the date of the enactment of this title,
19 submit a report to Congress on the results of the investiga-
20 tion and analysis. The report shall include—
21 (1) the current status and level of effort of
22 programs at the Department of Agriculture to evaluate
23 present agricultural water use and predict future use
24 and availability of water for agricultural and rural
25 residents,

1 (2) the current status and level of effort of pro-
2 grams at the Department of Agriculture to evaluate,
3 prevent, and mitigate water quality problems in both
4 surface and ground water,
5 (3) the current status of efforts to coordinate the
6 undertakings described in paragraphs (1) and (2) both
7 within the Department of Agriculture and within other
8 departments and agencies of the Federal Government,
9 including a detailed description of how the water qual-
10 ity and use issues are being included in management
11 plans for lands of the Department of Agriculture,
12 (4) an estimate of the extent of the water quality
13 problem, in both surface and ground water, due to ag-
14 ricultural operations and an examination of the extent
15 to which these problems are due to identifiable organic
16 and inorganic sources of pollution,
17 (5) an estimate of the availability of water for ag-
18 ricultural uses on a geographic area basis, based upon
19 current and predicted levels of use and withdrawal,
20 (6) an analysis of the interrelationships and com-
21 pounded problems, if any, between agricultural water
22 use and water quality,
23 (7) the policy of the Department of Agriculture on
24 water quality and use which should be used to guide

1 programs associated with agricultural and rural water
2 needs, and
3 (8) specific recommendations for changes in exist-
4 ing programs and new initiatives in monitoring, re-
5 search, extension, and technical assistance efforts to
6 address present and potential water quality and quan-
7 tity problems.
8 (b) The Secretary of Agriculture and the Administrator
9 of the Environmental Protection Agency shall conduct and
10 complete within 12 months of the date of enactment of this
11 Act a joint study of the impact on ground water and agricul-
12 tural interests of proposals to dredge sediments which contain
13 PCB's from the Hudson River and dispose of such sediments
14 on land.

15 SEC. 304. AGRICULTURAL NITROGEN BEST MANAGEMENT
16 PRACTICES TASK FORCE.

17 (a) ESTABLISHMENT.—The Secretary of Agriculture
18 shall establish an Agricultural Nitrogen Best Management
19 Practices Task Force. The Secretary shall appoint as mem-
20 bers of the Task Force—
21 (1) the Administrator of the Agricultural Research
22 Service,
23 (2) the Administrator of the Extension Service,
24 (3) the Chief of the Soil Conservation Service,

1 (4) the Administrator of the Agricultural Stabiliza-
2 tion and Conservation Service,
3 (5) the Administrator of the Cooperative State
4 Research Service,
5 (6) the Manager of the National Fertilizer Devel-
6 opment Center of the Tennessee Valley Authority,
7 (7) the Director of the Office of Ground Water
8 Protection of the Environmental Protection Agency,
9 (8) one representative of persons engaged in the
10 agricultural production,
11 (9) one representative of the fertilizer industry,
12 (10) one representative of State government,
13 (11) one representative of the public with exper-
14 tise in agricultural practices, and
15 (12) the Director of the United States Geological
16 Survey.
17 (b) FUNCTIONS.—The Task Force appointed under sub-
18 section (a) shall—
19 (1) review the status of current information on the
20 relationship between agricultural nitrogen and water
21 quality, including the quality of both surface and
22 ground water,
23 (2) develop and improve agricultural best manage-
24 ment practices, systems, and technologies for (A) im-
25 proving nitrogen utilization in agricultural production,

1 and (B) reducing or mitigating any negative effects of
2 agricultural nitrogen and environmental nitrogen on
3 water quality, and
4 (3) develop educational and training materials for
5 providing information and technical assistance to farm-
6 ers through appropriate means to encourage the adop-
7 tion of the recommendations developed under para-
8 graph (2).
9 (c) REPORT.—The Task Force shall report to the Sec-
10 retary of Agriculture and to Congress one year after the date
11 of the enactment of this title and annually thereafter on the
12 progress of its efforts under subsection (b). Each report shall
13 include a description of—
14 (1) the extent of problems posed by agricultural
15 nitrogen and environmental nitrogen for water quality,
16 (2) the agricultural best management practices
17 recommended by the task force with particular empha-
18 sis on practices to minimize the impact of agricultural
19 nitrogen and environmental nitrogen on ground and
20 surface water quality,
21 (3) the means for disseminating to farmers and
22 producers data and information relating to environmen-
23 tal nitrogen sources as they may impact on agricultural
24 best management practices,

1 (4) the educational and training materials devel-
2 oped to promote adoption of agricultural best manage-
3 ment practices and the strategy for their dissemination,
4 and
5 (5) progress made by the agricultural community,
6 to date, to address these problems, including progress
7 in disseminating information to agricultural producers.
8 (d) DEFINITIONS.—For the purpose of this section—
9 (1) AGRICULTURAL NITROGEN.—The term "agri-
10 cultural nitrogen" means nitrogen in all forms (whether
11 manmade, chemical, or biological) which may be
12 present or available for crop production including nitro-
13 gen supplied by leguminous plants, animal manures,
14 decaying leaves, and other vegetation, commercial fer-
15 tilizers, applied human and industrial sewage, and such
16 other nitrogen sources that are within the control of a
17 farmer or producer.
18 (2) ENVIRONMENTAL NITROGEN.—The term "en-
19 vironmental nitrogen" means nitrogen fixed or occur-
20 ring in the soil by means not under the control of a
21 farmer or producer, including nitrogen from naturally
22 occurring sources, such as precipitation and dustfall,
23 and nitrogen from non-naturally occurring sources,
24 such as air and water pollution.

(3) AGRICULTURAL BEST MANAGEMENT PRACTICES.—The term "agricultural best management practices" means generally recognized management practices under the control of farmers engaged in crop production that may be designed to reduce or prevent contamination of ground and surface water.

SEC. 305. NONPOINT SOURCE MANAGEMENT PROGRAMS.

(a) STATE REPORTS AND MANAGEMENT PROGRAMS.—Section 319(c) of the Federal Water Pollution Control Act (33 U.S.C. 1329(c)) is amended by adding at the end thereof the following new paragraph:

"(3) CONSULTATION REQUIREMENT.—Any report required by subsection (a) and any management program and report required by subsection (b) shall be developed in consultation with the Agricultural Nitrogen Best Management Practices Task Force of the Department of Agriculture established by section 304 of the Agricultural Ground Water Management Act of 1987.".

(b) REPORTS OF THE ADMINISTRATOR OF EPA.—Section 319(m) of such Act (33 U.S.C. 1329(m)) is amended by adding at the end thereof the following new paragraph:

"(3) CONSULTATION REQUIREMENT.—In preparing the reports under this subsection, the Administrator shall consult the Agricultural Nitrogen Best Management Practices Task Force of the Department of Agriculture established by section 304 of the Agricultural Ground Water Management Act of 1987.".

SEC. 306. AUTHORIZATION.

There are authorized to be appropriated to carry out this title such sums as may be necessary for each of the first 3 fiscal years beginning after the date of the enactment of this title.

TITLE IV—GROUND WATER RADIUM CONTAMINATION

SEC. 401. ASSISTANCE FOR SMALL COMMUNITIES WITH GROUND WATER RADIUM CONTAMINATION.

(a) RADIUM REMOVAL DEMONSTRATION PROGRAM.—The Administrator of the Environmental Protection Agency, in cooperation with State public authorities, may assist local governments in demonstrating mitigation of radium contamination in ground water. Upon application of any State public authority, the Administrator may make a grant to that authority for such purposes. Assistance provided pursuant to this subsection shall be used for financing the acquisition and installation of ground water treatment technologies needed to remove radium from ground water used as a source of public drinking water for residents of small communities under the jurisdiction of such local governments.

(b) LEVEL OF CONTAMINATION.—A grant may only be made under subsection (a) for removal of radium from ground water if the level of contamination from such radium exceeds the maximum contaminant level for radium established under title XIV of the Public Health Service Act (relating to safe drinking water).

(c) PURPOSES OF GRANTS.—Funds made available through grants under subsection (a) may only be used by the grant recipient for one or both of the following purposes:

(1) Providing insurance or prepaying interest for local obligations issued by a local government to finance the acquisition and installation of treatment technologies described in subsection (a).

(2) Paying for the costs of administration for establishment and operation by such authority of a program to provide financing for such acquisition and installation.

(d) DEFINITIONS.—For purposes of this section—

(1) SMALL COMMUNITY.—The term "small community" means a political subdivision of a State the population of which does not exceed 20,000 individuals.

(2) STATE PUBLIC AUTHORITY.—The term "State public authority" means an agency or instrumentality of a State which is established for the purpose of assisting local governments in financing capital improvements on a statewide or regional basis.

(e) AUTHORIZATION OF APPROPRIATIONS.—The following sums are authorized to be appropriated to carry out this section:

Fiscal Year	Amount
1988	$4,000,000
1989	$5,000,000
1990	$5,000,000

Passed the House of Representatives December 2, 1987.

Attest: DONNALD K. ANDERSON,

Clerk.

United States
Environmental Protection
Agency

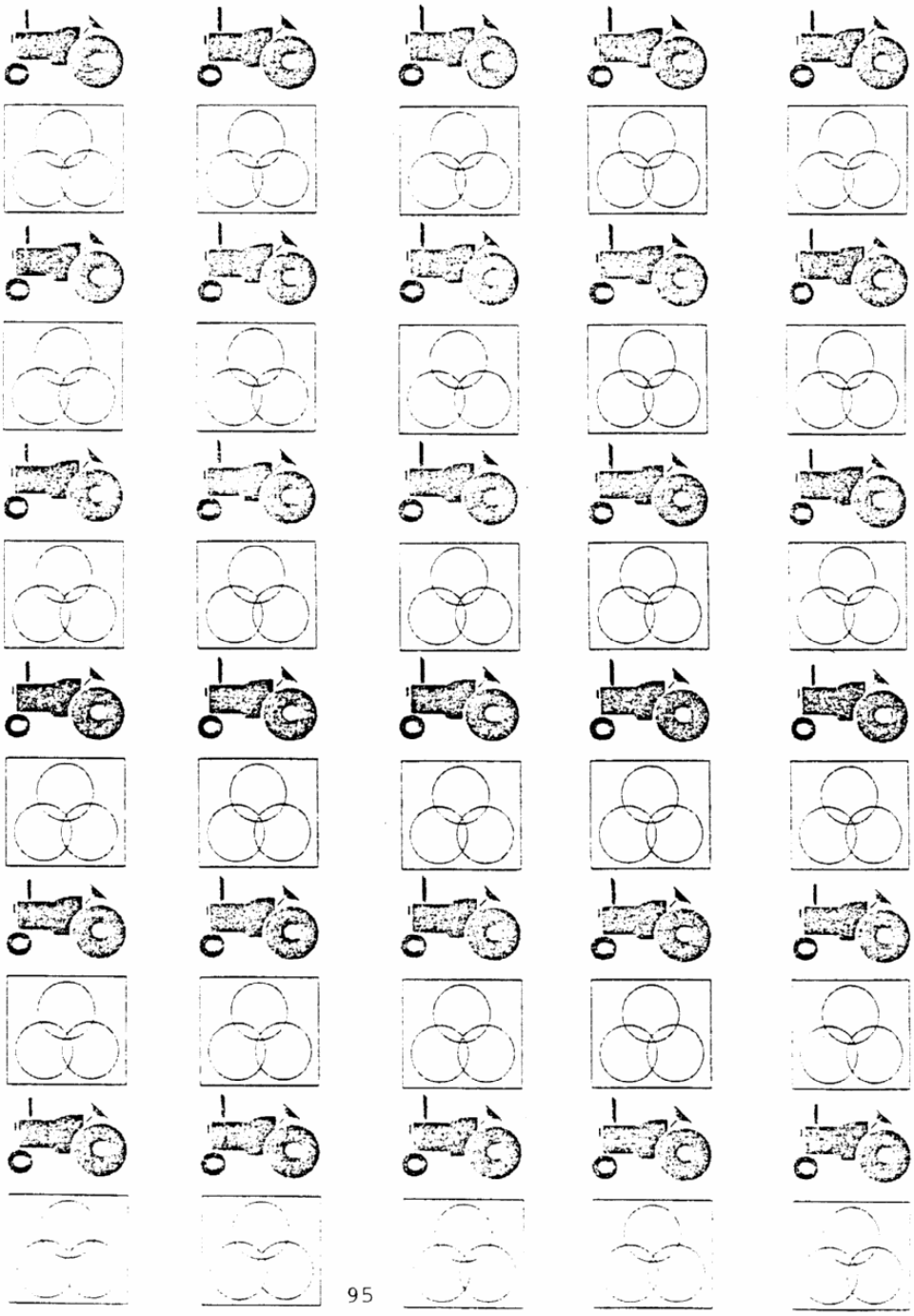
Office of Pesticides
and Toxic Substances
Washington, DC 20460

December 1987

Pesticides and Toxic Substances

EPA

Agricultural Chemicals in Ground Water: Proposed Pesticide Strategy



HR 791 RFS

PROPOSED PESTICIDE STRATEGY

The purpose of this second part of the document is to present EPA's proposed strategy for addressing the pesticides in ground water concern. The presentation of the proposed strategy is divided into three chapters (Figure II-1):

- Environmental Goal
- Prevention Policy and Program
- Response Policy and Program

In the first chapter, the Agency defines its environmental goal in terms of what waters to protect and the criteria for determining protection. The resolution of these issues is a prerequisite for establishing policies for both prevention and response efforts.

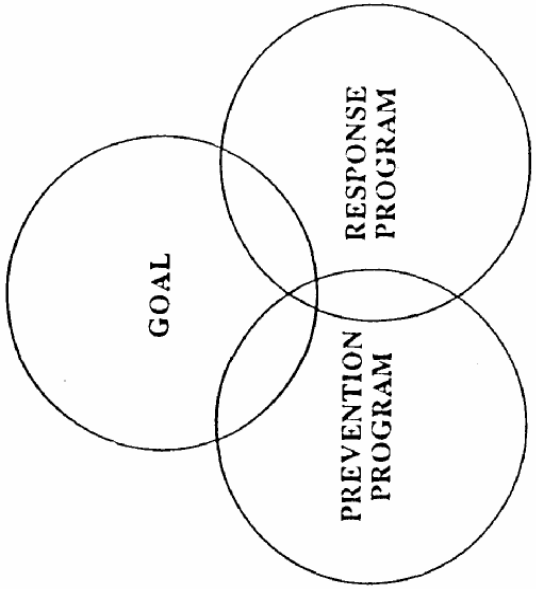
The second chapter presents the Agency's strategy for preventing contamination and focuses on the key issues of how to address local variability and the appropriate Federal/State roles and responsibilities in managing the problem. In defining its prevention policy and program, the Agency has examined options available, not only under its basic pesticide law, but also under other environmental authorities and the authorities of other Federal agencies as well as State capabilities.

The final chapter of the pesticide strategy establishes the overall framework for responding to ground-water contamination that has already occurred. Here again the critical question is the appropriate Federal and State roles and responsibilities.

For each of these chapters, the document will first highlight the options and the factors which the Agency considered in formulating its strategic approach. The second section of each chapter will present EPA's proposed approach and specific positions on a number of key issues.

Figure II-1

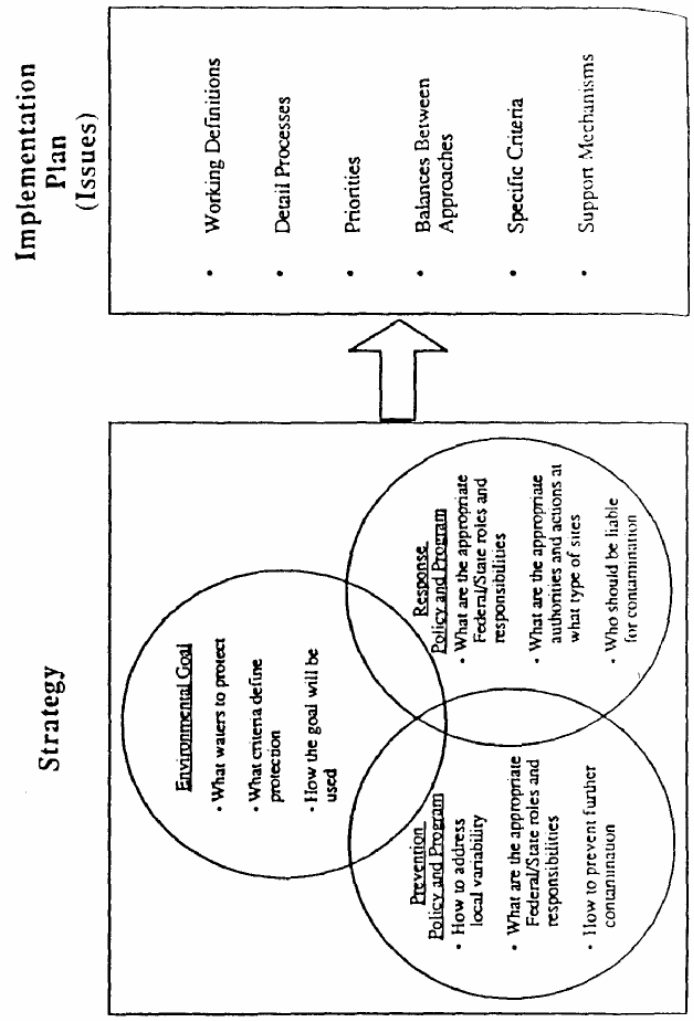
Pesticide Strategy



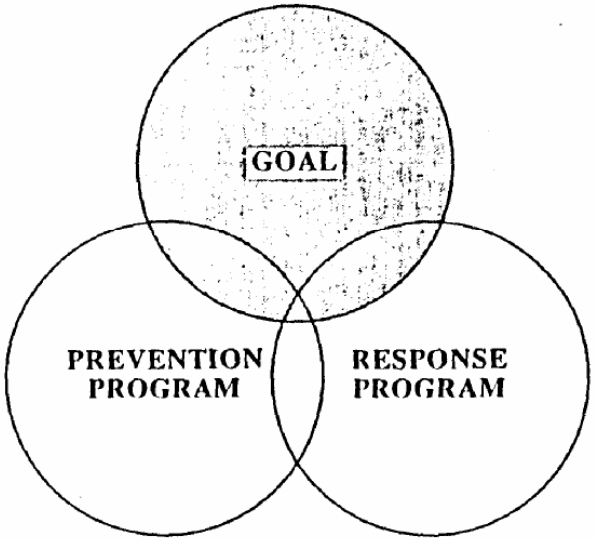
The policies presented in these three chapters form EPA's proposed strategy for dealing with pesticides in ground water. It is important to note that a number of key implementation issues are associated with this strategic approach. These issues are summarized in the final part of this document. The next major step in the planning process (Figure II-2) is to seek extensive input on these particular issues from State agencies, other Federal agencies, and other parties who will have key roles in the successful implementation of this strategy. After receiving public input on the proposed strategy and implementation issues, EPA will develop a detailed implementation plan -- the final step in the process.

Figure II-2

Pesticides in Ground Water Strategy



Pesticide Strategy



CHAPTER 1

ENVIRONMENTAL GOAL

EPA's proposed environmental goal will be to manage the use of pesticides in order to protect the ground-water resource. The Agency will give specific attention to preventing unacceptable contamination of current and potential drinking water supplies. MCLs or other EPA-designated criteria will be used as reference points for helping to define unacceptable contamination. This environmental goal will be used as a benchmark to:

- Identify and evaluate if, and where, the problem exists;
- Establish priorities to focus both prevention and response efforts;
- Select the most appropriate control measures; and
- Assess progress in preventing the problem or responding to existing threats.

Below is a discussion of the options and factors which the Agency considered in developing its goal for the pesticides in ground water strategy. Following this section is a presentation of the Agency's proposed position on the key issues underlying the environmental goal.

SECTION 1: FACTORS AND OPTIONS CONSIDERED

The two key questions which the Agency has addressed in defining its environmental goal for pesticides in ground water are: (1) what waters to protect and (2) what criteria determine protection (Figure II-3). The Agency has addressed these questions within the context of its regulatory statutes and other Agency policies, including its basic policies for pesticide registration.

In 1984, EPA issued the EPA Ground-Water Protection Strategy (GWPS) after many years of internal debate and external review and comment. The Strategy sets out goals and objectives for the Agency's ground-water protection efforts. In the GWPS, EPA established the policy of protecting the

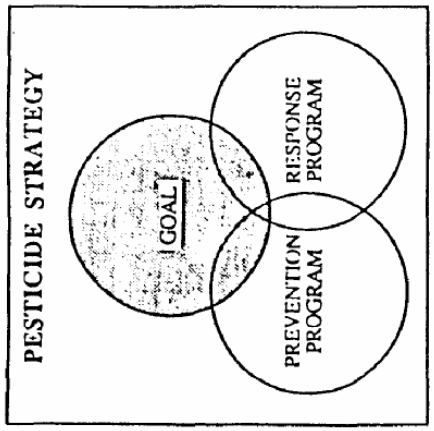


Figure II-3

Goal Definition Issues:

- What Waters to Protect
- What Criteria Determine Protection

ground-water resource to ensure its quality for the highest present or potential beneficial use. The highest beneficial use is defined as drinking water.

The GWPS also developed a general policy for classifying ground waters based on their use, value, and vulnerability. Dividing ground water into three classes, this policy provides an extra degree of protection to ground water that is highly vulnerable to contamination and is of great value because of its importance as a source of drinking water or its contribution to a unique ecological habitat (Class I). The majority of the nation's ground water is in Class II, a current or potential source of drinking water, and it is for this ground water that certain EPA ground-water protection requirements are designed. Class III ground water is not a potential source of drinking water because of levels of contamination from naturally occurring conditions or the effects of broad-scale human activity.

The strategy proposed in this document affirms the intended extension of EPA's basic ground-water policies to the Agency's efforts to protect ground water from pesticide contamination. A number of policy issues and options, already addressed under the GWPS, are presented here with options primarily for those who may not be familiar with the Agency's basic ground-water policies.

In developing the strategic approach for pesticides in ground water, EPA considered several aspects of this overall Agency policy for ground-water protection to determine the extent to which they were appropriate for the pesticides effort. Alternative approaches, such as approaches that would focus only on ground water currently supplying a drinking water well or that would solely rely on treatment at the tap as the means for protecting public health, were rejected as inadequate for protecting the ground-water resource for present and future generations. The Agency concluded that while the unique needs of agriculture must be accommodated in the strategic approach for pesticides, the basic policy of protecting the ground-water resource itself and focusing efforts on current and potential sources of drinking water would be the appropriate framework. The differential approach in the EPA Ground-Water Protection Strategy allows management strategies to be tailored

to ground waters of varying use, value, and vulnerability, but aims at adequate protection for all ground water that is a current or potential drinking water supply.

The following discussion outlines the factors and options which EPA considered in determining its environmental goal for addressing the pesticides in ground water concern.

1. What Waters to Protect

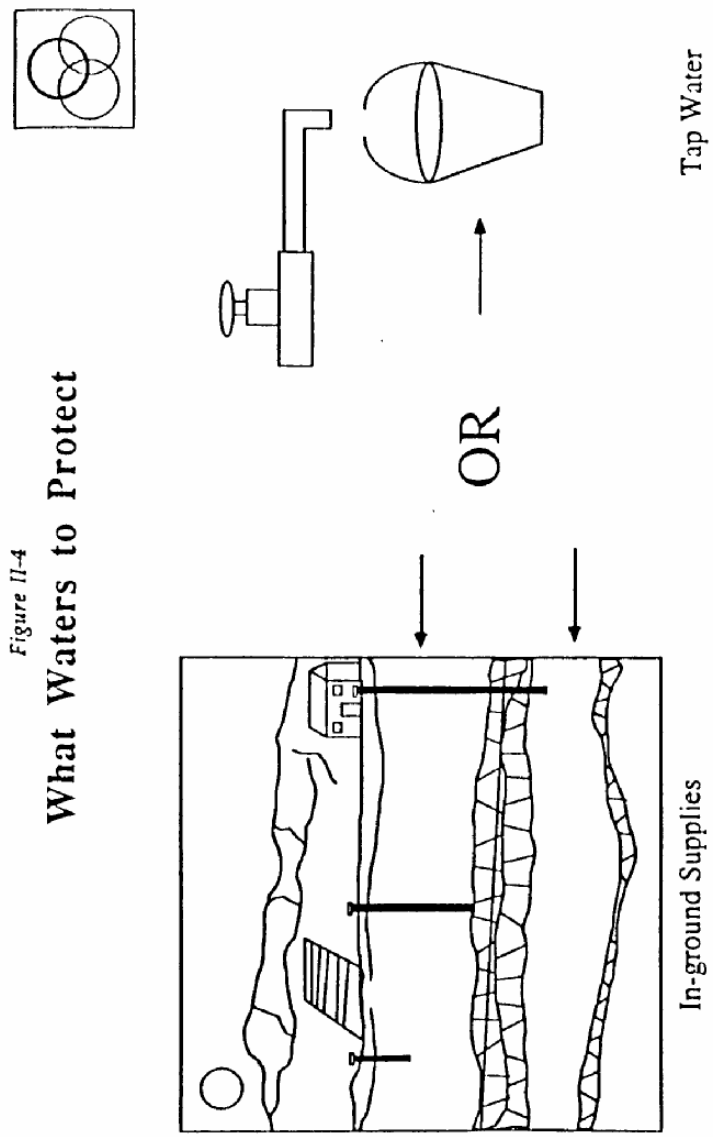
Ground waters vary greatly in how they are used and in their value to society. For example, in some areas, ground water may provide an irreplaceable source of drinking water to a large population, while in other areas, ground water may not be usable as a drinking water source because of its high salinity or its low yield. Other ground water, that may or may not be a drinking water source, could be valued for its importance to an area's fragile ecosystems.

The first issue in determining what waters to protect is whether protection efforts should be focused on assuring the quality of the ground-water resource or the quality of water actually delivered to the tap for drinking (Figure II-4). The difference between these two options is that the latter choice could allow for the contamination of ground water in areas where there is adequate treatment capability for reducing contamination to acceptable levels before it is provided for drinking.

A second key decision for the Agency is to determine whether to spread its protection efforts widely to protect all ground waters or to narrow its protection focus on some selected waters that provide more valuable use. If the Agency focuses its efforts on assuring that safe drinking water is provided, it would have to decide whether to protect private wells to the same extent as public water systems. If the Agency chooses to protect water in the ground, then the Agency has a number of options, based upon the different degrees of use and value of ground water (see Figure II-5), including:

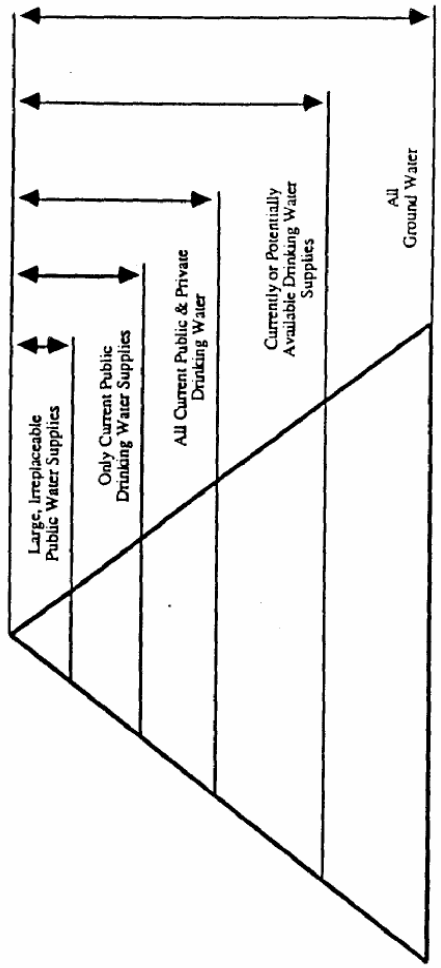
Figure II-4

What Waters to Protect



What Waters to Target for Protection

Figure II-5



- **Protection for All Ground Water** - One option is to protect all ground water as it exists in the saturated zone regardless of its current or potential use as a drinking water source. (As seen in Figure II-6, the saturated zone lies below the unsaturated zone, which is the first zone of water and soil below the surface layer).

- **Protection for All Ground-Water Resources That Are Current or Potential Drinking Water Sources or of Ecological Importance** - This option would also protect the ground water in the saturated zone, but would limit protection to those ground-water resources that are currently or potentially available for drinking water. A key consideration in implementing this option would be defining potential drinking water.

- **Protection for Only that Ground Water Currently Used as a Drinking Water Source** - This option would limit protection to those ground-water resources that currently supply drinking water. A key implementation issue would be defining what ground water actually supplies a drinking water well.

- **Protection for Only that Ground Water Supplying Public Drinking Water Systems** - This option is similar to the previous one except that protection is limited to those ground waters that supply public water systems. Again, a key implementation issue would be deciding what ground water actually supplies these drinking water wells.

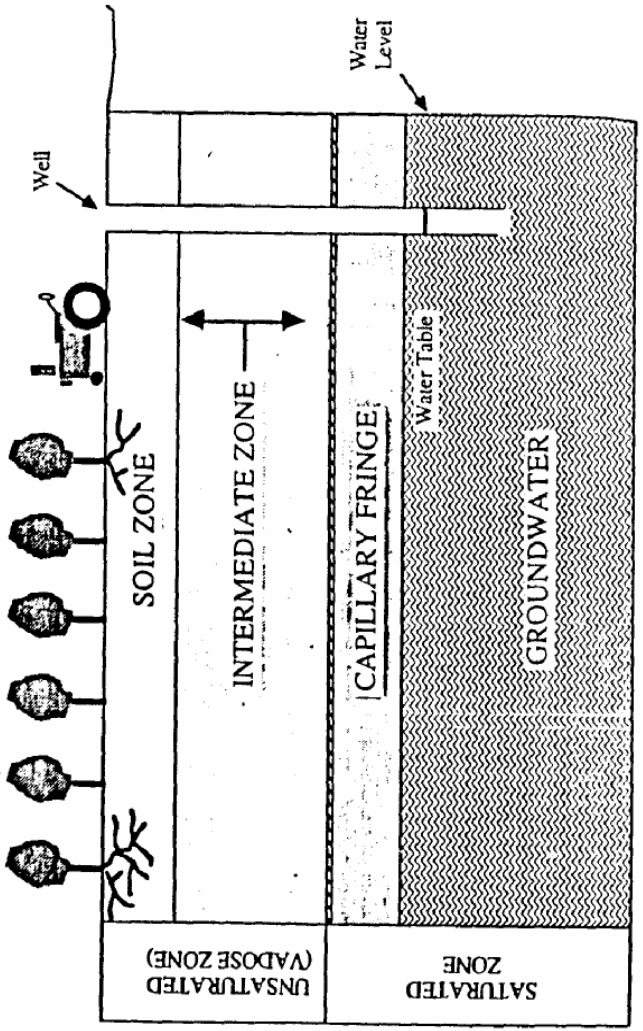
- **Differential Ground-Water Protection** - With this option, all ground waters would be considered for protection, but priorities and stringency of prevention and response efforts would be based on the relative use and value of the ground water. For example, basic protection efforts could be provided for ground waters that are a current source of drinking water. Higher degrees of protection could be provided to ground waters that serve large populations. On a case-by-case basis, some ground waters that are not a drinking water source could be afforded less protection where conditions warranted such actions.

With regard to what waters to protect, EPA's legislative priorities provide somewhat different direction. The major relevant EPA statutes which address this question include:

- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) - The basic pesticide law, FIFRA does not specifically identify ground water as an environmental medium requiring protection. However, EPA recognizes that the public may be exposed to pesticides in drinking water as a result of contaminated ground water, and thus, the ground-water medium is included in EPA's interpretation of FIFRA's general requirement for protection of the environment. In addition, several recently proposed bills to amend FIFRA would mandate a differential protection approach requiring special protective measures for ground waters that are a current or potential source of drinking water.

Zones of Subsurface Water

Figure II-6



- Safe Drinking Water Act (SDWA) - Federally-enforceable drinking water standards under the SDWA are limited to the drinking water that is provided by public water systems, i.e., those systems having at least 15 service connections or serving at least 25 persons daily. If the question of what waters to protect is limited to those waters covered by these SDWA drinking water standards, then individual private wells, which are often found in rural areas and are most at risk from pesticide contamination, would be excluded. (Note - some States do take action for private wells based on SDWA drinking water standards.)

  Another important factor to consider is that these SDWA drinking water standards, which apply to public water systems, do not apply to the ambient or raw water used by these systems unless it is provided directly to the public. The public system can treat or blend its water, however, to meet SDWA drinking water standards before delivering it to the user.

  The 1986 amendments to the SDWA established the Wellhead Protection Program which, unlike previous SDWA measures, is designed to protect ambient ground waters, but the focus remains on public water systems and has no Federally-enforceable quality standards.

- Clean Water Act (CWA) - As amended by the Water Quality Act of 1987 (WQA), the CWA does not differentiate ground water in terms of its protection goal of restoring and maintaining the integrity of the Nation's waters.

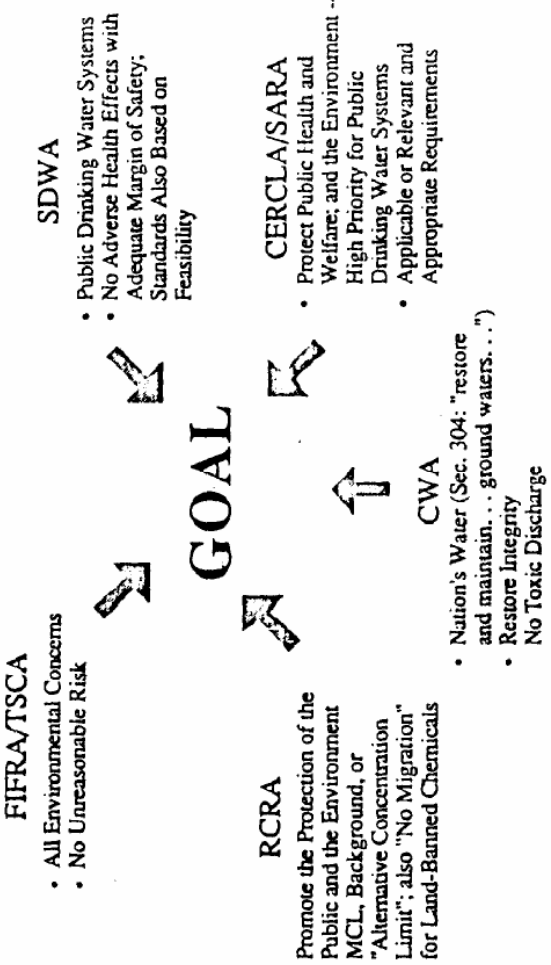
- Resource Conservation and Recovery Act (RCRA) - As amended by the Hazardous and Solid Waste Amendment of 1984 (HWSA), RCRA identifies ground water as a specific medium for protection and requires ground-water monitoring at hazardous waste facilities.

- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or "Superfund") - As amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), CERCLA establishes criteria for determining response priorities among releases or threatened releases of hazardous substances. The potential for a release to contaminate a drinking water supply is a major CERCLA criterion. Under CERCLA, a drinking water supply is defined as being "any raw or finished water source that is or may be used by a public water system (as defined by SDWA) or as drinking water by one or more individuals," which would include private wells.

In summary, EPA's various legislative statutes provide a range of guidance on what ground waters to protect (figure II-7). In some of EPA's existing statutes, ground water is not specifically mentioned; in others, EPA's enforceable authorities are limited to ensuring that the quality of drinking water supplied by public water systems is adequate.

Figure II-7

Goal: Varied Legislative Direction



In addition to these legislative considerations, the Agency also considered its existing policies in addressing the question of what waters to protect. In this regard, the Agency's basic ground-water policy states that the ground-water resource will be protected to ensure quality for the highest present or potential beneficial use. The highest beneficial use is defined as drinking water. The Agency's basic policy is also based on differential protection in regard to the use, value, and vulnerability of ground waters.

2. What Criteria Determine Protection

The second key part of the Agency's goal is identifying the criteria to be used for determining protection. Again, the Agency's legislative authorities provide varying guidance for addressing this issue (Figure II-7).

- Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) - This basic pesticide law requires the Agency to weigh the health and environmental risks of the use of each pesticide against the benefits of such use. Those pesticide uses which are found not to present an unreasonable risk may be registered.

- Safe Drinking Water Act (SDWA) - In contrast to FIFRA, the SDWA does not require considerations of the benefits of any regulated chemicals, including pesticides. Rather, the SDWA establishes a goal of protecting public health from exposures to contaminated public water supplies. SDWA standards are set as close as possible to those goals, but must take into account the cost and availability of feasible treatment technology to reduce contamination of water delivered to the consumer.

- Clean Water Act (CWA) - The stated goal of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. EPA has established human health protection criteria for pesticides in edible fish tissue based on levels that provide negligible or no significant risks.

- Resource Conservation and Recovery Act (RCRA) - Under RCRA, the contamination of ground water by hazardous waste facilities cannot exceed standards based on background environmental levels, SDWA standards, or levels that would pose a substantial present or potential hazard to human health or the environment. Of particular note, RCRA does provide EPA more flexibility in establishing protection criteria for releases from nonhazardous waste facilities, such as municipal landfills.

- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) - CERCLA or "Superfund" must be considered when responding to existing contamination. As amended by SARA in 1986, CERCLA now requires that clean-up levels (i.e., protection criteria) be defined in terms of applicable or relevant and appropriate regulatory requirements of other environmental statutes, such as the SDWA and CWA.

To date, the Agency has discussed the question of what criteria to use for ground-water protection mainly in relationship to the regulation of waste sites. This discussion has focused on both the differences within a statute (i.e., RCRA requirements for hazardous waste facilities versus nonhazardous waste facilities), as well as between statutes (i.e., RCRA versus CERCLA). When pesticides are considered in this discussion, the extent of the differences in legislative direction becomes even more pronounced.

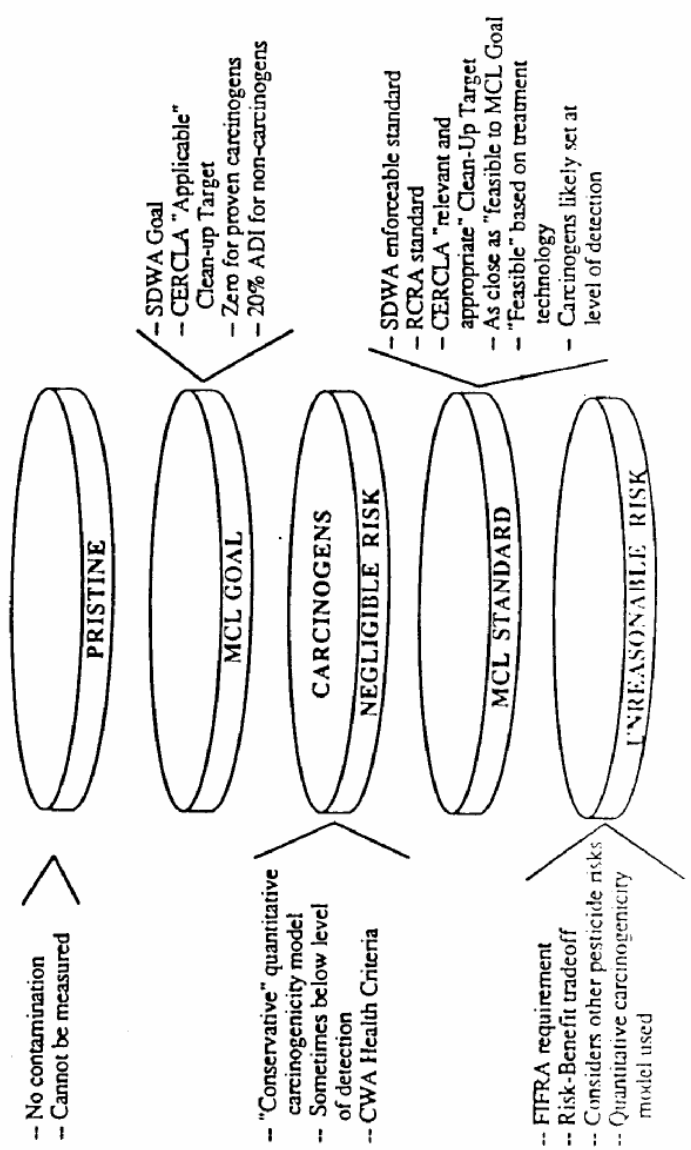
As described above, FIFRA requires the Agency to consider the benefits of a pesticide as well as its risks. Those risks considered reasonable under FIFRA's mandate may not be consistent with the regulatory policies established under other environmental statutes. The potential for this discrepancy is perhaps greater for ground water than for other pesticide concerns because of the number of relevant statutes.

The options which EPA considered for the criteria for defining protection are shown in Figure II-8 and include:

a) PRISTINE - Protection criteria based on pristine conditions would require prevention efforts that are designed to achieve zero contamination in waters chosen for protection. With this option, response efforts would have to restore protected ground waters to zero contamination levels. While an unspoiled environment is desirable, there are a number of practical barriers to achieving such a goal. First of all, zero is not scientifically measurable and therefore not attainable. Secondly, efforts to attain pristine ground water would be enormously expensive and would limit greatly the type of waters that could be targeted for such protection.

Figure II-8

Basic Protection Criteria Options



b) **MAXIMUM CONTAMINANT LEVEL GOAL (MCLG)** - The SDWA requires the Agency to set a Maximum Contaminant Level Goal (MCLG) for any potential drinking water pollutant at a level that has no known or anticipated adverse effect. EPA's policy has been to set the MCLG at absolute zero for a chemical proven to be carcinogenic (cancer-causing) in humans, or a probable carcinogen in animal studies. For noncarcinogens, the MCLG is set at a level corresponding to a percentage of the Acceptable Daily Intake (ADI) or more recently, Reference Dose (RfD).[1/]

In developing the MCLG policy, EPA considered setting the MCLGs for carcinogens at the lowest levels that could be detected by modern analytical technology (the limits of detection). The Agency also considered setting MCLGs at levels that would pose insignificant or negligible risks (see below). The Agency's most compelling argument for choosing the more conservative option of absolute zero for probable carcinogens is that the MCLG was not intended to be used as a practical regulatory standard, but rather as a statement of the SDWA program's general long-term aim.

Where the concern is for a carcinogenic pesticide in ground water, the use of the MCLG as the protection criterion would have the same problems as the pristine option. In this case, a measurable goal could not be established because a zero level is not scientifically measurable. Furthermore, prevention and response efforts could constantly be in doubt as the ability to measure smaller and smaller levels of environmental contaminants progresses. Use of the MCLG as the criterion for protection could also skew public health and environmental priorities since this approach does not consider the relative potency of different carcinogens, nor does this

1/ To simplify somewhat, the ADI is developed by first determining the concentration of a chemical that shows no observable effect level (NOEL) in animal tests. After factoring the size of humans and possible other biological differences, the NOEL is divided by a margin of safety factor, the magnitude of which is determined by the quality of the toxicology data and other factors. EPA uses a percent of the ADI for setting an MCLG because humans may be exposed to the chemical through other routes such as food.

approach consider that a noncarcinogen could pose a much greater risk than a weak carcinogen. Furthermore, as with the pristine option, the cost of protecting, monitoring, and restoring ground water based on a zero level may limit greatly the type of waters that could be targeted for such protection.

c) **NEGLIGIBLE RISK** - EPA has applied the concept of negligible risk to carcinogens. Substances shown primarily through controlled animal studies to have the capacity to cause cancer (malignant tumors) are considered to be carcinogens. In assessing the risks of these substances, EPA assumes that there is no level of exposure that has a zero chance or risk of an adverse effect. However, the risks are assumed to be proportional to the level of exposure. Therefore, at some exposure level the risk posed by a carcinogen can be considered to be insignificant or negligible.

EPA uses a number of "worst case" assumptions to estimate the risks to humans from environmental exposures to carcinogens based on extrapolations from animal studies. If a "worst case" or "upper bound" estimate of cancer risk is one in a million (1×10^{-6}) or less, the risk at that level of exposure is generally considered to be insignificant or negligible.

The use of negligible risk as the basis for a protection criterion provides a level that is considered very protective of human health. Such a goal could be measurable, but for some chemicals the concentration of a chemical at a negligible risk level may not be detectable. In this case, a decision would have to be made to accept the limits of detection as an acceptable level. Because of its stringency, a standard based on the concept of negligible risk may not be achievable as a clean-up standard for certain pesticide contamination incidents.

d) **MCL STANDARD** - Following the development of an MCLG, the SDWA requires EPA to establish a Maximum Contaminant Level (MCL) that is the enforceable standard used to guard the adequacy of the drinking water provided by public water systems. The SDWA requires EPA to set the MCL as close as

possible to the MCLG, taking into account the cost and feasibility of measuring and reducing the contamination. MCLs are set in a range that is considered protective of human health.

MCLs as protection criteria have already been established for public water systems, and as such they can provide measurable goals. In some cases, though, MCL's may be difficult to achieve, particularly when they are used to protect private well water or the ground-water resource. Like the previous options, MCL's are not based on a consideration of the benefits of the contaminants to society.

e) UNREASONABLE RISK - As mentioned earlier, FIFRA is a risk-benefit statute and requires the weighing of the human health risks posed by a pesticide's use against its benefits. In some cases, concentrations posing a nonnegligible risk may be tolerated if the benefits of the pesticide's use are found to be uniquely critical.

The key question for the Agency is how to develop a goal for protecting ground water from pesticide contamination that is compatible with the requirements under each of its legislative mandates. From a prevention perspective, FIFRA requires the Agency to weigh the benefits of a pesticide's use against its risks. Obviously, EPA must attempt to prevent the creation of contamination problems that would require corrective actions, such as treatment by public water systems. From a response perspective, actions are based on criteria (e.g., SDWA goals and standards) that do not consider the benefits of pesticide use. The critical issue is whether the criteria used to define protection under other legislation can be used as the basis for unreasonable risk determinations under FIFRA.

SECTION 2: EPA'S PROPOSED POLICY POSITION

EPA's proposed environmental goal will be to protect the ground-water resource with the key focus on preventing unacceptable contamination of current and potential drinking water supplies. MCLs or other EPA-designated protection

criteria will be used as reference points for helping to determine unacceptable levels of contamination. Specifically, the Agency will adopt the following policies for protecting ground water from pesticide contamination:

1. The Agency will use a differential protection approach to protect the ground-water resource. With this approach, the Agency will focus protection efforts on ground waters that are current or potential sources of drinking water or that are vital to fragile ecosystems (Figure II-9). Additional measures may be taken to ensure protection of certain "high priority ground waters."

Ground water provides nearly half of the drinking water used in this country. Regardless of whether that water is being provided through a community public water system or to a private individual, it is not usually monitored for the presence of pesticide residues, nor is it usually subject to any treatment technology capable of removing low, but possibly health-significant, levels of pesticides.

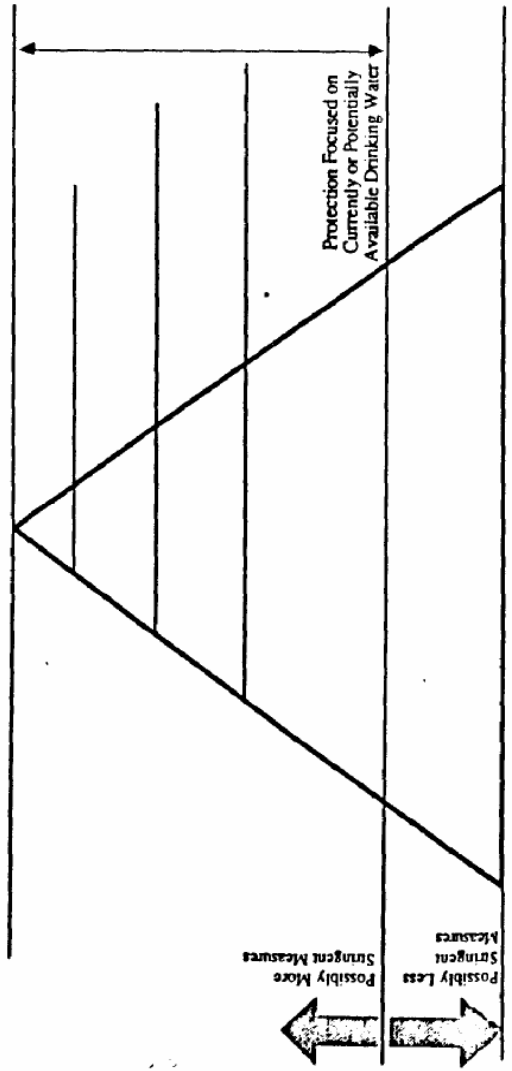
Under the SDWA, EPA is establishing standards which will require public drinking water systems to identify, and where necessary, to remove pesticide residues posing potential health concerns before supplying the water for use. However, it will take substantial time and investment for public systems to achieve this capability; these requirements also will not be applied to the approximately 12 million private wells that supply drinking water to millions of Americans. Thus, EPA must assume that contaminated ground waters which are used as a source of drinking water may result in direct human exposure. It is the Agency's position that protection of these ground waters is synonymous with public health protection. As such, EPA's protection efforts must target those ground-water resources that serve as drinking water sources.

Since the natural cleansing processes of ground waters can be extremely slow, contamination of this resource poses a potential hazard for future generations. Contaminated ground water could be used as a drinking water source before being tested for contamination. Where contamination is

Figure II-9

What Waters to Target for Protection

EPA Policy:
Differential Protection Based on Use and Value of the Ground Water Resource



identified, efforts could be made to restore the ground water for use as a drinking water source, but this option could present insurmountable technological difficulties and exorbitant costs.

In practice, alternative water sources or point-of-use treatment, if technology is available, may be the only viable preventive measures for a community. Although local governments could regulate the placement and construction of wells, there is the possibility that these ordinances may eventually be ignored or overlooked before the ground water has been cleansed by natural processes. For these reasons, EPA may have to assume that contaminated ground water that is a potential drinking water source could eventually result in human exposure. EPA's protection goal therefore includes ground-water resources that are potential as well as current sources of drinking water.

The need to protect the ground-water resource is further underscored by the fact that ground waters provide approximately 30% of the annual base flow to surface water systems. In certain dry areas of the country or during periods of drought, ground-water flows to surface waters can have a more dominant role. As such, the continued existence of fragile ecosystems may depend on the quality of certain ground water. To meet its basic environmental protection mission, EPA must focus protection efforts on ground-water resources from an ecological perspective as well as from a public health concern.

As part of its differential protection approach, the Agency will take additional measures to protect "high priority ground water." These "high priority ground waters" may serve as irreplaceable sources of drinking water for sizable communities, or they may be vital to the continued survival of endangered species or critical ecosystems. For these situations, additional measures, beyond baseline protective efforts, may be required to provide further assurances that these, and perhaps other, "high priority ground waters" are not contaminated or that they have priority for corrective actions, if already contaminated.

2. EPA will use MCLs, as defined under the SDWA, as reference points for helping to determine unacceptable contamination of ground waters that are drinking water sources. When no MCL exists, EPA will use interim drinking water protection criteria as its reference points. These will be equivalent to an MCLG for noncarcinogenic pesticides and to a negligible risk level for carcinogenic pesticides (Figure II-10). The Agency will also use ecologically based protection criteria as reference points for helping to determine unacceptable contamination of ground waters.

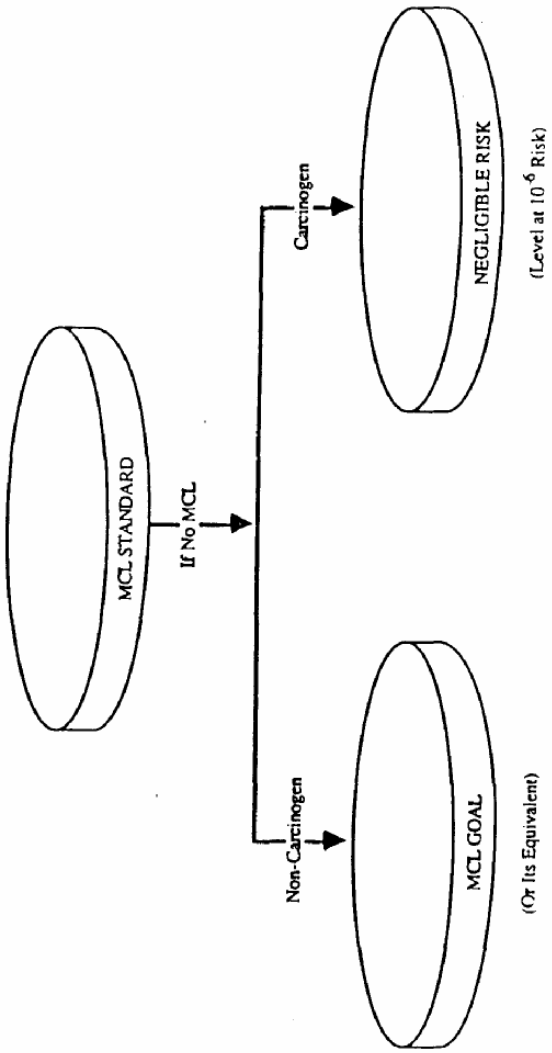
Under the 1986 SDWA Amendments, EPA is moving to establish new MCLs for potential drinking water contaminants, including a number of pesticides. In the interim, EPA will have available other drinking water protection criteria that will be based on standard risk assessment procedures. For noncarcinogens, EPA will establish these interim protection criteria based on a No Observable Effect Level (NOEL) with appropriate margins of safety of two or three orders of magnitude depending on the confidence in the toxicity data and other risk assessment factors (this approach is essentially the same one used for setting an MCLG for a noncarcinogen). For carcinogens, the interim protection criteria will be set at a level that corresponds to a negligible risk, i.e., the level of exposure that has an upper bound estimate of one in a million chance of causing cancer (see previous description). Establishment of interim protection criteria for pesticides in drinking water is jointly undertaken by EPA's Office of Drinking Water and Office of Pesticide Programs. EPA has recently developed interim levels for over 60 pesticides through the Agency's health advisory process.

Since an MCL or an interim protection criteria is developed for human health reasons, these levels could pose concern for fragile aquatic ecosystems. Of particular concern would be pesticide contamination that would result in risks to endangered species. Because the Agency's mandate is to protect the environment as well as public health, EPA also establishes ecologically based protection criteria. EPA's Office of Pesticide Programs

Figure II-10

What Criteria Determine Protection

EPA Policy:



will continue to work closely with the Office of Water Regulations and Standards in the latter Office's development of such water quality criteria for pesticides.

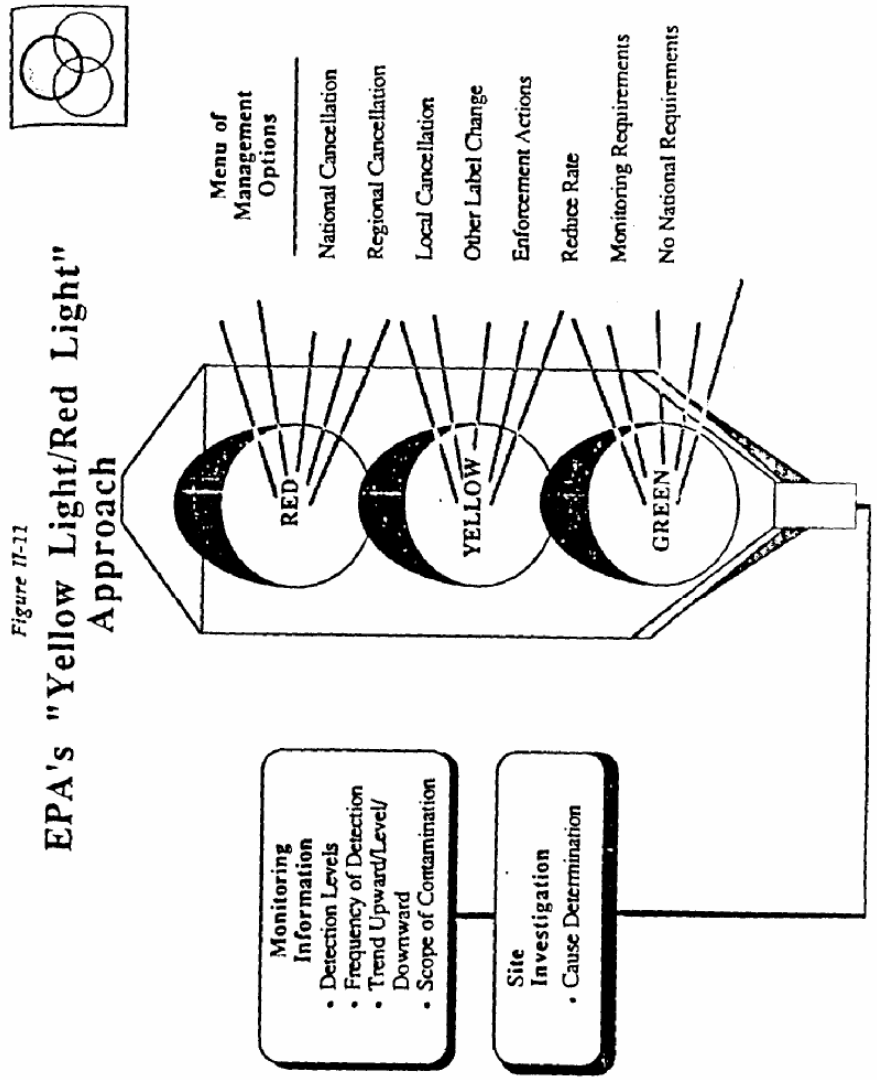
For response actions, the above criteria will be used as reference points to help determine where and what measures should be taken to protect human health and the environment should unacceptable levels of contamination be reached. Contaminated ground waters that are current or potential sources of drinking water or ground waters of ecological significance are all possible candidates for corrective efforts. Highest priority attention, however, should be given to responding to incidents of ground-water contamination where levels exceed an MCL or an interim reference point and that water is used as a current drinking water source.

For prevention efforts, the protection criteria, described above, will be used as reference points for helping to define unacceptable levels of contamination and to determine when certain pesticide management actions may be needed to reduce the likelihood of ground-water contamination reaching or exceeding such levels. Efforts to manage a pesticide's use will begin with early indications of its potential to contaminate ground water. These early indications can be based on information about the physical and chemical properties of the pesticide, how and where it may be used, and predictions of its fate in certain usage areas.

When a pesticide is found in ground water that is a current or potential drinking water source, additional management actions may need to be triggered. The need for, and the stringency of, these management actions will depend on the number of sites where the pesticide is detected, and whether the levels found are above or moving toward a reference point. In effect, EPA intends to establish an "early-warning" or "yellow light/red light" management process (Figure II-11), whereby increasingly stringent control measures will be applied in response to an increasing threat of a pesticide reaching or exceeding an unacceptable level.

Figure II-11

EPA's "Yellow Light/Red Light" Approach



EPA's rebuttable presumption will be that the risks posed by pesticide contamination of a local underground source of drinking water, at or above the MCL or an interim reference point, will be more significant than the benefits derived from the pesticide's use in the area. Depending on the frequency and scope of such contamination, EPA will consider the cancellation of the pesticide's use in such areas as an appropriate response. However, a number of factors would need to be consider that could make cancellation inappropriate. For example, the benefits of using the pesticide in an area could be substantial and there may be management measures, other than cancellation, that could reduce contamination to acceptable levels. Also, the cancellation of a pesticide's use would not be appropriate if the ground-water contamination resulted from unusual circumstances such as an accident.

Before taking action to mitigate ground-water contamination threats, EPA must also consider such action in the context of overall pesticide exposure risks, including risks to applicators and farm workers and risks to the general population through dietary exposures. The Agency will maintain its regulatory flexibility to delay or modify ground-water protection measures should the Agency find that pesticide substitutes or alternative use practices would result in greater overall pesticide risks.

In conclusion, EPA's proposed goal is to protect the ground-water resource with specific attention given to preventing unacceptable contamination of current and potential drinking water supplies or ground water of ecological importance. Additional measures may be required to provide further assurances that certain "high priority ground waters" are not threatened by such contamination.

EPA will use MCLs, as defined under the SDWA, as its basic point-of-reference for determining unacceptable contamination for ground waters that are current and potential drinking water supplies. When no MCL exists, EPA will use an MCLG or its equivalent for noncarcinogenic pesticides and a negligible risk level for carcinogenic pesticides as interim reference points. The Agency will also use ecologically based protection criteria as reference points for determining unacceptable ground-water contamination.

Pesticide Strategy

CHAPTER 2

PREVENTION POLICY AND PROGRAM

Prevention of pesticide contamination of ground water is the centerpiece of the Agency's strategy for protecting ground water. As part of its prevention strategy, EPA will employ a multi-prong approach to prevent pesticides from reaching an unacceptable level in ground water.

First, EPA will take uniform action for pesticides posing widespread national concerns and will establish generic requirements for certain pesticide use and disposal practices that pose unique ground-water threats independent of area-specific ground-water conditions.

Secondly, EPA will adopt a differential approach to the management of pesticide availability and use. Under this approach, prevention measures will be tailored to an area's ground-water conditions to the extent feasible. Certain State-wide or county-wide measures will be required by EPA. Additional site-specific measures may be required in which the user will be responsible for determining their applicability to a given application site based on site-specific ground-water vulnerability or the user's location in an area of "high priority ground water" (i.e., high-use/value ground waters).

Third, the Agency will encourage a strong State role in the local management of pesticide use. Under this approach, a State will have the opportunity to develop a pesticide management plan that may be the basis for EPA's registration of a pesticide within that State. While the basis of a State plan must be to meet EPA's goal of protecting ground-water resources, a State will have flexibility in its management approach to better tailor measures to local needs.

Pesticide users and registrants will also continue to have key roles in protecting ground water. The users will be responsible for complying with label instructions and keeping informed of ways to prevent ground-water contamination, while the registrants will be responsible for monitoring certain ground waters and improving communication to the users on proper use of their

products. Monitoring will play a major role in the prevention program by identifying potential contamination problems early and triggering appropriate pesticide management actions.

The next section discusses the options and factors that the Agency considered in developing its prevention strategy. Following this section is a detailed presentation of the Agency's proposed position on key aspects of the prevention approach.

SECTION 1: FACTORS AND OPTIONS CONSIDERED

In designing its program for preventing ground-water contamination by pesticides, the Agency addressed two strategic questions: (1) how to address local variability and (2) what are the appropriate Federal-State roles (Figure II-12). An important consideration, related to the latter issue, was determining the role of the pesticide user and registrant in ground-water protection. Another key consideration was how to control further contamination of ground water once a pesticide has been detected in an area.

1. How to Address Local Variability

Since 1970, EPA has been responsible for regulating the use of pesticides in the environment. Through its regulatory programs under FIFRA, the basic pesticide law, the Agency has developed a number of tools for controlling pesticide use in the United States. Foremost among these tools is the authority to require extensive environmental and toxicological testing of pesticides. Through its registration and reregistration programs, EPA can require the manufacturer, or registrant, to conduct comprehensive testing of a pesticide, including environmental fate studies that will indicate the potential of a pesticide to leach into ground water.

Based on the results of these tests and other available data, the Agency approves or disapproves certain or all uses of a pesticide. When the Agency approves the use of a pesticide, it can further regulate the conditions of its use by imposing certain requirements or restrictions on the pesticide's labeling. Historically, the Agency has used product labeling as the major

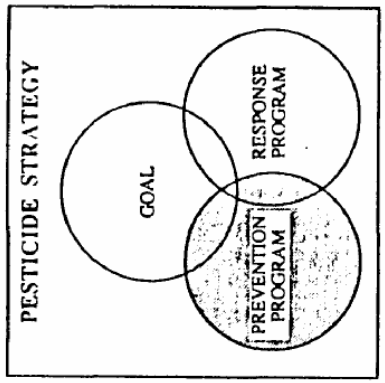


Figure II-12

Prevention Program Issues:

- How to Address Local Variability
- What Are the Appropriate Federal/ State Roles
- How to Control Contamination

vehicle for communicating information to the users regarding proper application and disposal of pesticide products. For those pesticides that pose significant risks but do not warrant complete removal from the marketplace, the Agency may impose labeling requirements that change the rate, timing, or method of application or that restrict its use to trained and certified applicators.

Under FIFRA, the States have the primary responsibility for enforcing the proper use of pesticides, as defined by the EPA-approved label. States may also require more stringent controls than the Federal Government for the use of pesticides within their individual States.

For dietary exposures and applicator or farm worker exposures, a uniform, national management approach is warranted. In the case of dietary exposures, differences among regions of the country are usually not significant since our food distribution system is national in scope. More important differences can be found among males and females or among infants, children, and adults because of differences in the diets of these subpopulations. Important differences also exist among these groups in their susceptibility to pesticide toxicity. For these reasons, the Agency generally evaluates the exposures from pesticides in the food supply based upon national averages for these subpopulations. Exposure to applicators or farm workers can also be regulated on a national basis by considering the physical-chemical properties of the pesticide and by requiring certain safety precautions on the label, such as protective clothing requirements.

Unlike dietary and applicator exposure, the pesticides in ground water concern does not lend itself easily to a uniform, national management approach. As previously mentioned, the use and value of ground water varies extensively across the country and as stated in the previous chapter, EPA will differentiate its protection efforts according to these differences. The vulnerability of ground water to pesticide contamination also varies substantially depending on such area-specific factors as the depth to ground water and the type of soil. Other factors that determine whether or not a pesticide will reach the ground water are local agricultural practices, the physical-chemical properties of the pesticides selected to deal with an area's pests, and how and when these pesticides are applied. A more detailed

discussion of these factors can be found in the Problem Assessment of this strategy and in several other documents (e.g., Pesticides in Ground Water: Background Document, U.S. EPA 1986; Practices to Mitigate Contamination of Ground Water from Pesticides Used in Crop Production, U.S. EPA, in draft).

In addition to distinctions in management plans based on the use and value of ground waters, distinctions based on different vulnerability of ground water may be appropriate.

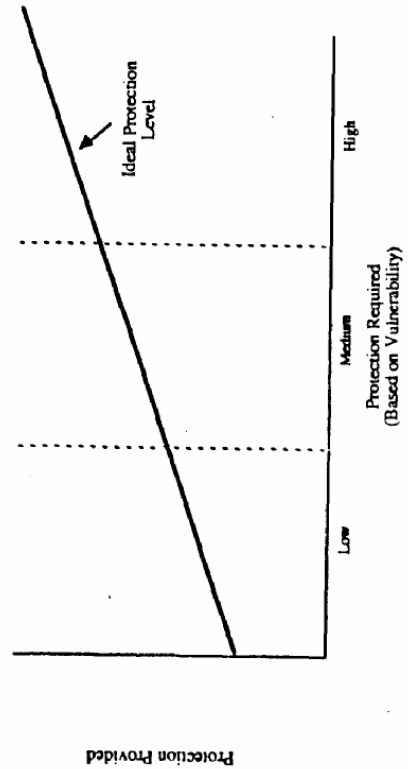
Figure II-13 illustrates an ideal approach to managing pesticides based on differences in ground-water vulnerability to contamination. Ideally, prevention measures would be tailored so that they provide the optimum level of protection without undue restrictions. Any protective measures above this optimum line for a given level of vulnerability would provide more protection than is actually needed. Protective measures below this optimum line for a given level of vulnerability would provide less protection than is actually needed. This graph is used in the following presentation of three possible management approaches for addressing the variability in ground-water vulnerability:

a) **Uniform Approach** - A uniform approach essentially ignores area variability in vulnerability and applies the same prevention measures uniformly to all areas. If EPA relied on a uniform national approach to prevent ground-water contamination by pesticides, it would have to decide if its prevention decisions should be based on a worst-case situation of high vulnerability (Figure II-14a) or on a moderate case of medium vulnerability (Figure II-14b).

A worst-case basis could result in a great deal of overprotection for less vulnerable areas, while a moderate-case basis could result in both overprotection of low-vulnerability areas and underprotection of high-vulnerability areas. The obvious drawback of underprotection is the likelihood of ground-water contamination exceeding acceptable levels as defined by EPA's environmental goal. The problem with overprotection is that it could result in the loss of valuable pesticide uses in important farming areas of the country -- a situation that would not be compatible with the intent of FIFRA.

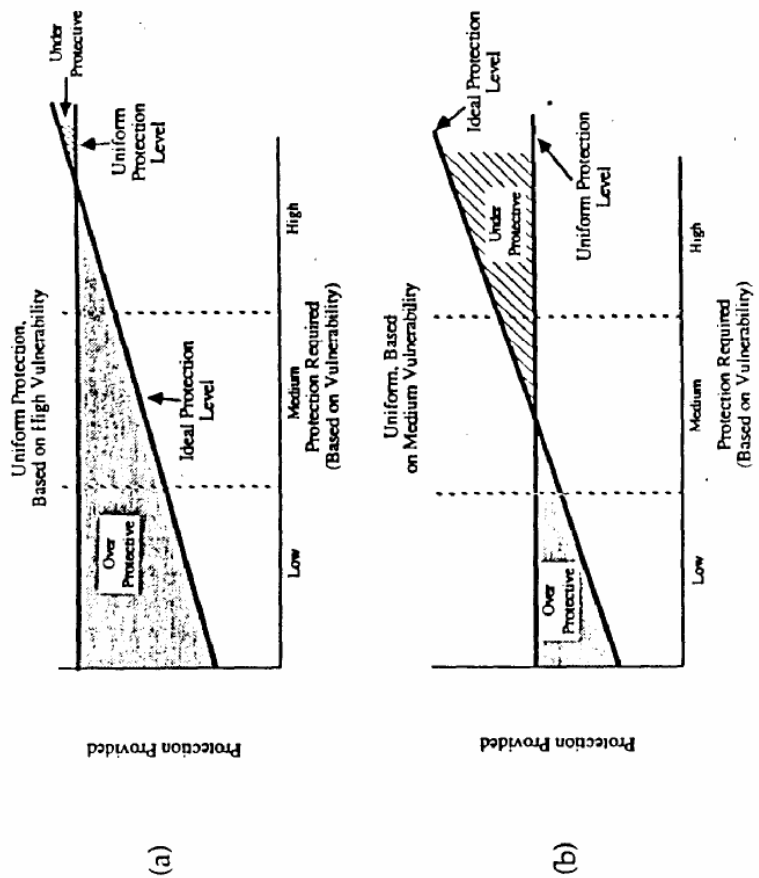
Figure II-13

"Ideal" Protection



Vulnerability-based Uniform Approaches

Figure II-14



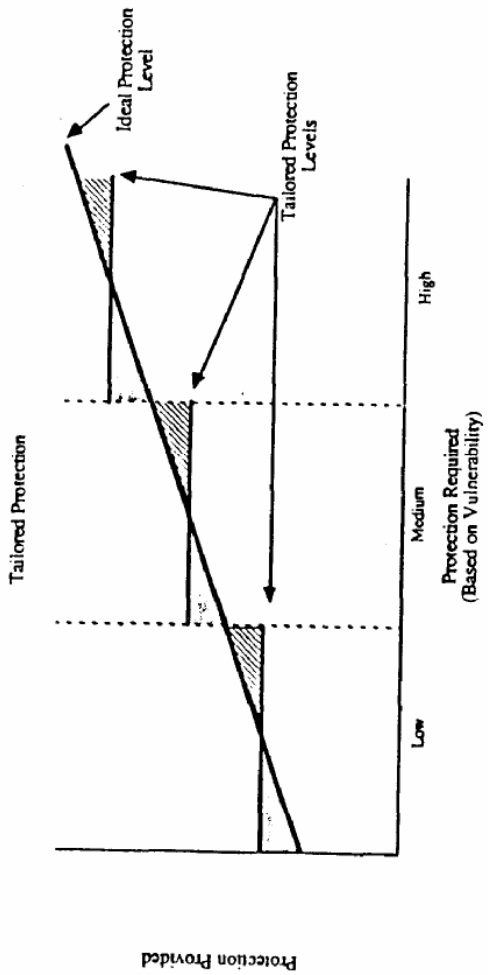
b) Uniform Baseline Prevention Measures with Local Exemptions and Additional Special Measures - Under this option, uniform baseline measures would be established for a pesticide in the same manner as the above option, but area-specific exemptions would be allowed for those places that would otherwise be overprotected. Such an approach could be implemented through a permit system in which exemptions from baseline requirements would be allowed for less vulnerable areas. Additional special measures could be applied on a case-by-case basis to those areas that would otherwise be underprotected. These additional measures could be specified on a label and the user made responsible for determining if they are applicable to the user's particular area.

While addressing some of the concerns for overprotection and underprotection of the previous option, this approach has some major limitations. A permit system carries major administrative costs and can place significant burdens on pesticide users. It would be highly impracticable for EPA to operate a national system of area-specific permits. Having the user determine the applicability of more restrictive measures could result in compliance problems. The user may not have the training to determine if the user's area is more vulnerable than the general case and, therefore, underprotected by the uniform measures.

c) Differential Approach (Figure II-15) - A third approach for addressing area variability is to tailor prevention measures to different levels of ground-water vulnerability. The number of vulnerability levels is practicably limited by: (1) the technical ability to accurately differentiate vulnerability; and (2) the number of different prevention measures that could reasonably be used to provide differential protection. Figure II-15 divides ground water into three different vulnerability levels. A different degree of stringency in prevention measures is then applied to each of these three levels of ground-water vulnerability. While there is still a likelihood of underprotection and overprotection measures for any given area, the number of such measures would be reduced in comparison to the first two options discussed above.

Figure II-15

Tailored Preventive Measures Based on Vulnerability



This option requires the designation and mapping of specific areas, based on ground water vulnerability, as well as the development of differential measures for each level of vulnerable ground water. The success of this option depends to a large extent on the degree of resolution (i.e., county, farm, acre, etc.) in designating and mapping local vulnerability. Note that such mapping would be in addition to mapping of ground waters by their use and value.

Vulnerability to pesticide contamination may be fairly uniform across some large areas, while in other areas it may vary on a farm-by-farm basis or even on an acre-by-acre basis. Figure II-16 presents the different degrees of resolution that could be used as the basis for differentiating agricultural areas by relative vulnerability. At one end of the spectrum is resolution at the national level, which as previously described is the Agency's basis for addressing dietary and applicator exposure concerns. At the other end of the spectrum is resolution at the level of individual acres. Although making determinations of vulnerability at the highest degree of resolution would be the preferred technical basis for management, the sheer number of decisions required by such an approach could be overwhelming (See Figure II-17). EPA may be able to manage a differential approach to pesticide use at one degree of resolution, whereas a State may be successful in conducting a management program at a much higher degree of resolution. A State should also be in a better position to make decisions on the use and value of ground water in a given location. Who should determine the vulnerability and the use and value of ground water in an area and who should manage a differential approach are the subjects of the second strategic question.

2. <u>What Are the Appropriate Federal/State Roles?</u>

The options the Agency has considered for Federal and State roles in addressing ground-water contamination using a differential approach are as follows:

Figure II-16

Level of Resolution

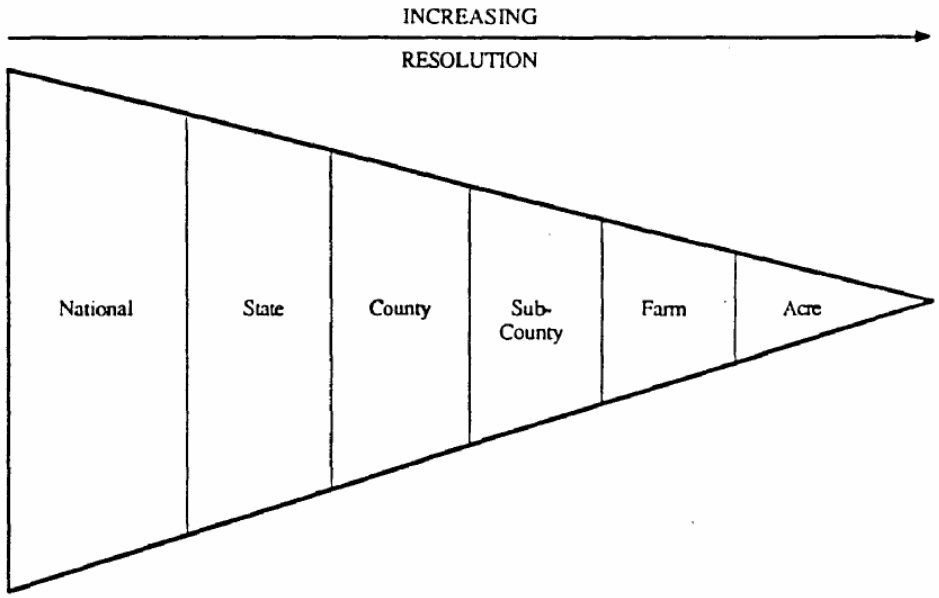
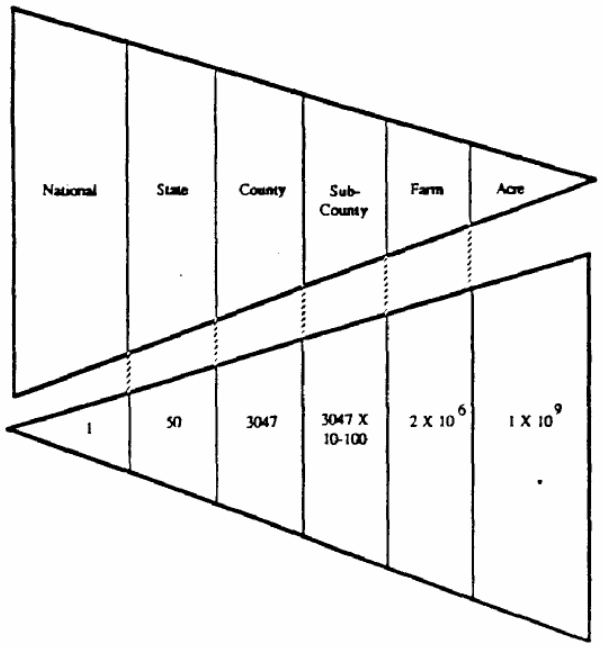


Figure II-17

Level of Resolution



a) **EPA Establishes Differential Measures/User Determines Applicability** - In this approach (Figure II-18), the Agency would establish differential protective measures for a pesticide based on ground-water use and value considerations and/or different levels of vulnerability of the ground water where the pesticide is being used or proposed for use. The Agency may decide that certain pesticides cannot be used in areas of high use and value and/or high vulnerability. For moderately vulnerable areas, the use of the pesticide could be subject to special restrictions, such as changes in the rate, timing, or method of application. Furthermore, representative monitoring of ground water for the pesticide in these moderately vulnerable areas could be required of the registrant to ensure that no threat of unacceptable contamination emerges. For low vulnerability areas, special ground-water protection measures might not be required, although there might be applicable generic requirements, such as a requirement for special measures near drinking water wells.

An important characteristic of this option is that the user would be primarily responsible for determining the applicability of differential requirements based on a required assessment of local vulnerability and the user's location within an area of "high priority ground waters." The user would base a decision on label directions and possibly on supplemental instruction or training. One problem with this option is that most users do not have the scientific background in hydrogeology or environmental fate processes to make accurate field decisions. With this option, directions must be provided that translate technical assessments of ground-water vulnerability into directions that a user can understand and apply. However, determinations of ground-water vulnerability to pesticide contamination are very complex, and simple but effective label directions for users are difficult. Because of these constraints, implementing this option could likely result in misuse and possible unacceptable contamination of ground water.

b) **EPA Specifies Differential Measures for Individual Counties or States; Users Determine Applicability of EPA-Specified Sub-County Measures** (Figure II-18b) - As with the previous option, the Agency would develop differential prevention measures based on ground-water use and value and/or

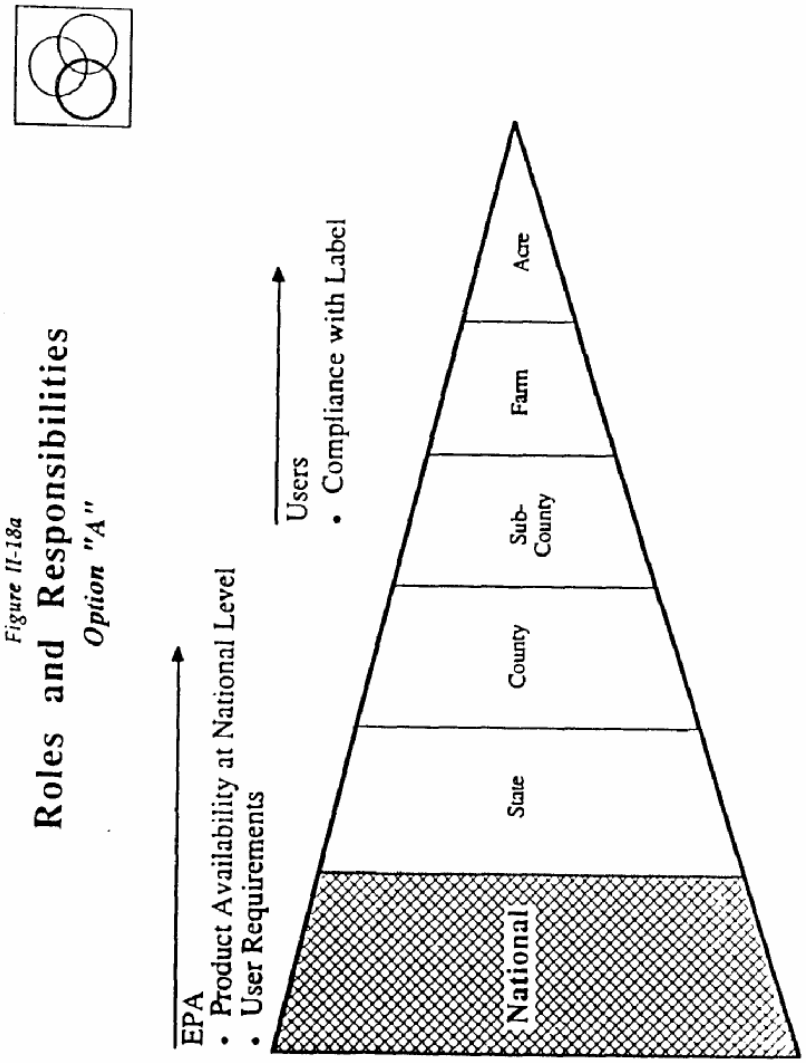


Figure II-18a

Roles and Responsibilities

Option "A"

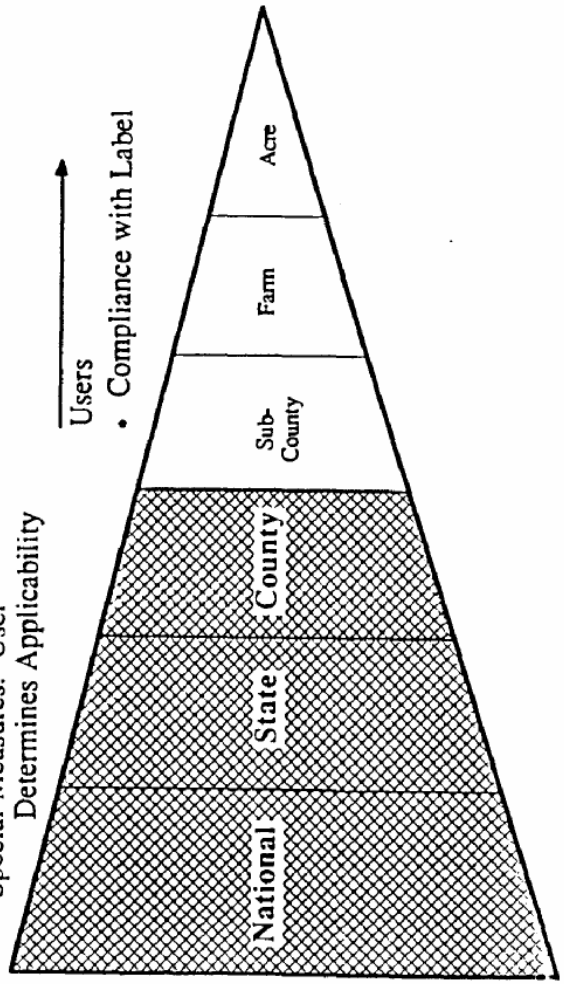
Figure II-18b

Roles and Responsibilities

Option "B"

EPA
- Product Availability at National, State, or County Level
- User Requirements
  - -- National, State, or County Measures
  - -- Special Measures: User Determines Applicability

Users
- Compliance with Label



different degrees of vulnerability, but in this option the Agency would identify or map vulnerability areas on a county basis. This information would be provided to the user on the label, supplemental labeling, or by other means.

While EPA's designation of ground-water vulnerability could be based on sub-county assessments, the actual management of pesticide use could only occur, at best, at the county level because of administrative factors, such as labeling constraints and enforcement considerations. In fact, there might be certain situations in which EPA would decide to apply the same protection measures to an entire State as a result of these administrative difficulties. At this level of resolution, EPA would base minimum county- or State-wide measures on the assumption that all ground waters in the area are, at least, a current or potential drinking water source.

Since the vulnerability within a county can vary greatly, this approach could unnecessarily apply stringent measures, including local bans, to sub-county areas that are less vulnerable than the average for the county in which they are located. Similarly, such variation could result in underprotection for sub-county areas more vulnerable than a county average. This latter possibility could cause the Agency to make overly conservative decisions when classifying counties based on vulnerability. As with the first option, the user would be required to make difficult location-specific judgments on the applicability of prevention measures that would be more stringent than the minimal county-wide requirements because of site-specific vulnerability or the user's location within an area of "high priority ground water."

c) State Specifies Differential Measures for Sub-County Areas Based on EPA Criteria (Figure II-18c) - With this option, the State would have the dominant role in determining differential prevention measures, but such measures would be based on EPA criteria. The States would identify and map their ground waters in terms of use, value and vulnerability and provide pesticide users with explicit directions on where and how pesticides could be applied.

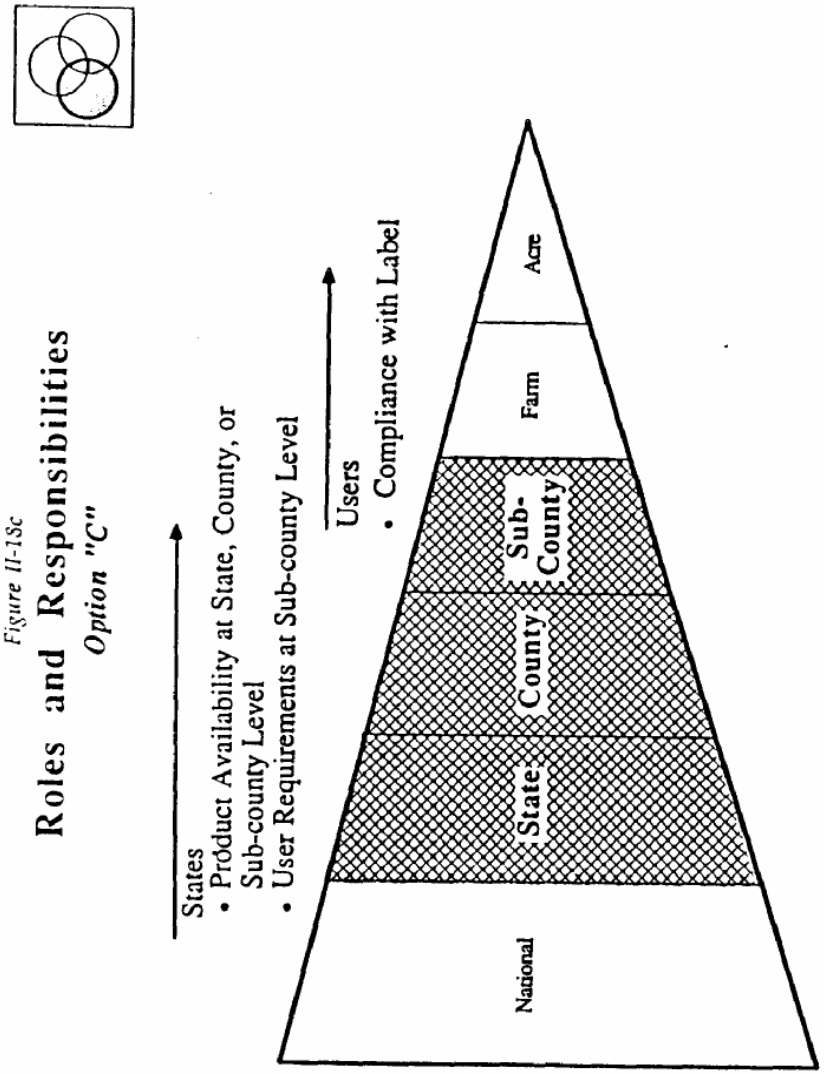


Figure II-18c

The States should be able to provide a differential management approach based on highly-specific area designation of ground-water vulnerability, use and value. As such, the user in the field would have more explicit directions as to where and how the pesticide could be used, and would not have to determine local vulnerability. Another advantage to this option is that the State could also closely tie user training and enforcement efforts to its own differential approach.

Although the States are in a better position than EPA to understand local conditions and establish a differential approach that is highly tailored to these conditions, there are a number of drawbacks to this option. These include the potential lack of uniformity among States and possible political and legislative constraints within particular States, which may jeopardize obtainment of EPA's environmental goal of protecting the ground-water resource. The option could also result in the inefficient use of State resources because of unnecessary duplicative efforts in developing pesticide prevention measures.

SECTION 2: EPA'S PROPOSED POSITION

EPA will employ each of the three basic management approaches, described above, to prevent pesticides from reaching unacceptable levels in ground water. EPA will continue to develop uniform, national measures, but will also begin to implement a differential management approach at the county level or, in some cases, at the State level. A State will have the opportunity to take a stronger role in local pesticide management through the development of a State management plan. The responsibilities of pesticide users and registrants will grow along with an increasing reliance on monitoring information.

EPA's specific strategic policies are as follows:

1. EPA will continue to take uniform action for pesticides causing widespread, national concerns and will establish generic prevention measures to address certain pesticide use

and disposal practices that pose ground-water threats independent of area-specific vulnerability. National uniform measures will not be differentiated on the basis of local differences.

Obviously, when a pesticide's use poses a serious, widespread ground-water threat, EPA will take steps at the national level and, if necessary, impose a regional or even a national cancellation of the use of the pesticide. Of particular national concern are those general ground-water threats that are not dependent on local vulnerability and require generic prevention measures. For example, EPA has proposed regulations for the application of pesticides through irrigation waters, often referred to as chemigation. This practice can directly introduce pesticides into ground water if precautions, such as anti-back siphoning devices, are not used.

EPA is also developing a rule to restrict the use of potential leaching pesticides to certified applicators. The Agency is also considering the development of national rules to address the potential problem of pesticide applications too near a well which can result in "run-in" of pesticides into ground water, a particular problem in areas with uncapped, abandoned wells. Finally, EPA is considering additional generic rules and guidelines for pesticide disposal and for preventing and handling leaks and spills, all of which can be important sources of a number of pesticide concerns, including ground-water contamination. For the disposal concern, EPA is looking at its options under both FIFRA and RCRA.

2. EPA will also adopt a new approach of differential management of pesticide use based on differences in ground-water use, value and vulnerability to an extent that is administratively feasible. County- or State-level measures based on ground-water vulnerability will be employed, including use cancellations. In some cases, the user will have to determine the applicability of differential prevention measures based on interpretation of local field conditions and the user's location within areas of "high priority ground waters."

When a pesticide poses serious but localized risks due to local ground-water vulnerability, an appropriate prevention approach is to remove the threat where it exists and allow the use of the pesticide in other areas to continue without undue restrictions. EPA's prevention measures will thus be differentiated in their stringency on the basis of relative vulnerability of local ground water to pesticide contamination. Because of a number of administrative limitations, as mentioned earlier, EPA's prevention measures will generally be differentiated at the county or State level. EPA will do its best to assess the vulnerability of pesticide usage areas within counties and to determine the appropriate mix of prevention measures necessary to protect ground waters within the entire county. At this level of aggregation, EPA will have to assume that all ground water, at a minimum, is a current or potential drinking water source requiring protection.

Prevention measures will include minimum, county-wide requirements that must be followed by all users within a designated county. For some counties, the minimum measure may be a ban on a pesticide's use. For other counties, the pesticide's use will be allowed, but minimum county-wide measures will range from general advisories to extensive requirements involving changes in the rate, timing, or method of application or other agricultural practices that can influence pesticide movement to ground water. Additional measures, beyond minimum county-wide requirements, could also be required of users in certain areas of a county. The determination of the applicability of these additional measures will be the responsibility of the user and will be based on site-specific factors, such as the presence of ground-water conditions more vulnerable than generally found in a county or the need to protect certain "high priority ground waters," such as those within a drinking water wellhead protection area.

In some cases, EPA may apply minimum prevention measures, including geographic bans, to an entire State. Such a situation may occur where there is generally uniform ground-water vulnerability to contamination by a pesticide in all usage areas of a State. State-wide measures could also occur where EPA believes the State does not have the ability to support a differential approach to the management of pesticides, particularly from enforcement and user education perspectives.

3. EPA will encourage the development of a strong State role in area-specific management of pesticide use to protect the ground-water resource. State pesticide management plans will be used to strengthen EPA's foundation for decisions on pesticide use. In some cases, the use of a pesticide in a State will depend on the existence of and adequacy of such a State management plan. Under its management plan, a State will develop and implement highly tailored prevention measures based on local differences in ground-water use, value and vulnerability.

As discussed earlier, there are a number of limitations to an EPA-directed differential management approach for pesticides at the county or state level. Such an approach can prohibit or restrict the use of a pesticide unnecessarily in some areas. This approach also places a major burden on the user to determine the applicability of more restrictive measures that are based on site-specific conditions that the user must assess. These disadvantages could result in noncompliance and a failure of this approach to meet EPA's environmental goal of protecting the ground-water resource. Therefore, the Agency is looking for strong State involvement to determine where a pesticide can, and cannot, be used without ground-water restrictions. This alternative cooperative approach between EPA and a State will lessen the burden on the user to determine the applicability of site-specific measures, and in turn, reduce noncompliance and increase the likelihood of attainment of EPA's environmental goal.

States often can have the technical expertise and have more specific knowledge of local ground-water conditions and agricultural practices than EPA. States are also likely to be in a better position to work more directly with the user to ensure that potential ground-water contamination problems are identified and that pesticides are properly used to avoid these problems. EPA wants to strengthen and utilize the unique position of the States in efforts to prevent ground-water contamination by encouraging the States to develop pesticide management plans to protect their local ground waters.

Under a State management plan, the State would identify where a pesticide with ground-water contamination concerns is being used or is likely to be used. The State would also use its knowledge of local ground-water resources and determine where protection measures would be differentiated based on local differences in the use and value as well as the vulnerability of ground waters. The State would adopt prevention measures that would prevent unacceptable contamination of current and future drinking water sources as well as ground waters that are ecologically important. As part of its management plan, the State could also identify areas with "high priority ground waters," such as wellhead protection areas, where more stringent measures may be required.

In some cases, the State would obviously have to employ EPA-designated measures for certain types of areas, such as local cancellations of high risk pesticides in highly vulnerable ground-water areas. However, it is EPA's intent that a State generally have the opportunity to select from a broad menu of management measures (Table II-1) and to tailor prevention to local needs. Some of these measures may be Best Management Practices (BMPs) which have been developed and demonstrated by a state, perhaps under EPA's Nonpoint Source Program. Those measures which are chosen by a State will have to be supported by strong, coordinated education and enforcement programs.

Development and implementation of a State management plan will require the active participation of all key state agencies including the departments of agriculture, public health, water, natural resources, or environmental protection. A State's pesticide management plan will be a key component of its overall ground-water protection strategy and should be consistent with its Wellhead Protection Program, if one exists. The State should take a holistic approach to protecting its water resources and realize the important relationship between ground-water protection and surface water quality. The State pesticide management plan should be consistent with any State clean water strategy for protecting surface waters.

State Management Menu

Table II-1

Pesticide Use
• Moratorium Areas
• Wellhead Protection Areas
• Well Set Backs (Buffer Zones)
• Future Well Requirements: Location, Depth, Construction
• Change in Rate of Application
• Change in Timing of Application
• Change in Method of Application
• Advance Notice of Application
• Integrated Pest Management
• Best Management Practices
• Additional Monitoring
• Additional Training and Certification

When deciding on the national registration of a pesticide with ground-water contamination concerns, EPA will consider a State's management plan. EPA will work with each State to determine if a pesticide's use can be managed locally by the State to prevent or reduce the threat of ground-water contamination. In some situations, EPA will require a State-specific label or supplemental labeling with the approved conditions of use based on a State management plan. In other cases, EPA will have to take steps, including possible State-wide cancellations, to control the use of a pesticide that poses a significant ground-water threat if there is no adequate State management plan that can reasonably be expected to prevent or reduce the threat of unacceptable contamination.

While over the longer-term, States may develop generic management plans that can be applied to any specific pesticide, the Agency expects that the States will adopt chemical-specific management schemes for those pesticides that pose major ground-water risks. As EPA and the States gain practical experience with the concept of State management plans, and as our understanding of approaches for mitigation of pesticide contamination increases, the need for chemical-specific schemes may diminish.

Development of a management plan does not necessarily have to be accomplished by each State acting alone. Where ground-water resources are continuous under State boundaries and contamination problems in one State could threaten the quality of waters of another State, it would make sense for adjacent States to coordinate their State plan development. In the case of chemical-specific schemes, certain States may also find multi-State or regional management schemes desirable to obtain or continue EPA's registration of a pesticide that is important to a regional crop.

One of EPA's key responsibilities under this approach will be to provide as much technical support to the States as possible, including information on the physical/chemical/toxicological characteristics of pesticides of concern and their behavior in the environment. To meet this responsibility, EPA will keep abreast of monitoring information to detect new pesticide contamination concerns as well as to assess the effectiveness of various management approaches. The Agency will also keep the States informed of national trends

and will facilitate exchange of information between the States on the problems and successes of different local management approaches. Through the Office of Ground-Water Protection's Wellhead Protection Program, and through several CWA grant programs, including the nonpoint source authorities, EPA will provide financial and technical support to States for the development and implementation of their State management plans. The Agency will also coordinate with other Federal agencies, such as USDA and USGS, to conduct research and to communicate results to the States on pesticide behavior, monitoring methods, best management practices, and other technological information needs.

Table II-2 provides scenarios for how pesticides that pose a moderate to high ground-water threat would be managed in States with different vulnerability situations. Two options are presented: 1) no State plan; and 2) State plan in place.

4. <u>The user's role in preventing ground-water contamination is pivotal; the user's decisionmaking in the field must be better supported.</u>

Regardless of whether a pesticide is managed under an EPA-State cooperative management approach or an EPA-only approach, the user will continue to be in the unique position of directly controlling the use of pesticides in the field. Thus, the user has the responsibility to seek better understanding of ground-water concerns. At a minimum, a user must follow the instructions found on the label of each pesticide product and when required, be trained and certified in the proper use of the pesticide.

However, we cannot expect the typical pesticide user to make highly technical decisions on his own. The best approach is to provide the user with clear instructions either to not use a pesticide or to use it in a certain manner in highly specified areas. Such areas should be familiar to the user, or a map should be provided that clearly delineates the area. To some degree, a State's management plan should have the capability to provide such specificity.

Table II-2

Comparison of Possible Outcomes for Pesticide Use in a State

Situation	No State Plan	State Management Plan
High-risk pesticide State has extensive high-vulnerability areas	Probable statewide cancellation	Possible special state management measures in lieu of EPA cancellation
High-risk pesticide State has mixture of high- to moderate-vulnerability areas	Possible statewide cancellation Probable county cancellations County-based use requirements Other use requirements[1] Monitoring requirements	Possible county cancellations Area-specific use moratoriums Area-specific use requirements Monitoring requirements
Moderate-risk pesticide State has primarily moderate-vulnerability areas	Possible county cancellations County-based use requirements Other use requirements Monitoring requirements	Possible area-specific use moratoriums Area-specific use requirements Possible monitoring requirements

[1] Typical requirements for protection of "high priority areas" such as within the immediate vicinity of drinking water wells. Illustrative protection measures, such as those required for chemigation practices. Finally, these requirements include those measures that may need to be determined on a project-by-project basis, based on the ground water of the specific site.

However, as discussed earlier, the area-specific nature of ground water could still require the user to identify vulnerable ground water in the user's specific fields and to determine if special prevention measures are needed. This will be especially true where the State has not taken an active management role. There are no easy formulas to provide exact "answers" to the user through label instructions alone. The Agency recognizes that it and the States must provide better support to the user for making proper use decisions. USDA, with its existing field network, also can play a key role.

A major vehicle for improving user decisions in the field is applicator training and certification programs. EPA is establishing a generic rule for restricting the use of those pesticides with potential ground-water threats to certified applicators. Working with the States and the Cooperative Extension Service, EPA is attempting to improve and expand training and certification programs so that users may become more aware of ground-water concerns and the measures necessary to protect this vital resource.

5. Registrant responsibilities will need to grow in three areas: (1) technical support for the user in the field; (2) ground-water monitoring to ensure the adequacy of pesticide management plans in protecting ground water; and (3) the development of safer alternative pesticides.

While there are State and Federal programs that can shoulder some of the need, registrants will need to play a greater role in assisting the user in the proper, environmentally sound application of their products.

In the future, registrants will also be expected to conduct representative monitoring of ground water in areas where pesticide use occurs and where ground water may be vulnerable. These studies will be critical to ensure that protection efforts are working. Where there is a potential ground-water contamination concern, certain new registrations may be granted on the condition that the registrant conduct monitoring studies. Continued registration of certain pesticides, under a State management plan, may also hinge on monitoring data to

Table II-3

Responsibilities in the Strategic Prevention Approach

EPA	STATE
Responsibility Level: National, County or State ***Responsibilities:*** • Differential Preventive Measures – Minimum Statewide or Countywide Requirements – User Site Requirements • County, State, or National Cancellations • Generic National Measures for Pesticide Use • Oversight of State Plans • Technical Support to States • Labelling Requirements	***Responsibility Level:*** State, County or Sub-County ***Responsibilities:*** • State Management Plan -- Foundation for EPA Use Decisions – Identify Pesticide Use Locations – Classify & Map Ground Water Resources, Designate Vulnerability – Tailor Prevention Measures to Meet EPA Goal • User Support • Monitoring
USER	**REGISTRANT**
Responsibility Level: Site Specific ***Responsibilities:*** • Additional Understanding of Ground Water Concerns • Close Adherence to Labels • Application Training and Certification as Necessary	***Responsibility Level:*** All ***Responsibilities:*** • Technical Support of User • Ground Water Monitoring • Safer Alternative Pesticides

indicate the environmental adequacy of those management efforts. Registrants may find it beneficial to pool their efforts to establish a joint and effective monitoring capability.

Finally, registrants will be expected to develop safer alternative pesticides that do not pose a threat to ground water. This message will become increasingly obvious to the registrants as the Agency and the States continue to restrict or cancel the uses of more pesticides that threaten the quality of the nation's ground waters.

6. Increased monitoring of pesticides in ground water is critical to the implementation of this strategy. EPA will establish an "early-warning," or "yellow light/red light," approach to prevent further area contamination, once detected. The approach will use the MCL or other EPA-specified protection criteria as the point of reference to evaluate, and when necessary, change pesticide management plans.

Even though the Agency has developed a number of models for predicting ground-water contamination, there is still a great deal of uncertainty in identifying the exact locations of areas vulnerable to contamination and in estimating the levels of contamination that could be reached in the ground waters of these areas. Thus, monitoring of pesticides in this environmental medium is a critical need that can provide the needed feedback to determine the success or failure of pesticide management efforts.

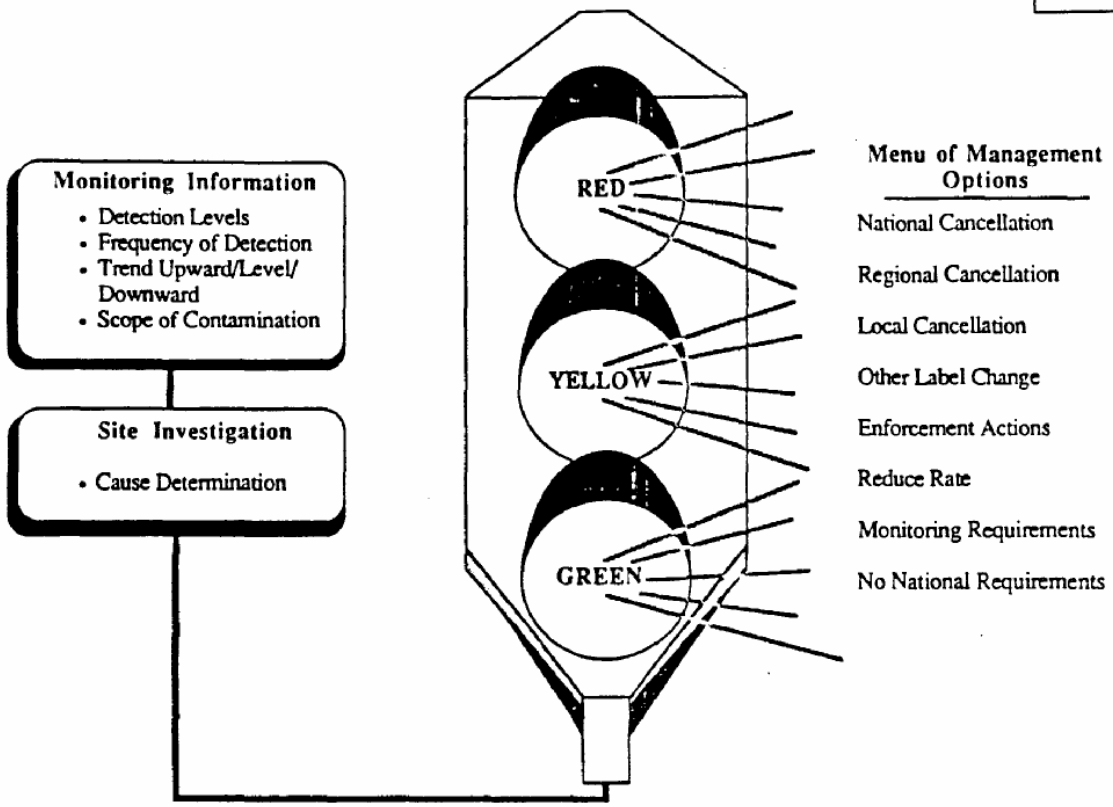
EPA or a State, under its management plan, will direct or conduct monitoring of pesticides in ground water that is representative of where the pesticide use occurs and where there is a potential ground-water problem. When pesticide contamination is found to be moving toward an MCL or other EPA-designated ground-water protection criteria, EPA or the State will revise the pesticide's management plan, as necessary, to prevent further contamination. The stringency of new measures will depend on the likelihood of contamination

reaching or exceeding these reference points in current or future drinking water or ground water of ecological importance. Factors to be considered are the levels found, the number of contamination sites, whether the trend is upward, and the cause, if known (Figure II-19).

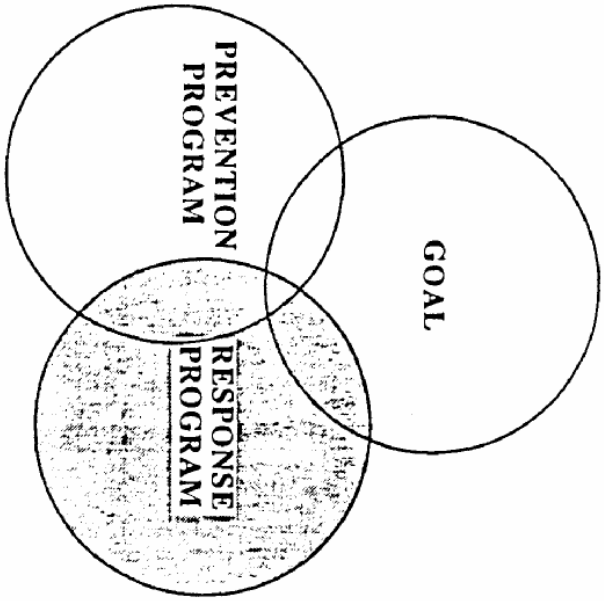
As discussed above, registrants will often be responsible for conducting monitoring in representative areas of a pesticide's use. The registrant may also be required to do site-specific monitoring in an area where contamination has already occurred if the registrant desires to continue the registration of the pesticide in that area or other areas with similar pesticide use characteristics and ground-water vulnerability.

Figure II-19

EPA's "Yellow Light/Red Light" Approach



Pesticide Strategy



CHAPTER 3

RESPONSE POLICY AND PROGRAM

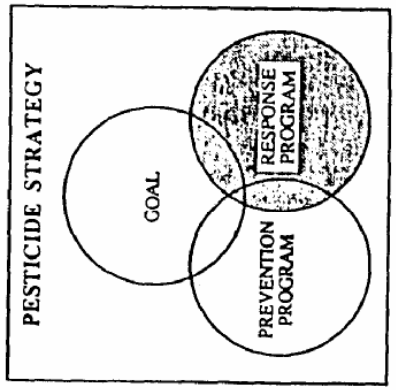
One of the most challenging tasks facing the Agency and the States is developing a strategy for responding to ground-water contamination resulting from normal use of pesticides. EPA's approach will be to work closely with the States in their efforts to remove public health threats. Where a pesticide has reached unacceptable levels, strong actions will be taken to prevent further contamination. The Agency will continue to emphasize the development and enforcement of MCLs to ensure the adequacy of drinking water from public water systems. In the future, the Agency will focus on coordinating enforcement activities under a number of Federal authorities so that responsible parties can be identified and required to take the actions necessary to eliminate imminent health threats. On a case-by-case basis, EPA will assist the States by providing funds for removal actions, including provisions of alternative drinking water, when a imminent public health threat exists.

SECTION 1: FACTORS CONSIDERED

To develop its response strategy, the Agency had to address three questions: what are the appropriate Federal/State roles; what are the appropriate authorities and actions for what type of contamination; and who is liable for contamination (Figure II-20). To address these questions, several site-specific conditions must be considered, including: the type of ground water affected, the source or circumstances that resulted in contamination, and the appropriate type and degree of response needed.

The type of ground water that has been contaminated is a critical consideration in determining both the level of concern and the authorities available to conduct or require a response action. For instance, the SDWA addresses only the contamination of public water systems, defined as those systems providing drinking water to 15 or more permanent service connections or 25 people a day for at least 60 days a year. Under the SDWA, public water systems are required to provide water satisfying drinking water standards (i.e., no contamination exceeding MCLs). Although SDWA regulations do not

Figure II-20



Response Program Issues:

- What Are the Appropriate Federal/State Roles
- What Are the Appropriate Authorities and Actions for What Type of Contamination
- Who is Liable for Contamination

apply to private wells, most States use these or their own similar standards to inform well owners of possible health risks, and in some cases, State laws may require closure of private wells that do not meet drinking water standards.

The source and circumstances of contamination at a given site are other important considerations in determining the appropriate authority for responding to contamination. Under the Comprehensive Emergency Response, Compensation and Liability Act (CERCLA), EPA has the authority to clean-up contamination and recover the cost of these actions from responsible parties. Cost-recovery, however, is specifically excluded when the contamination is a result of pesticide use in accordance with label requirements. Recovery of cost from responsible parties is a possibility, however, when contamination is a result of illegal disposal or leaks and spills.

The type and degree of response must be based on the specifics of each case. The type of response needed bears on all of the three questions -- Federal/State roles, appropriate authority, and who will be liable. An initial response action can be limited to investigating the site to evaluate the extent and severity of the contamination problem. Should a site pose an immediate public health threat, corrective actions can be taken such as providing a temporary, alternative source of drinking water. Eventually, more permanent solutions may have to be considered, including the establishment of long-term capacity to treat the contaminated water as it is drawn for actual use. In this regard, aquifer restoration will be a very costly, if not an impracticable, type of response when contamination is widespread.

SECTION 2: EPA's PROPOSED POSITION

EPA's response strategy will be to address the problem of ground-water contamination on a number of fronts. The Agency will exercise its own authorities and will also encourage and assist State efforts to remove imminent public health threats posed by pesticides in drinking water. Specifically, the Agency proposes the following policies:

1. Where a pesticide has reached unacceptable levels in ground water, strong actions must be taken to stop further

contamination. These actions can range from enforcement actions to modification of the way a pesticide is managed, including geographic restrictions on the pesticide's use.

An essential part of any response action is eliminating the threat of further contamination of ground water. As discussed in the prevention section, the capacity to respond to reports of ground-water contamination must be developed. When a pesticide is initially detected in ground water, a response should include increased monitoring as well as site-specific determinations as to the extent, source and circumstances of the contamination. Enforcement actions should be taken to prevent further incidents where contamination is found to be a result of misuse. On the other hand, where contamination is the result of approved use of a pesticide, modifications in EPA's or a State's management of the pesticide must occur to minimize the likelihood of further contamination. When a pesticide level has reached or exceeded an MCL or other reference point as a result of normal agricultural use, a more aggressive stance needs to be taken, including the possibility of prohibiting further use of the pesticide in the affected areas.

When the State lacks a management plan to respond to incidents of contamination, EPA will have to decide whether to allow continued use of a pesticide in an affected area. Because the Agency has limited capacity to make site-specific decisions, its choices would most likely be made at a more aggregated level, such as a county or perhaps even an entire State. In this event, infrequent occurrences of contamination in an area may not be sufficient for EPA to undertake county-wide or State-wide cancellation of a pesticide's use. On the other hand, when repeated incidents clearly point to a ground-water threat from a registered use in an area, EPA would have to consider cancelling the use of the pesticide in an entire county or State. This situation underscores the benefits of a State management plan in which area use decisions can be tailored to local circumstances.

2. EPA will encourage a strong State role in responding to contamination. A State's management plan should consider the development of a valid corrective response scheme.

Because a State is more attuned to local conditions, it should have the dominant role in ensuring that corrective actions are taken to address threats to it's citizens' health posed by pesticide contamination of ground water. At a minimum, a State needs to take steps to identify and track ground- water contamination in order to determine if current drinking water wells will be affected and to notify users of the potential health risks. By integrating its federally delegated authorities and resources with its own authorities and resources, a State can provide an effective overall scheme for responding to, and where needed, correcting, public health problems resulting from pesticide contamination of ground waters. In particular, the response scheme should identify the resources and the appropriate corrective actions needed when contamination is found as a result of the approved use of a pesticide.

With respect to funding for response actions, the Agency believes that States should have the lead. In establishing a corrective response capability, a State needs to select from a number of alternative mechanisms. In this regard, a number of States have already adopted or are considering funding mechanisms, such as general State revenues, a State trust fund generated by a tax on pesticide use, or a requirement for users or registrants, jointly or alone, to provide corrective actions.

EPA is also considering the development of a number of assistance measures to indirectly support States in their corrective response efforts. These measures range from site-specific and general technical assistance to providing public information and education. Table II-4 outlines some of these measures.

In summary, a State's corrective response scheme should be a key component of its pesticide management plan. The presence of such a response scheme does not, however, change the primary objective or emphasis in a State management plan from one of prevention. Recognizing that contamination is still a possibility even under the best management efforts, States should develop corrective mechanisms to respond effectively should this possibility become a

Table II-4

Indirect EPA Response Options

Technical Assistance

Site-Specific:

- Review of corrective action plans developed by State/local authorities
- Guidelines for sample analysis and data interpretation
- Development of health advisory notices

General:

- Development of pesticide fact sheet
- Development of treatment technology
- Development of State/local training programs for monitoring, risk assessment, and mitigation methods
- Contingency Plan guidelines
- Information on pesticide contaminations

Public Information/Education Programs

- Telephone hotline for public inquiries
- Pollution insurance information for ground water users
- Low-interest loan information for ground water users
- Press releases on contamination problems/solutions

reality. In the event that a State lacks a corrective response scheme, EPA may consider the option of denying registration, for use in that State, of pesticides that could pose major threats to ground water.

3. EPA will continue to develop and stress enforcement of MCLs. Under the SDWA's emergency powers, EPA will consider issuing orders requiring responsible parties to provide alternative water supplies when levels of pesticides present an imminent and substantial endangerment to public health.

In response to the 1986 amendments to the SDWA, EPA is accelerating the development of MCLs, particularly those for pesticides considered to be potential drinking water contaminants. Once these MCLs are finalized, the States will be able to better assess the quality of drinking water supplied by public water systems. In those cases where a public water system draws on a contaminated ground-water supply, the State must require the system to reduce contamination to acceptable levels before allowing public consumption of the water. A system may treat the water to remove the contamination, blend the water with noncontaminated water to reduce levels in delivered water, or close the well and find an alternative water supply. In some cases, it may not be feasible for a drinking water system to comply with such requirements, and States may need to close the system or provide resources to the system to comply with these requirements. Exemptions to meeting the MCL can be allowed by a State during the time it takes for a system to implement necessary corrective measures, but the system must notify its users that it is providing water with contaminants exceeding MCLs.

Under the 1986 SDWA Amendments, EPA has been given expanded authority to respond to contamination of a public drinking water system or an underground drinking water supply when it may present an imminent and substantial endangerment and when State or local authorities have not acted to protect public health. Under this expanded authority, EPA may issue orders requiring the provision of alternative water supplies by persons who caused or contributed to the endangerment. EPA will consider such action where a public system drawing on pesticide-contaminated ground water poses imminent and substantial endangerment to public health.

4. EPA and the States will place greater emphasis on coordinating FIFRA, SDWA, and CERCLA enforcement activities to identify parties responsible for ground-water contamination as a result of the misuse of pesticides, including illegal disposal or leaks and spills.

Under CERCLA, EPA has the authority to require corrective actions by parties responsible for ground-water contamination as a result of pesticide misuse, including illegal disposal or leaks and spills. The Agency can also recover the costs of cleaning up a site resulting from illegal disposal or leaks and spills. EPA and the States need to take advantage of the CERCLA enforcement authorities by closely coordinating their efforts under FIFRA and the SDWA with those of CERCLA.

5. On a case-by-case basis, EPA may assist States by undertaking CERCLA Fund-financed removal actions to provide alternative drinking water supplies where there is an imminent human health threat.

The Agency may consider on a case-by-case basis providing CERCLA Fund financing for immediate, short-term response actions. Actions under CERCLA's Removal Program can only provide for alternative drinking water and other types of short-term responses to eliminate imminent human health threats. The Agency will seek cost recovery when the contamination is shown to be a result of misuse and a responsible party is identified.

6. The question of who should pay for long-term corrective actions at sites contaminated by the approved use of a pesticide is a legislative question. EPA believes that several aspects of the problem must be considered before a decision can be made.

When contamination of ground water appears to be a result of registered use, and that use was based on sound data and reasonable efforts to predict the potential for contamination, it is not clear who should be considered the responsible party. In this situation, several parties have some involvement,

including the user who applied the pesticide, the registrant who brought the pesticide to market, and EPA and state agencies who registered the product. The well owner may even bear some responsibility if he knowingly placed his well in a high-risk setting.

EPA is not in the position to make liability decisions. This question is one to be resolved by Congress or State legislatures. When contamination is a result of use in accordance with the label, all the parties described above could be considered to have some responsibility. Liability in this situation, perhaps, should be limited to mitigating imminent public health threats with provisions for alternative drinking water or point-of-use water treatment.

Table II-5

Pesticides In Ground Water
EPA's Response Strategy

EPA	STATES	LEGISLATION (FEDERAL/STATE)
Registration modification to prevent further area contamination Indirect responses of technical assistance to States and public education efforts Case-by-case assistance to States, under CERCLA Removal Program, to address imminent public health threats primarily by providing alternative water supplies Better coordination of enforcement activities under FIFRA, RCRA, SDWA, and CERCLA to identify parties responsible for contamination resulting from misuse including illegal disposal or leaks and spills	Modification of pesticide management plan to prevent further area contamination Corrective action scheme as part of pesticide management plan; Decision on funding source for responses to imminent health threats resulting from ground water contaminated by registered pesticide use Better coordination of enforcement activities under FIFRA, RCRA, SDWA, and CERCLA to identify responsible parties for contamination resulting from misuse including illegal disposal or leaks and spills	Need to establish how response to contamination from approved pesticide use will be funded

ACRONYMS

ARS	- Agricultural Research Service
ASCE	- American Society of Civil Engineers
ASCS	- Agriculture Stabilization & Conservation Service
AWRA	- American Water Resources Association
BOR	- Bureau of Reclamation
CERCLA	- Comprehensive Environmental Response, Compensation and Liability Act
CWA	- Clean Water Act
CWS	- Community Water System
DBCP	- Dibromochloropropane
DDT	- Dichloro-diphenyl-trichloroethane
DOI	- U.S. Department of Interior
EDB	- Ethylene dibromide
EPA	- Environmental Protection Agency
FCCSET	- Federal Coordination Council for Science, Engineering, and Technology
FIFRA	- Federal Insecticide, Fungicide, and Rodenticide Act
FWS	- Fish & Wildlife Service
H.R.	- House of Representatives
MCLs	- Maximum contaminant levels
NOEL	- No observable effect level
NPS	- Nonpoint source
OTA	- Office of Technology Assessment
RCRA	- Resource Conservation & Recovery Act
SDWA	- Safe Drinking Water Act
UDC	- University of the District of Columbia
USGS	- U.S. Geological Survey of the Department of Interior
USDA	- U.S. Department of Agriculture
WRRC	- Water Resources Research Center

GLOSSARY

Acre-foot. A unit quantity of water; an amount which would cover 1 acre to a depth of 1 foot; consists of 326,000 gallons.

Alkalinity. A measure of the weight of carbonates in water usually given in milligrams per liter (mg/l) as calcium carbonate and represents the buffering capacity of the water. Water with alkalinity less than 60 mg/l is considered soft and greater than 60mg/l is considered hard.

Biochemical Oxygen demand (BOD). A microbiological measurement of the quantity of dissolved oxygen, espressed in milligrams per liter (mg/l), required to stabilize the demand for oxygen in a water sample, usually resulting from the process of microorganisms consuming organic matter (decomposition) and utilizing the available dissolved oxygen in the oxidation process. BOD is expressed as a result of five day (BOD5) incubation of the sample at 20 degrees centigrade.

Consumptive use. Use of water resulting in a large proportion of loss to the atmosphere by evapotranspiration. Irrigation is a consumptive use.

DDT. (dichloro-diphenyl-trichloro-ethane) A colorless, odorless, water-soluable crystalline insecticide ($C_{14}H_9 Cl_5$) that may concentrate in certain organisms and whose effects may be toxic.

Dissolved oxygen (DO). The measurement of oxygen in water expressed in mg/l or in percent of saturation under existing ambient conditions, the amount present reflects chemical, physical, and biological activities in the water body. It can only be increased by aeration and the photosynthetic processes of aquatic matter.

Effluent. Wastewater or other liquid, partially or completely treated, or in its natural state, flowing out of a reservoir, basin, treatment plant, or industrial treatment plant, or part thereof.

Evapotranspiration. Water withdrawn from soil by evaporation and plant transpiration. This water is transmitted to the atmosphere as vapor.

Humus. Organic matter in or on a soil; composed of partly or fully decomposed bits of plant tissue derived from plants on or in the soil, or from animal manure.

Infiltration. The flow of a fluid into a substance through pores or small openings. The common use of the word is to denote the flow of water into soil material.

LC_{50}. The <u>concentration</u> of a substance which is <u>lethal</u> to <u>fifty</u>

percent of the test organisms within a specific time period (96 hours).

Leaching. The removal in solution of the more soluble minerals by percolating waters.

Nonpoint source. A discharge wich originates over a broad area, such as storm water runoff from forested, agricultural, and urban area. Distinguished from **point source.**

Pesticides. Chemical compounds used to control undesirable plants and animals. Major categories of pesticides include insecticides, miticides, fungicides, herbicides, and rodenticides. Insecticides and herbicides, which control insects and plants respectively, are the two categories reported.

Point source. A discharge with a definite outlet such as a pipe, tunnel or channel. Usually industrial and/or municipal discharges.

Riparian. Relating to or living or located on the bank of a natural watercourse (as a river) or sometimes of a lake or tidewater.

Runoff. The portion of the precipitation on the surface of the land that ultimately reaches the streams.

Salts. Dissolved chemical substances in water; table salt (sodium chloride) is but one of many such compounds which are found in water.

Sediment. Fragmental mineral material transported or deposited by water or air.

Sedimentation. The process of subsidence and deposition of suspended matter carried by water, wastewater, or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid below the point at which it can transport the suspended material. Also called settling.

Toxicity test. A test which determines the potency of a toxic substance by measuring the intensity of a biological response.

Unconfined aquifer. An aquifer that has a water table; contains unconfined ground water.

Waterfowl. Aquatic or semiaquatic birds of the Anseriformes (ducks, geese, and swans).

Watershed or **drainage area.** An area from which water drains to a single point; in a natural basin, the area contributing flow to a given place or a given point an a stream.

Water table. The top of the zone of saturation in the ground.

Wetlands. Marshes, swamps, and other land-water interface areas that receive enough moisture and sunlight to support extensive growths of specifically adapted vegetation.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS*

The American Society of Civil Engineers is the oldest national engineering society in the United States. Founded in 1852 with only 12 members, the Society was created to disseminate information among engineers who were building the roads, canals, bridges and railroads of a young nation.

Today, ASCE has more than 100,000 members, including some 10,000 of whom are spread throughout the world. Membership, held by individual professional engineers rather than companies or organizations, is divided among consulting engineers and those who work for them; engineers working for federal, state, or local governments; and those involved in engineering research, industry, construction or teaching in universities. The members are organized geographically into 19 regional councils, 80 sections, 141 branches and 211 student chapters and 23 clubs.

ASCE maintains several grades of members: Student Members, Affiliate Members, Associate Members, Members, Fellows, and Honorary Members. To advance form one grade to another, an engineer must attain a certain amount of responsibility in his or her job. "Honorary Member" status is achieved through very distinguished work during a career. Less than 110 of ASCE's 100,000 members have achieved "Honorary Member" status.

The Society is governed by a 28-member Board of Direction. The Board, which includes ASCE officers and representatives elected by the membership, creates all policy for the organization. The policies are implemented by a staff of 150 at ASCE headquarters, located in the United Engineering Building in New York City. The headquarters is led by a Board-appointed Executive Director, Dr. Edward O. Pfrang.

ASCE operates on an annual budget of over $16 million. Publication sales and advertising account for nearly 50 percent of the yearly income. Entrance fees and dues represent 32 percent of the Society's income. The remainder is brought in by conventions, conferences, exhibits, continuing education courses and investments.

ASCE GOALS

Three main goals are the driving force behind ASCE: to train and educate engineers to improve and develop technology to be better as a whole; to promote the dedication and technical capability of its members; and to advance the professional and economic stature of civil engineers.

* Courtesy of: Sheila Brand
Manager, Public Relations
ASCE - New York

AMERICAN WATER RESOURCES ASSOCIATION*

The establishment of the American Water Resources Association (AWRA) was the result of both a vision and a determination on the part of a civil engineer, Dr. Sandor C. Csallany, and a librarian, Dr. Icko Iben. These two individuals perceived the need for a medium which would advance both communication and knowledge in the increasingly important field of water resources. Thus, on the basis of the lack of a national scientific society exclusively devoted to water resources, and a significant increase in national and international activities in the field of water resources, the dream of AWRA became a reality in 1964 with the major objective of fostering a program of information exchange between professionals in water-related disciplines.

Based on this broad objective and with the express support of many engineers and scientists, the American Water Resources Association was officially incorporated on April 6, 1964, as a non-for-profit scientific organization with headquarters in Urbana, Illinois.

In 1974, a National Headquaters was established at the University of Minnesata's St. Anthony Falls Hydraulic Laboratory in Minneapolis, Minnesota; finally, in 1982, the Association established a permanent office at the Renewable Natural Resources Center in Bethesda, Maryland.

Publications have always been a vital part of the Association. The first AWRA publication, Hydata, an international review of the contents of periodicals in the field of water resources, came out in January of 1965. This was followed by Volume I, Number 1, of the Water Resources Bulletin, the journal of AWRA, in March 1965; the AWRA Newsletter, which was first published in 1966 and which eventually re-emerged as a bi-monthly publication entitled Hydata - News and Views; The Water Resources Abstracts in 1967; and Hydor, an annual summary of titles, published in 1968.

To further communication among water resource professionals, AWRA also provided a forum to meet, present papers, and discuss problems. AWRA's first annual meeting was held in Chicago, Illinois at the University of Chicago in 1965 and in the two decades that followed, AWRA continued to sponsor conferences supplemented by a yearly symposium. It also adopted the concept of sections (generally the geographic area of a state) and chapters (students groups).

Today the AWRA currently has over 3,100 members, and in addition, over 800 subscribers to the Water Resources Bulletin. The Association's conferences, symposia, and publications are widely regarded for their technical content and contributions to the water resources community.

* from "American Water Resources Association 1988-89 Membership Directory" - page 141.

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THE D.C. WATER RESOURCES RESEARCH CENTER (WRRC)

Mission:

The DC-WRRC was established at the University of the District of Columbia in 1973 under the Water Research Development Act of 1964. The mission of the DC-WRRC is to provide the District of Columbia with interdisciplinary research support to their solution.

The DC-WRRC major programs include:

- RESEARCH - The DC-WRRC research activities address water resources problems, quantity, quality, legal, social, institutional management of water resources, groundwater, water management and conservation, and issues of fundamental nature.
- TECHNOLOGY TRANSFER AND PUBLIC EDUCATION - designed to increase the communication of technical and scientific knowledge and to promote a general understanding of water resources problems.
- WATER INFORMATION MANAGEMENT SYSTEM - designed to provide a data base and management of information involving the District of Columbia's Water Resources.
- TRAINING - provides the opportunity for faculty members and students in Washington, D.C. to develop their expertise in water resources, as well as in-service training and assistance for internships with water agencies.

For additional information, write or call: Dr. M.H. Watt, Director, DC-WRRC, 4200 Connecticut Ave. N.W., Washington, D.C. 20008. Telephone: (202) 673-3442.