III. Appendices

E. Water Appendix

2. Summary of State Monitoring Programs

The EPA Office of Pesticide Programs (OPP) contacted State Lead Pesticide Agencies in October and November, 2001 to inquire whether OP insecticides were included in ground-water or surface-water monitoring programs over the last decade. When monitoring programs were performed by agencies other than the Lead Pesticide Agency, these were contacted, as well. If OP monitoring data were available for a particular state, OPP inquired whether the data were available over the Internet. Many State Agencies offered to provide data if information has not yet been made available online.

The majority of State monitoring programs included few OPs in their analysis, if any. The majority of States have focused monitoring efforts on ground-water monitoring, including monitoring of five herbicides under the Pesticide Management Plan. With few exceptions, such as California's program to evaluate the effect of OP dormant spray applications on surface-water quality, State monitoring programs have not specifically been targeted to the areas and timing of OP application. Because of this, and because OPs are not yet required by the Safe Water Act to be included as analytes in drinking water sampling, data from State monitoring programs are used as important supplemental data for the OP cumulative drinking-water risk assessment.

a. Alabama

Tony Cofer, Pesticide Administrator of the Alabama Department of Agriculture and Industry Groundwater Protection Section, reports that OPs have not been included in joint sampling with the Alabama Department of Environmental Management. If analysis using immunoassay methods indicated detections of pesticides above 1 ppb, a full gas chromatography scan was done. In addition, a full scan was performed every 10 samples.

Dr. Enid Probst of the Alabama Department of Environmental Management does not recall if OPs were ever detected. However, no more than 1% of samples taken in the program had detections of pesticides other than those in the Pesticide Management Plan. This could be due in part to the detection limits used by the State Agricultural Lab earlier in the program. If OPs were detected at any point, it was not because of systematic, targeted monitoring in OP use areas.

b. Alaska

Rose Lombardi of the Department of Environmental Conservation Pesticide Program reported that Alaska does not look for OPs in drinking water. The pesticide program has done some outreach by offering domestic well testing, mostly for 2,4-D.

c. Arizona

The Agency has not obtained monitoring data from the State of Arizona.

d. Arkansas

Charles Armstrong, Assistant Director of the Arkansas State Plant Board reported that Arkansas has detected a few herbicides in ongoing ground-water monitoring since 1992, but no OPs.

e. California

The California Environmental Protection Agency Department of Pesticide Regulation (CDPR) performed a 10-year study of **rice pesticides in surface water**, which included methyl parathion and malathion. CDPR samples the Colusa Basin Drain, an agricultural discharge channel that collects outflow from rice fields from about 20 to 100 miles north of Sacramento, and west of the Sacramento River. This area is used for many continuous miles of rice monoculture on heavy clay soils.

According to the CDPR, methyl parathion was detected at concentrations of up to 6 ppb in 1989. CDPR was concerned with surface water contamination by a suite of rice pesticides. By the late 1980s, CDPR had instituted a control program to reduce the surface water impacts of rice herbicides. In the early 1990s, the CDPR expanded the program to include rice insecticides.

The program includes both irrigation and application controls to reduce direct input of pesticides to the Colusa Basin Drain, which drains to the Sacramento River. Rice farmers are required to hold water on flooded rice fields for prescribed periods of time before releasing it to the drainage system, periods which depend on the pesticides applied. The holding time for methyl parathion is 24 days, but it is held longer if applied concurrently with another pesticide that must be held longer. A voluntary holding time of 4 days is suggested for malathion. Application controls include requirements such as positive shutoff systems for aircraft nozzles, use of drift control agents, and a 300-foot buffer from water bodies for aerial applications.

CDPR has seen measurable improvements in the samples they have taken each year from early or mid-April to mid-June. For instance, the peak concentration of methyl parathion detected in 1996 was 0.12 ppb. A maximum concentration of 0.107 ppb of methyl parathion was detected in 32 samples taken in 1997. A single detection of <0.1 ug/l of malathion was detected in 1997. These data reflect successful mitigation, and also a reduction in methyl parathion use in the area over 15 years.

The California Department of Pesticide Regulation and the USGS have ongoing studies investigating OP contamination from winter use as a **dormant spray to tree fruits and tree nuts**. Since the series of CDPR dormant spray studies focus sampling on pesticides used in the area, coinciding with when they were applied, the frequency and concentrations of OP detections have both been relatively high. For instance, in sampling in the winters of 1991-1992 and 1992-1993, diazinon, methidathion and chlorpyrifos were detected in 72, 18 and 10% of 108 samples collected in the San Joaquin River Basin, respectively. Dimethoate was detected in 60% of samples taken in the watershed in the summer of 1992, at concentrations up to 2.4 ug/l. Azinphos-methyl, chlorpyrifos, diazinon and methidathion were also detected in summer sampling.

Sampling in the Sacramento River watershed has also led to detections of OPs from dormant spray use. Diazinon and methidathion, the two most importan tree fruit and tree nut dormant spray insecticides in the watershed, were detected at levels toxic to some aquatic invertebrates. Concentrations and frequency of detection of diazinon was greater than that of methidathion. Details of the detection of diazinon in studies performed by the State of California can be found in the diazinon Reregistration Eligibility Document, which is available on the internet at http://www.epa.gov/pesticides/op/status.htm .

Frank Spurlock of the CDEP has written a paper on the findings of chlorpyrifos and diazinon in surface water. This paper, which has not yet been published, is a summary of about 30 monitoring studies, including samples from the Sacramento and San Joaquin Rivers and their tributaries, as well as agricultural drains. The monitoring was predominantly from streams affected by agricultural runoff. Urban data is limited, but urban concentrations were much higher.

Agricultural loading was the most significant load of these chemicals in the Sacramento River. Small streams in the Sacramento basin had the highest agricultural detections. Of approximately 3900 individual samples for diazinon a very small percentage exceeded the lifetime Health Advisory of 0.6 ppb in rivers and tributaries. None of the 3700 samples for chlorpyrifos had concentrations that exceeded the lifetime Heath Advisory of 20 ppb. Overall, concentrations of chlorpyrifos were lower than those of diazinon. In general, based on analysis which will be available when the paper is published, overall concentrations in the winter application months have declined since a decade ago, corresponding with reductions in use (Frank Spurlock, personal communication).

A **prospective ground-water monitoring study for fenamiphos** use on grapes in California was begun in October, 1997, and preliminary information and monitoring results have been submitted in interim and progress reports. Interim reports indicate that fenamiphos and its sulfone and sulfoxide degradates were found in soil-pore water and ground water after one application of 6 lb A.I./acre. Fenamiphos and fenamiphos sulfone were detected in one ground-water sample, at concentrations of 0.05 and 0.53 ppb respectively, 216 days after treatment (DAT). Fenamiphos sulfoxide was detected in ground water samples from four of eight well clusters, at concentrations up to 2.13 ppb. These concentrations can be considered as a lower bound measure of the peak concentrations of total fenamiphos residues in ground water resulting from use of fenamiphos on HSG A soils. It is likely that application to similar soils in areas with higher rainfall or at higher applications rates will result in higher groundwater concentrations. A similar study on more vulnerable soils in the Florida Central Ridge resulted in significantly higher ground-water detections.

The California Department of Pesticide Regulation is currently sampling “about 40 **domestic wells for fenamiphos** in high use areas” (Robert Matzner, CDPR, written communication to EPA). Twenty-eight wells sampled in 2001 did not have detections of fenamiphos, fenamiphos sulfoxide, or fenamiphos sulfone. This sampling program is ongoing. These OPs were also not detected in 803 wells sampled in California from 1985 to 1994.

California has a ground-water monitoring database required under their Pesticide Contamination Prevention Act that includes data since 1984. No OPs are among the pesticides California reports as having “verified” detections in more than 20,000 wells sampled since 1984.

f. Colorado

Brad Austin of the Colorado Department of Health reported that diazinon and malathion were detected in ground water one time each in 784 wells since 1992. Chlorpyrifos and dimethoate were also included, but not detected in monitoring.

g. Connecticut

Judith Singer of the Connecticut Department of Environmental Protection Pesticide Management provided data from a USGS report which covers monitoring of the Connecticut, Housatonic and Thames Rivers from 1969 to 1992. This report indicates that diazinon was detected in 3 surface water samples from 0.01 to 0.03 ppb (although a detection limit of 10 ppb was reported). Chlorpyrifos, diazinon, and phorate were detected once each at 0.01 ppb, and a single detection of “total diazinon” occurred at 0.07 ppb.

Connecticut’s main focus for ground-water monitoring is the Pesticide Management Plan (PMP).

h. Delaware

Scott Blaier, a hydrologist with the Delaware Department of Agriculture, indicated that chlorpyrifos was detected one year in domestic and monitoring wells. As part of the PMP program, chlorpyrifos was included in 1998. The top of the well screen of 70% of the “domestic and agricultural wells” sampled was between 16 and 35 feet. Top of screen for 80 percent of the monitoring wells was shallower than 15 feet.

Chlorpyrifos was detected in a single well (LOD = 0.22 ppb) at a concentration of 0.75 ppb. This was a domestic well screened between 33 and 38 feet. Details of the monitoring program are available in “The Occurrence and Distribution of Several Agricultural Pesticides in Delaware's Shallow Ground Water”, 2000: http://www.udel.edu/dgs/pub/RI61.pdf

i. Florida

Keith Parmer of the Florida Department of Agriculture and Consumer Services provided results of three ground-water monitoring programs (plus data from an additional background well network) which included OPs as analytes. Seventeen OPs and transformation products are included as analytes among these three studies:

azinphos-methyl, chlorpyrifos, diazinon, dichlorvos, disulfoton, ethion, ethoprop, fenamiphos, fenamiphos sulfone, fenamiphos sulfoxide, malathion, methamidophos, methyl parathion, methyl paraoxon, naled, phorate and terbufos.

The three studies include both monitoring and drinking water-supply wells:

The Florida Department of Environmental Protection and the Florida Department of Health in which “up to 50 private drinking water wells were selected from each of Florida's 67 counties, to be sampled for a fairly comprehensive list of ground water contaminants. As of 1998, wells from approximately 26 counties had been sampled. The extent to which the selected wells represent either the private drinking water resource or the ground water resource is unknown” (Keith Parmer, personal communication).

This data set includes 7016 “determinations” for OP insecticides. “Determinations” are the total number of analyses made for OPs, including duplicates and split samples. No OPs were detected in these samples “without qualifiers.”

The second dataset included results from the “Very Intense Study Area Network.” There have been 22 VISA studies to date, “with 7-45 well/spring stations located in each VISA. VISA sample stations were deliberately located to fall within particular land use/vulnerability domains; the water quality in these areas may very likely be impacted by human activities" (Keith Parmer, personal communication). No OP was detected in 12,136 determinations for OPs in this data set.

A follow-up monitoring program to that performed by the FDEP and the FDEH include private and public drinking water supply wells. This dataset includes 7411 determinations for OPs. Fenamiphos sulfoxide was detected in five samples in 2 wells from this study in 1992 and 1993. The maximum concentration detected in both wells was 1 ug/l.

Mr. Parmer reported that a "Lake Wells Ridge monitoring network" included shallow ground-water samples analyzed for OPs. He related that other compounds have been detected in this study, but not OPs.

j. Georgia

Doug Jones of the Department of Agriculture indicated that GDA has a Pesticide Monitoring Network in conjunction with the Georgia Geological Survey. This ground-water monitoring program includes annual sampling of a wide number of pesticides, including OPs included in EPA method 507. Before 1999, NAWQA monitoring wells were included in the program. Recently, GDA has limited sampling to domestic wells, and excluded monitoring wells. Sampling has been mostly in southern, agricultural portion of state, which includes recharge areas for the Floridan aquifer. Wells in the program are located where the water table is shallower than 100 feet.

Reports from the last three years indicate that no OPs were detected in samples from this network. Previous studies indicate that no pesticides were detected above MCLs; OP insecticides have not yet been assigned MCLs.

k. Hawaii

Robert Boesch of the Department of Agriculture Pesticides Branch described a drinking-water study conducted in March, 2001. In preparation for the OP risk assessment, Hawaii sampled 36 drinking-water wells in areas where OPs are used on pineapples, or for urban use. These water supply wells, which have shown contamination for other organic chemicals, did not have detections (LOD 0.5 ppb) of the following OPs:

acephate, azinphos methyl, chlorpyrifos, DDVP, demeton, diazinon, dimethoate, disulfoton, ethoprop, fenamiphos, malathion, methidation, methyl parathion, mevinphos, monocrotophos, naled and parathion.

l. Idaho

Gary Bahr of the Idaho Dept of Agriculture Division of Agricultural Technology indicated that Idaho tests for OPs on a routine basis. There have been occasional, rare detections of diazinon and methidathion.

m. Illinois

Dave McMillan of the Illinois Environmental Protection Agency Bureau of Water's Ground Water Section indicated that Illinois has focused ground-water monitoring on herbicides since 1993, due to reduced funding. The Illinois Source Water Protection Program, which will lead to assessment of the State's community and non-community water supplies, does not include OPs. Ambient lake monitoring done by the State also does not include OPs.

n. Indiana

Ryan McDuffee, an Environmental Scientist with of the Indiana Department of Environmental Management Office of Water Quality sent data sets of pesticides detected in surface water during their 5 year "Surface Water Quality Assessment Program." The program has tested for 226 pesticides and semi-volatile compounds using EPA methods 525.5 and 547. The first of these methods includes many OPs. Three years of data are available, and Mr. McDuffee provided spreadsheets of detections in these three years. Only one OP, stirofos, was detected in the three years of sampling.

- 1997- Stirofos, a cattle OP detected at 0.1ppb in 898 records of stream-water detections.
- 1998- No OPs detected in 1416 records of stream-water detections
- 1999- No OPs detected in 563 records of stream-water detections

Al Lao of the Indiana Department of Environmental Management indicated that OPs are not included in surface-water or ground-water drinking water analyses, as they are not required to be by the Safe Drinking Water Act.

o. Iowa

Mary Skopec, Acting Section Supervisor of the Iowa Department of Natural Resources' Water Monitoring Section, reports that "Iowa's ambient water monitoring program was expanded in 1999 in response to increased appropriations from the State. Prior to 1999, very little state money was spent on money and nearly all ambient monitoring was paid for by EPA. Therefore our monitoring program was constructed to provide basic information (water chemistry and nutrients). Since 1999, we have been working to expand the number of sites and the types of analyses conducted as part of our monitoring program. Due to the severe restrictions in funding, OPs were not very often included in the monitoring programs."

Chlorpyrifos, ethoprop, fonofos, phorate, terbufos, dimethoate, diazinon, malathion, and parathion were included in Iowa's Statewide Rural Well-Water Study. This study included 686 private wells sampled once during 1988-89, with 10% of the private wells repeat-sampled during 1990 and 1991. None of the OPs were detected in this study. After the conclusion of the SWRL study, private wells continued to be monitored as part of Iowa's Grants to Counties program, but not for pesticides.

Iowa has a cooperative program with the USGS to sample 90 municipal wells on a four-year cycle. Iowa samples 45 wells in surficial materials (alluvial and Pleistocene) each year; bedrock wells are cycled in based on vulnerability to contamination. Twenty-two "vulnerable" wells are sampled every two years, and 23 "protected" wells are sampled every 4 years. OPs are not included in this monitoring.

i. Future ground-water monitoring

Beginning this winter, domestic well monitoring will examine the occurrence of many different contaminants (including OPs) in communities without public water supplies. Dedicated groundwater wells are being drilled to assess the quality of water in many different aquifers around the state. Sampling has not begun, but a wide array of analyses will be run on these wells (at least initially) to characterize water quality. This program may include OPs, depending on budgets.

ii. Surface Water Monitoring

Iowa's Ambient Surface Water Monitoring program has included about 80 sites (including 23 up/downstream of 10 major cities)in two years of sampling. Sampling during the first year included two analyses for OPs (Fall of 1999 and Spring of 2000), and samples in the second year were collected and analyzed for OP insecticides during April, May, June, and July, 2001. Only one detection of parathion and two detections of chlorpyrifos have occurred since 1999. Concentrations detected were low, in the 0.05 ppb range. In 2002, Iowa will sample and analyze for OP insecticides during April, May, June, and July.

p. Kansas

Theresa Hodges of the Kansas Department of Health and Environment reports that of the OPs, only diazinon has been detected in their routine ambient surface water quality sampling network. While diazinon is not on the list of pesticides routinely included, it was added because it had been detected. Since 1995, 44 detections were found at 16 urban or golf course sites. The range of detections was from 0.19 to 1.5 micrograms/liter.

Dale Lambley, Special Environmental Assistant to the Secretary of the Kansas Department of Agriculture sent information on their ground-water monitoring of chemigation wells. The objective of the study "is to assess and monitor groundwater quality by obtaining water samples at selected chemigation sites located at agricultural irrigation wells." In sampling from 1987 to 2000, chlorpyrifos was detected three times at concentrations of 1.9, 3.5 and 4.2 ppb (LOD = 0.5 µg/l). Dimethoate, disulfoton and methyl parathion were included in sampling, but were not detected above detection levels of 2.0, 0.5 and 1.0 µg/l, respectively.

The 100 samples taken annually are apportioned among five Groundwater Management Districts based on the number of registered chemigation sites in each. Highest priority is given to finding active chemigation sites. Ranking of wells has also been based on proximity to public water supplies (within 3 miles), depth to water, soil type, and whether chemigation misuse is suspected.

q. Kentucky

Peter Goodman of the Kentucky Division of Water reports that the following OPs are included in their ground-water monitoring program: acephate, chlorpyrifos, diazinon, disulfoton, ethoprop, malathion, methyl parathion and terbufos. Each was included in more than 1300 analyses from over 300 wells, but only diazinon, chlorpyrifos and malathion were detected.

Chemical	# Wells	# Samples	# Detections	Max. Conc.
Diazinon	362	1809	10	0.17 ppb
Chlorpyrifos	398	2057	7	7.1 ppb
Malathion	364	1821	2	0.32 ppb

r. Louisiana

Karen Irion indicated that it is very unlikely that Louisiana would have analyzed drinking water for OPs, since they have not been required up to now by the Safe Drinking Water Act.

s. Maine

Julie Chizmas, Senior Water Quality Specialist of the Maine Department of Agriculture Board of Pesticides Control wrote that Maine samples drinking water wells no more than 1/4-mile down-gradient of an active pesticide use site. Analytes are chosen based on local sales data. Sampling took place in 1994 and then in 1999, and included the following OPs:

azinphos methyl, chlorpyrifos, diazinon, ethoprop and phosmet.

No OPs were detected in 1999. One detection of diazinon in 1994 (7.4 ppb) was determined to be the result of a homeowner putting diazinon around her well head to get rid of ants. Ethoprop was detected in one well at 0.075 ppb. No followup to that detection was conducted.

Surface-water monitoring in Mane has included the following OPs:

azinphos methyl, chlorpyrifos, diazinon, ethoprop, malathion and phosmet.

Most surface-water monitoring in Maine is in response to the endangered species designation for Atlantic salmon. “Blueberries are the most intensively grown commodity in the salmon watershed.” Only phosmet has been detected to date in surface water, with a maximum detection of 0.52 ppb (3 detections). In this study, surface water samples were collected less than 2 hours after a phosmet application. Sampling continues in that watershed, except for ethoprop.

t. Maryland

Rob Hofstedter of the Maryland Department of Agriculture reports that their agency has a current ground-water study that includes diazinon. Results of this study are not yet available. He referred me to the Maryland Geological Survey for information on previous surface-water studies which included malathion.

David Bolton of the Maryland Geological Survey provided summary tables from the MGS Report of Investigations number 66, “Ground-Water Quality in the Piedmont Region of Baltimore County, Maryland.” Analysis in this rural region included 12 OPs, 10 of which are still registered. Seven of the 10 current OPs were not detected in ground water. Results of the monitoring are as follows, which concentrations in µg/l.

Pesticide	# samples	MRL	>/=MRL	<MRL	Maximum Conc.
Azinphos-methyl	112	0.001	0	0	
Chlorpyrifos	112	0.004	0	0	
Diazinon	112	0.002	1	0	0.003
Dimethoate	1	0.004	0	0	
Disulfoton	112	0.017	0	0	
Ethoprop	112	0.003	1	1	0.004
Fonofos	112	0.003	0	0	
Malathion	112	0.005	0	0	
Methyl parathion	112	0.006	0	0	
Parathion	112	0.004	1	0	0.022
Phorate	112	0.002	1	0	0.010

Terbufos	112	0.013	0	0

MRL = Minimum Reporting Limit

Surface-water sampling at 8 sites at the Pocomoke River in 1998 did not result in detections of chlorpyrifos, dimethoate, malathion or terbufos above levels of detection. One sample included a “trace” level of terbufos, reported as between 0.07 and 0.1 ppb.

u. Massachusetts

Kenneth Pelotiere of the Massachusetts Department of Environmental Protection Source Water Assessment Program indicated that over the last 10 years, testing of surface water and ground water has been for pesticides required under the Safe Drinking Water Act. Therefore, OPs have not been included as analytes.

v. Michigan

Dennis Bush from the Surface Water Quality Division has sent information on a study of tributaries of the Saginaw River, which included OPs as analytes. The Agency has not yet reviewed this data.

Mark Breithart of the MDEQ Drinking Water Division examined their database, and found that analysis was done for the following OPs in Michigan drinking water:

azinphos methyl, chlorpyrifos,,diazinon, dimethoate, disulfoton, fenamiphos, malathion, methyl parathion

None of these were detected in 49 analyses of public water supplies. Of the 421 analyses from private water supplies, only dimethoate was detected. This single detection of 2 micrograms/liter occurred at an aerial spray service, and therefore it is not clear if it was the result of a point source.

w. Minnesota

Daniel Helwig reported that the Minnesota Pollution Control Agency does not have ground-water monitoring data for insecticides.

Mark Zabel of the Minnesota Department of Agriculture reported that OPs are not included on the list of pesticides included in surface-water and ground-water monitoring. Although pesticides are added if they are identified in anomalous gas-chromatography peaks, he cannot recall any OPs being so identified.

x. Mississippi

Rusty Crowe reported that the Mississippi Department of Agriculture and Commerce Bureau of Plant Industry has not conducted ground-water monitoring since performing an atrazine study in the mid-1990s.

Shedd Landreth of the Mississippi Department of Environmental Quality reports that about 125 wells a year are included in the Mississippi Agricultural Chemical Ground-Water Monitoring Program. This program, which is funded by user fees, concentrates on existing shallower wells, including drinking wells and irrigation wells, and is patterned after the EPA's National Pesticide Survey.

A number of OPs are included in their analytical method. However, if other peaks are found in GC analysis, they are identified. Since 1989 through present, 910 wells in the state have been sampled, concentrating in areas of pesticide usage. Out of 910, chlorpyrifos was detected in 3 wells, with a concentration range of 0.002 to 0.22 ug/l. Diazinon was detected in one well early in the study at a concentration reported as "trace".

Profenofos was detected in three samples collected from center-pivot irrigation system. Mr. Landreth collected these samples himself, and noted at the time that he believed the samples had suffered from cross contamination from the irrigation equipment itself, resulting from application the day before. Resampling the next day resulted in non-detections.

Malathion was also detected in one well. Mr. Landreth suspects this may also have been external contamination, because malathion was being aerially applied in area.

y. Missouri

Paul Andre, Program Coordinator of the Department of Agriculture Plant Industries Division indicated that the Department of Natural Resources undertakes water monitoring. Terry Timmons of the Department of Natural Resources explained that they sample surface water and ground water used as drinking water, and analyze for pesticides using several EPA methods. However, although method 507 can include OPs, Missouri does not include them among the analytes.

John Ford from the Department of Natural Resources sent 1997 to 1999 stream-water monitoring data from their Water Pollution Control Program for diazinon, chlorpyrifos and malathion. Results from the fixed-station database are as follows:

diazinon: 124 detections in 330 samples, range 0.001 to 0.976 ppb;
chlorpyrifos: 50 detections in 328 samples, range 0.001 to 0.691 ppb;
malathion: 36 detections in 223 samples, range 0.004 to 0.325 ppb.

z. Montana

Donna Rise of the Montana Department of Agriculture (MDA) Agricultural Sciences Division Technical Services Bureau reports that the MDA samples ground water for pesticides generally, although the Department of Environmental Quality undertakes monitoring on a “project or issue basis”. The State has specific criteria under which to put pesticides in a “Groundwater Management Plan”. The only current management plan is for imazamethabenz methyl.

Montana currently has a network of 14 shallow wells throughout the state, which are <50 feet deep, “most between 13 and 35 feet.” These wells are sampled twice a year, in the spring before application, and in the fall post-harvest. Analytes are chosen based on use. In addition, a “Domestic Rural Monitoring Program” took place from 1992 to 1995, and included two domestic wells in each county.

There was a single detection of malathion in a 35-foot well drilled into “a cobbly or gravelly loam.” The detection was at a concentration of 4.8 ppb in May 1999. A sample from the same well in June was estimated at 0.017 ppb (LOQ = 0.4), and there was no detection in July, October or December. Although this was a very vulnerable well, there also had been a dirt-floor storage shed 10 feet unpradient of the well three years before. MDA is not certain that the single detection reflected normal agricultural use.

aa. Nebraska

Craig Romary of the Nebraska Department of Agriculture Bureau of Plant Industry indicated that Nebraska maintains the “Quality-Assessed Agricultural Contminant Database for Nebraska Ground Water,” which was created from ground water quality data submitted by many organizations.” The following OPs are included in the database:

Chlorpyrifos- No detections in 3936 aalyses.
Diazinon- No detections in 190 analyses.
Disulfoton- No detections in 185 analyses.
Ethion- No detection in 1 analysis.
Malathion- No detections in 31 analyses.
Methyl parathion- No detections in 3679 analyses.
Phorate- No detections in 182 analyses.
Terbufos- No detections in 4729 analyses.

The levels of detection are generally below 1 ppb.

Mr. John Lund, supervisor in the Surface Water Unit of the Nebraska Department of Environmental Quality, indicated that OPs have not been included in the State’s surface-water monitoring.

bb. Nevada

Scott Cichowlaz reported that malathion, diazinon and guthion were found at low levels in some ground-water monitoring studies. Perhaps 200 shallow wells that are 10 to about 90 feet deep are included in this study. These include monitoring wells installed by the State, NAWQA wells, and water authority wells. Each year a subset of 50 to 70 wells is sampled. Nevada has monitored all agricultural uses in the State, and looked only at active products, used in the areas where they are looking.

In most cases sampling was from drinking water wells, some of which are perforated pipe from surface down. The State hasn't found pesticides in the drinking water wells.

cc. New Hampshire

The New Hampshire Department of Environmental Services does not include the OPs in drinking water analysis. The state does not include OPs in systematic ground-water monitoring, which is focused on the Pesticide Management Plan program. Pat Bickford of the NHDES indicates that some monitoring of OPs has occurred, but only when the Department of Agriculture investigating misuse for enforcement, or rarely at the request of a homeowner.

dd. New Jersey

Dr. Roy Meyer of the New Jersey Department of Environmental Protection (NJDEP) Pesticide Monitoring and Evaluation group indicated that NJDEP has not detected OPs in its ground-water monitoring program. The wells in this program are mostly concentrated in the agricultural areas of southern New Jersey. The wells are shallow (<30 feet), and are intended to give a sense of pesticide migration through the vadose zone.

Another program is in place for the Pesticide Management Plans.

ee. New Mexico

The surface water program in New Mexico monitors stream samples over a 5 year cycle. The program is done in order to meet requirements of the Total Maximum Daily Load program. The State attempts to look at more extreme conditions, such as storm-water or low-flow conditions. The State runs the EPA method 8270, which includes many OPs.

Before 1998, all of their data were entered into STORET (21-NEX is their STORET code). The State is attempting to move to an ACCESS- based database, but this more recent data is not entered yet.

ff. New York

Jeff Myers of the New York Department of Environmental Conservation Bureau of Technical Support says that the emphasis in New York is bottom sediments and fish tissue, with little sampling in the water column. This sampling has concentrated more on organochlorines, although some less persistent pesticides have recently been included.

gg. North Carolina

Dr. Henry Wade, Environmental Programs Manager of the North CarolinaDepartment of Agriculture and Consumer Services described the “Interagency Study of the Impact of Pesticide Use on Ground Water in North Carolina,” which took place between 1991 and 1995. Sampling of mostly shallow monitoring wells was performed based on information by farmers on which pesticides they used within 300 feet of the wells. By the end of the study, more than 240 pesticides were included as analytes.

Sixteen OPs were included in the analysis, but none were detected. The number of wells sampled for each OP is shown below:

acephate (23 wells), azinphos-methyl (7), chlorpyrifos (25), diazinon (8), dimethoate (5), disulfoton (12), ethoprop (6), fenamiphos (4), fonofos (1), malathion (9), mevinphos (1), parathion (5), phorate (3), phosmet (2), terbufos (13) and trichlorfon (2).

Other pesticides were detected in these wells, especially herbicides. The main focus of the study was herbicides which the EPA had identified as “potential leachers.”

A separate study of domestic wells resulted in a single detection of diazinon at 0.55 ppb. It is not clear if this was the result of domestic use.

hh. North Dakota

Bill Schuh of the North Dakota State Water Commission described the ground-water monitoring program run by the ND Department of Health. About 150 to 200 wells are sampled each year, and OPs are included among the analytes. More vulnerable aquifers are sampled on a one square-mile grid, with a bias toward shallow wells. This sampling occurs once every five years, and annual reports are available since 1992.

Norene Bartelson of the NDDoH provided further information. In its "Ambient Groundwater Monitoring Program," the NDDoH has collected "approximately 2,700 samples from 1465 wells." This program includes five OPs: chlorpyrifos, diazinon, ethyl parathion, methyl parathion and malathion. There have been OP detections in six wells over that time:

Well #	Date Sampled	Analyte	Concentration	Sample Type
15105504AAA	6/23/93	Ethyl Parathion	1.833 µg/l	Regular
	9/29/93	None		Regular
15305532AAA	6/23/93	Ethyl Parathion	0.274 "	Regular
	6/23/93	Ethyl Parathion	0.322 "	Duplicate
	5/11/94	None		Regular
13705228CAA	5/04/99	Malathion	0.379"	Regular
	5/04/99	Malathion	0.460 "	Duplicate
	9/21/99	None		Regular
14708011CAA	7/11/00	Malathion	0.171"	Regular
	1/30/01	None		Regular
15410113AAB	7/18/01	None		Regular
	9/13/01	Malathion	0.340 "	Regular
16305620BDC	6/26/01	None		Regular
	9/11/01	Diazinon	0.100 "	Regular

ii. Ohio

Only chemicals with MCLs are included in Ohio water monitoring programs, and therefore no OP insecticides (Todd Kelleher and Julie Letterhos, Ohio Environmental Protection Agency, personal communication). The "Ohio EPA Pesticide Special Study," a 4-year study which examined pesticides which might be found in finished drinking water, also did not include OPs.

OPs are not part of routine sampling, although Ohio does some watershed-specific monitoring (Gail Hess, OEPA, personal communication). Data collected through 1998 could be extracted from STORET, but anything since then isn't yet electronically available. Several OPs may have been included. The Agency will evaluate the data in the STORET database.

The Great Lakes represent a significant drinking water supply, but water monitoring of the lakes has not concentrated on OP contamination. According to the State of Ohio's State of the Lake Report, for instance, 31 water-treatment plants on the north shore of Ohio draw water from Lake Erie http://www.epa.state.oh.us/oleo/leqi/14.pdf . These systems have not analyzed for OPs to this point, as such analysis was not required by the Safe Drinking Water Act.

These systems are likely to look for triazines once a month in the summer, and quarterly otherwise. Ohio EPA undertook a "pesticide special study" between 1995 and 1999, but also looked only for herbicides (http://www.epa.state.oh.us/ddagw/pestspst.html). Cities like Cleveland and Toledo get their water from intakes a couple of miles into Lake Erie. Therefore, they rarely detect pesticides other than small levels of atrazine at times. Smaller communities might have their intakes somewhat closer to shore (Todd Kelleher, Ohio EPA Dept. of Drinking and Ground Waters, personal communication).

jj. Oklahoma

Don Molnar of the Oklahoma Department of Agriculture Plant Industry and Consumer Services Division indicated that the Pesticide Management Plan is the major monitoring effort currently underway in Oklahoma. While that program does not include the OPs, Oklahoma is performing a general "OP/OC" screen for a study monitoring irrigation tailwater from containerized nurseries, and in wells for their Organic Certification program. The data is not in an electronic format that would permit quick extraction of OP analyses. The specialized nature of these monitoring programs would limit the usefulness of the data for the cumulative risk assessment, in any case.

kk. Oregon

The Agency has not obtained monitoring data from the State of Oregon.

ll. Pennsylvania

John Pari of the Pennsylvania Department of Agriculture Bureau of Plant Industry indicated that Pennsylvania has ground-water monitoring programs that are tailored to particular crops uses. This includes a program focusing on corn that has run from 1995 to the present. The wells are described as "water supply" wells, whether as sources for drinking water for humans or livestock.

Chlorpyrifos is the only OP included in this analysis. There have been about 450 analyses to date, and chlorpyrifos was detected in "4 or 5" samples. The maximum concentration detected was 0.29 ppb. Another study is just beginning in orchard areas, and may include other OPs.

mm. Rhode Island

Eugene Pepper of the Rhode Island Department of Environmental Management Division of Agriculture and Resource Marketing reports that in addition to required Safe Drinking Water Act analyses, the Department of Health uses Method 525 to analyze ground water and surface water for chlorpyrifos, diazinon, and by special request, malathion. However, these insecticides have not been detected. Mr. Pepper pointed out that both raw and finished water are tested, but the lab does not include the transformation products in the analysis.

A nearly completed ground-water study for turf chemicals includes chlorpyrifos, but chlorpyrifos has not been detected in this study, either.

nn. South Carolina

Jerry Moore of Clemson University said that South Carolina has not detected OPs in ground water. South Carolina monitors about 150 rural wells (domestic supply, irrigation, shop wells) per year, and runs a broad GC screen. The analysis focuses on 22 pesticides, none of which are OPs. Therefore, the detection limit may be a little higher for pesticides other than the main 22. This program has been ongoing since 1990.

Peter Stone of the Department of Health and Environmental Control reports that South Carolina does not routinely analyze drinking water for anything but those required by the Safe Drinking Water Act. Kathy Stecker of the SCDHEC provided the internet address for the list of pesticides included in the State's ambient surface-water monitoring program (http://www.scdhec.net/eqc/water/pubs/appd.pdf). OPs are not included in that list.

oo. South Dakota

Brad Berven of the South Dakota Department of Agriculture Pesticide Program reports that the South Dakota "Statewide Ground Water Quality Network" was sampled between 1989 and 1997. This statewide program was meant to monitor "shallow, sensitive aquifers" in the state for non-point agricultural contamination. Monitoring wells were sampled for a number of chemicals, including pesticides. The wells were generally sampled once per year, although wells with pesticide detections were subsequently sampled four times per year. One aquifer (Big Souix) was sampled multiple times per year before 1994.

This monitoring program included six OPs: chlorpyrifos, ethoprop, fonofos, parathion, phorate and terbufos. Fonofos and parathion are currently in the process of voluntary cancellation. Chlorpyrifos was not detected in 231 analyses. Ethoprop was not detected in 160 analyses. Phorate was not detected in 230 analyses. Terbufos was not detected in 246 analyses.

pp. Tennessee

Ken Nafe of the Tennessee Department of Agriculture reports that, "We have found some chlorpyrifos is ground water in several wells. The primary source is from termite treatments that followed the supply line into the well and then went down the well casing. We have worked with Dow to clean up all wells successfully."

Mr. Nafe also provided a surface-water monitoring database, which included chlorpyrifos as the only OP in sampling from 1996 to 2001. Chlorpyrifos was not detected in ambient samples, nor in raw or finished drinking water samples.

qq. Texas

The USGS conducted a study of cotton pesticides in playa lakes in the High Plains of west Texas. Dicrotophos was detected in one sample of 32. The study authors indicate that the lack of OP detections could be due to the general short half-lives of these insecticides, but could also be due to sampling that may have occurred before the application of the OPs that season.

rr. Utah

Mark Quilter of the Utah Department of Agriculture and Food directed the Agency to a web page describing their private well monitoring network:

http://ag.utah.gov/mktcons/groundwater.htm

Mr. Quilter reported that Utah has not detected any insecticides in five years of sampling, and that a single detection of 2,4-D in a sump well is the only detection in the program to date.

Arne Hulquist of the Utah Department of Environmental Quality reported that their data through 2001 is on STORET, but that they have had few positive pesticide detections.

ss. Vermont

Cary Giguere of the Vermont Department of Agriculture, Food and Markets reports that OPs are not regularly included in their monitoring, but that the State has an OP screen. This is used for enforcement cases, generally. OPs are not included in drinking-water monitoring.

Surface-water monitoring is not only for corn herbicides, but also railroad program, golf course permitting (includes some OPs). Act 250 requires a detailed pesticide management plan to protect surface and ground water. They have a list of pre-screened pesticides, and the state monitors certain courses. The courses must monitor drinking water. State monitors surface water, in order to be sure that permitting is effective in protecting water resources.

In 1999, VDAFM analyzed turf (including lawns and golf courses) pesticides in streams adjacent to a residential complex immediately following a commercial landscape application. Diazinon, chlorpyrifos and malathion were included in the analysis. Of these, only diazinon was detected (2 samples), at concentrations of 0.08 and 0.22 ppb.

tt. Virginia

Marvin Lawson of the Virginia Department of Agriculture and Consumer Services indicated that Virginia undertook a ground-water monitoring study from the mid- to late-1990s. Daniel Schweitzer of VDACS reported that this study did not include OPs. He is unaware of any Virginia ground-water or surface-water monitoring program that included the OPs as analytes.

uu. Washington

The Agency has not obtained monitoring data from the State of Washington.

vv. West Virginia

Doug Hudson of the West Virginia Department of Agriculture says that West Virginia DoA does intermittent ground water sampling, including an OP screen. He could recall only a single detection of diazinon, which they could not confirm. Other OP detections in ground water were in response to improper termiticide use.

Chad Board of the West Virginia Department of Environmental Protection sent a spreadsheet with analytical results which included the following OPs: chloropyrifos, diazinon, disulfoton, ethoprop, malathion, phorate, and terbufos. Each were sampled in 12 wells, but not detected. The detection limits ranged from 0.005 to 0.027 ppb.

ww. Wisconsin

Bill Phelps, of the Wisconsin Department of Natural Resources Bureau of Drinking & Groundwater provided a summary of monitoring Wisconsin has done in public and private water supply wells and information on monitoring from their GEMS database performed at regulated/investigated sites.

Analyte	# Water Supply Wells	# Detects in Water Supply Wells	#GEMS wells	# GEMS wells with detections	Maximum concentration detected (ug/l)
chlorpyrifos	1	0	0		
diazinon	12	0	20	9	420
DDVP			20	0	
dimethoate	8	0	127	0	
disulfoton	0		190	9	240
malathion	1	0	20	5	19
methyl parathion	1	0	166	0	
phorate	54	0	199	21	37

xx. Wyoming

Jim Bigelow, manager of the Wyoming Department of Agriculture Technical Services Department, described the generic Pesticide Management Plan ground-water program, which includes a network of 178 wells. A total of 54 active ingredients are included as analytes, including eight active OPs:

azinphos-methyl, chlorpyrifos, diazinon, disulfoton, malathion, methyl parathion, phorate and terbufos.

Mr. Bigelow indicated that there have been detections of pesticides in 117 of 178 wells. The Agency will investigate further details of this program.