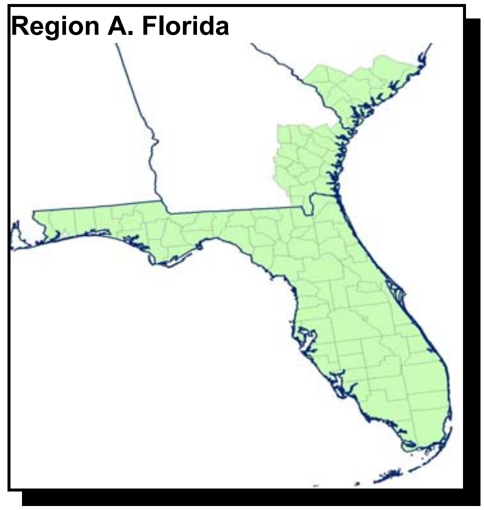
II. Regional Assessments

A. Region A - Florida Assessment

1. Executive Summary



This module of the Organophosphate (OP) cumulative risk assessment focuses on risks from OP uses in Florida (area shown to the right). Information is included in this module only if it is specific to Florida, or is necessary for clarifying the results of the Florida assessment. A comprehensive description of the OP cumulative assessment comprises the body of the main document; background and other supporting information for this regional assessment can be found there.

This module focuses on the two components of the OP cumulative assessment which are likely to have the greatest regional variability: drinking water and residential exposures. Dietary food exposure is likely to have significantly less regional variability, and is assumed to be nationally uniform. An extensive discussion of food exposure is included in the main document. Pesticides and uses which were considered in the drinking water and residential assessments are summarized in Table II.A.1 below. The OP uses included in the drinking water assessment generally accounted for 95% or more of the total OPs applied in this selected area. Various uses that account for a relatively low percent of the total amount applied in that area were not included in the assessment.

Table II.A.1. Pesticides and Use Sites/Scenarios Considered in Florida Residential/Non-Occupational and Drinking Water Assessment

Pesticide	Residential Use Scenarios	OP Drinking Water Scenarios
Acephate	Ornamentals, Golf Courses	Peppers (Bell)
Bensulide	Golf Courses	None
Chlorpyrifos	None	Oranges, Tangelos, Tangerines, Grapefruit, Sweet Corn
DDVP	Pest Strips	None
Diazinon	None	Lettuce, Tomatoes
Disulfoton	Ornamentals	None
Ethoprop	None	Sugarcane
Fenamiphos	Golf Courses	None
Fenthion	Public Health	None
Malathion	Ornamental Gardens, Public Health, Vegetable Gardens	None
Methamidophos	None	Tomatoes
Naled	Public Health	None
Phorate	None	Sugarcane, Sweet Corn
TCVP	Pet Uses	None
Trichlorfon	Lawns	None

This module will first address residential exposures. The residential section describes the reasons for selecting or excluding various use scenarios from the assessment, followed by a description of region-specific inputs. Detailed information regarding the selection of generic data inputs common to all the residential assessments (e.g., contact rates, transfer coefficients, and breathing rate distributions, etc.) are included in the main document.

Drinking water exposures are discussed next. This will include criteria for the selection of a sub-region within Florida to model drinking water residues, followed by modeling results, and finally characterization of the available monitoring data which support use of the modeling results. This assessment accounted for all OP uses within the selected location that are anticipated to contribute significantly to drinking water exposure.

Finally a characterization of the overall risks for the Florida region is presented, focusing on the residential and drinking water aspects of the assessment which are specific to this region.

In general, the risks estimated for the Florida region show a similar pattern to those observed for other regions. Drinking water does not contribute to the risk picture in any significant way at the upper percentiles of exposure. At these higher percentiles of exposure, inhalation exposure from DDVP pest strips are the major source of risk. These patterns occur for all population sub-groups, although potential risks appear to be higher for children than for adults regardless of the percentile considered.

2. Development of Residential Exposure Aspects of Florida Region

In developing this aspect of the assessment, the residential exposure component of Calendex was used to evaluate predicted exposures from residential uses. Except for golf course uses, this assessment is limited to the home as are most current single chemical assessments. The residential component of the assessment incorporates dermal, inhalation, and non-dietary ingestion exposure routes which result from applications made to residential lawns (dermal and non-dietary ingestion), golf courses, ornamental gardens, home fruit and vegetable gardens, public health uses, pet uses, and use of pest strips. These scenarios were selected because they are expected to be the most prominent contributors to exposure in this region. Additional details regarding the selection of the scenario-pesticide pairs can be found in Part I of this document. OPP believes that the majority of exposures (and all significant exposures) in this region have been addressed by the scenarios selected.

The data inputs to the residential exposure assessment come from a variety of sources including the published, peer reviewed literature and data submitted to the Agency to support registration and re-registration of pesticides. Generic scenario issues and data sources are discussed in Part I of this report. However, a variety of additional region-specific ancillary data were required for this assessment of the Florida region. This information includes region-specific data on pesticide application rates and timing, pesticide use practices, and seasonal application patterns, among others. The Gaant chart shown in Figure II.A.1 displays and summarizes the various region-specific residential applications and their timing (including repeated applications) over the course of a year. Specific information and further details regarding these scenarios, the Calendex input parameters, and the pesticides for which these scenarios were used is presented in Table II.A.2 which summarizes all relevant region-specific scenarios.

Table II.A.2. Use Scenarios and Calendex Input Parameters for Florida Residential Exposure Assessment

Chemical	Use Scenario	Application Method	Amt. Applied lb ai/A	Max. No./ Frequency Of Apps.	App. Schedule	% Use LCO	% Use HO	% Users	Residue Persistence (Days)	Routes of Exposure
Acephate	Golf Course	NA	5	2/yr, 2 wks. Between Apps.	Jan.-Dec. 1-52 wks.	100	--	10	10	dermal(p)
	Ornamental	hand pump sprayer	0.9-2	4/yr, 2 wks. Between Apps.	Jan.-Dec. 1-52 wks.	--	100	6	1	inhalation(a), dermal(a)
Bensulide	Golf Course	NA	12.5	2/yr, 26 wks. Between Apps.	Mar.-Apr. and Sept.-Oct.	100	--	1	14	dermal(p)
DDVP	Pest Strip	closet strip	NA	16 wks., Regular App. Schedule	Jan.-Dec. 1-52 wks.	--	100	2	120	inhalation(p)
		cupboard strip	NA	16 wks., Regular App. Schedule	Jan.-Dec. 1-52 wks.	--	100	2	120	inhalation(p)
Disulfoton	Ornamental	granular	8.7	3/yr, 6 wks. Between Apps.	Jan.-Dec. 1-52 wks.	--	100	2	1	inhalation(a), dermal(a)
Fenamiphos	Golf Course	NA	10	1/yr	Jan.-Dec. 1-52 wks.	100	--	1	2	dermal(p)
Fenthion	Public Health	aerial and ground	NA	10/yr, 21 days Between Apps.	Mar.-Oct. 10-43 wks.	100	--	5	2	oral(p), dermal(p)
Malathion	Ornamental	hand pump spray	0.9-2	2/yr, 2 wks. Between Apps.	Jan.-Dec. 1-52 wks.	--	100	4	1	inhalation(a), dermal(a)
	Public Health	aerial and ground	NA	15/yr, 2 wks. Between Apps.	Mar.-Oct. 10-44 wks.	100	–	42	2	oral(p), dermal(p)
	Vegetable Garden	hand pump sprayer	1.5	5/yr, 2 wks. Between Apps.	Jan.-Dec. 1-52 wks.	--	100	1	1 7	inhalation(a), dermal(a)(p)
Naled	Public Health	aerial and ground	NA	15/yr, 2 wks. Between Apps.	Mar.-Oct. 10-44 wks.	100	--	26	2	oral(p), dermal(p)

Chemical	Use Scenario	Application Method	Amt. Applied lb ai/A	Max. No./ Frequency Of Apps.	App. Schedule	% Use LCO	% Use HO	% Users	Residue Persistence (Days)	Routes of Exposure
TCVP	Pet Aerosol	aerosol spray	2.4×10^{-5}- 3.3×10^{-5} lb ai/lb dog	1/8 wks., Regular App. Schedule	Jan.-Dec. 1-52 wks.	--	100	5	1 32	inhalation(a), oral(p), dermal(a)(p)
	Pet Powder	shaker can	4.6×10^{-5}- 5.5×10^{-5} lb ai/lb dog	1/8 wks., Regular App. Schedule	Jan.-Dec. 1-52 wks.	--	100	5	1 32	inhalation(a), oral(p), dermal(a)(p)
	Pet Spray	hand pump sprayer	2.0×10^{-5}- 2.2×10^{-5} lb ai/lb dog	1/8 wks., Regular App. Schedule	Jan.-Dec. 1-52 wks.	--	100	5	1 32	inhalation(a), oral(p), dermal(a)(p)
Trichlorfon	Lawn Granular	rotary spreader	8	1/yr	Jan.-Dec. 1-52 wks.	13	87	1	1 2	inhalation(a), oral(p), dermal(a)(p)
	Lawn Spray	NA	8	1/yr	Jan.-Dec. 1-52 wks.	100	--	2	2	oral(p), dermal(p)

(a) = applicator exposure
(p) = post application exposure
Note: For applicator dermal exposure, the residue persistence is 1 day.

Figure II.A.1 Residential Scenario Application and Usage Schedules for the Florida Region (Region A)

<table>
<tr><th>January</th><th>February</th><th>March</th><th>April</th><th>May</th><th>June</th><th>July</th><th>August</th><th>September</th><th>October</th><th>November</th><th>December</th></tr>
<tr><td colspan="12">Acephate Golf</td></tr>
<tr><td colspan="12">Acephate Ornamental Spray</td></tr>
<tr><td></td><td></td><td colspan="2">Bensulide Golf</td><td></td><td></td><td></td><td></td><td colspan="2">Bensulide Golf</td><td></td><td></td></tr>
<tr><td colspan="12">DDVP Pest Strip (Closet)</td></tr>
<tr><td colspan="12">DDVP Pest Strip (Cupboard)</td></tr>
<tr><td colspan="12">Disulfoton Ornamental Granular</td></tr>
<tr><td colspan="12">Fenamiphos Golf</td></tr>
<tr><td></td><td></td><td colspan="8">Fenthion</td><td></td><td></td></tr>
<tr><td colspan="12">Malathion Ornamental Spray</td></tr>
<tr><td></td><td></td><td colspan="8">Malathion Public Health</td><td></td><td></td></tr>
<tr><td colspan="12">Malathion Vegetable Spray</td></tr>
<tr><td></td><td></td><td colspan="8">Naled</td><td></td><td></td></tr>
<tr><td colspan="12">TCVP Aerosol Spray</td></tr>
<tr><td colspan="12">TCVP Powder</td></tr>
<tr><td colspan="12">TCVP Hand Pump Spray</td></tr>
<tr><td colspan="12">Trichlorfon Granular</td></tr>
<tr><td colspan="12">Trichlorfon Spray</td></tr>
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a. Dissipation Data Sources and Assumptions

i. Acephate

A residue dissipation study was conducted on Bahia grass in Florida with multiple residue measurements collected over a period of 10 days (Days 0, 1, 2, 3, 5, 7, and 10 days). For each day following application, a residue value from a uniform distribution bounded by the low and high measurements for each day was selected. No half-life value or other degradation parameter was used, with current assessment based instead on the time-series distribution of actual residue measurements.

ii. Bensulide

A residue dissipation study was conducted with multiple residue measurements collected for up to 14 days after treatment. For each day following application, a residue value from a uniform distribution bounded by the low and high measurements was selected (the day zero distribution consisted of measurements collected immediately after application and 0.42 day after treatment). No half-life value or other degradation parameter was used, with the current assessment based instead on the time-series distribution of actual measurements. Residues measured at day 7 were assumed to be available and to persist to day 10 and day 10 measurements to persist to day 14.

iii. Malathion

A residue dissipation study was conducted with multiple residue measurements collected up to 7 days after treatment in Pennsylvania. A value selected from a uniform distribution bounded by the low and high measurements was used for each day after the application. Since the study was conducted at a one pound ai per acre treatment rate, the residues were adjusted upwards by a 1.5 factor to account for the 1.5 pound ai per acre rate for vegetables.

iv. Trichlorfon

Residue values from a residue degradation study for the granular and sprayable formulations were collected for the "day of" and "day following" the application. This was used for the lawn post-application exposure scenarios. For dermal exposure scenarios, a uniform distribution bounded by the low and high residue measurements was used, with these residue values adjusted upwards to simulate the higher active ingredient concentrations in use (i.e., adjusted to 0.5% and 1% for granular and sprayable formulations respectively). These distributions also reflect actual measurements including those based on "watering-in" directions on the product's label. These values were multiplied by a value selected from a uniform distribution bounded by 1.5 and 3 to account for wet hand transfer for assessing non-dietary ingestion for children.

v. Fenamiphos

Snyder et al., 1999 collected residue dissipation data on the day of and day after application following the application of fenamiphos on a golf course. Only mean measurements were collected.

3. Development of Water Exposure Aspects of Fruitful Rim-FL Region

Because of the localized nature of drinking water exposure, the water exposure component of this assessment focused on a specific geographic area within the Florida Region. The selection process considers OP usage and the relative potencies of those OP pesticides being used, along with the location, nature, and vulnerability of the drinking water sources. The methods used to identify a specific location within the region are described in the main document (Section I.E). The following discussion provides the details specific to the Florida regional assessment for OP cumulative drinking water exposure. The discussion centers on four main aspects of the assessment: (1) the selection of Palm Beach County, Florida for the drinking water assessment, (2) predicted cumulative concentrations of OPs in surface water for those OP-crop uses included in this regional assessment, (3) a comparison of the predicted concentrations used in the regional assessment with monitoring data for the region, and (4) a summary of water monitoring data used for site selection and evaluation of the estimated drinking water concentrations for the region.

a. Selection of Palm Beach County for Drinking Water Assessment

Region A encompasses all of Florida, and extends through coastal Georgia into southernmost South Carolina. The majority of people living in this region derive their drinking water from ground-water sources. Sandy, coastal plain sediments and shallow, unconfined aquifers make portions of the region particularly vulnerable to pesticide contamination. The drinking-water supply of a significant number of people in Florida might be vulnerable to contamination with OP insecticides, but (except for fenamiphos) there is little evidence of ground-water contamination in Florida. However, because all uses of fenamiphos are being voluntarily cancelled, future impacts of this chemical on ground water resources are not expected.

The high-use areas in southern Florida around Palm Beach County to the east and Manatee County to the west represent the most vulnerable areas where OP use coincides with surface water intakes. The Agency selected Palm Beach County because the combination of OP-use crops represented the greatest potential for co-occurrence in the region. While a surface water assessment using the index reservoir may be less representative of actual drinking water sources in this region than in other regions, it is likely to be health-protective for the region.

Total OP use on agricultural crops in the region is less than a million pounds (NCFAP, 1997), with sugarcane, vegetables, corn, cotton, tobacco, and citrus accounting for more than 90 percent of this use (Table II.A.3).

Table II.A.3. General Overview of OP Usage in the Florida Region.

Crops	Primary Production Areas	Total Pounds Applied	Percent of Total OP Use
Vegetables	Southern FL	229,000	24
Corn (field, sweet)	Northern end of region	161,000	16
Cotton	GA, SC coastal plain; northern panhandle of FL	116,000	12
Tobacco	Southern GA, northern FL	70,000	7
Citrus	FL	68,000	7
Alfalfa/Hay		35,000	4
Pecans	GA coastal plain	17,000	2
Sugarcane	Lake Okeechobee and south into Everglades	>250,000	~26
			98

(1) Source: NCFAP, 1997 for all crops other than sugarcane (not reported). Estimated sugarcane use based on US EPA OP Use/Usage Matrix, 1999.

Relatively high OP-use areas are found in southern Florida and in the coastal plain of Georgia and South Carolina (Figure II.A.2). In the high-use coastal plain counties, cotton, corn, tobacco, and pecans were the dominant OP-use crops. In southern Florida, vegetables, citrus, sugarcane, and sweet corn were the dominant use crops.

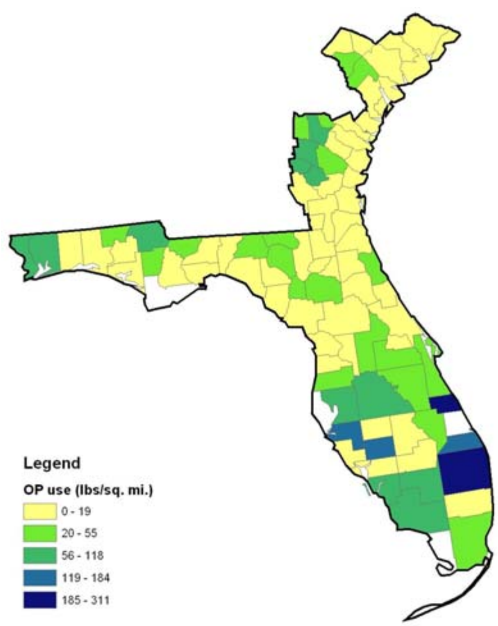

Figure II.A.2. Total OP usage (pounds per area) in the Florida Region (source: NCFAP, 1997).

Few surface water sources of drinking water occur in this region. Those intakes in the GA-FL coastal plain to the north are located in relatively low OP-use areas. Those intakes in southern Florida are located in high OP-use areas and are more vulnerable to runoff (Figure II.A.3). An examination of known community water systems (CWS) in the area show five CWS in Palm Beach County and two additional CWS in adjacent counties around Lake Okechobee.

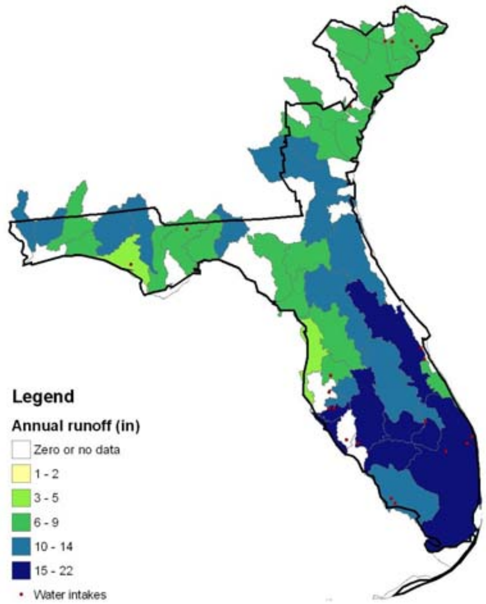

Figure II.A.3. Locations of surface water intakes of drinking water in relation to average annual runoff in the Florida Region.

Florida is served by five main aquifer systems. The vulnerability of drinking water derived from these aquifers to pesticide contamination varies.

The **Floridan Aquifer** is "one of the most productive aquifers in the world." The Floridan aquifer system provides water for the cities of Savannah and Brunswick in Georgia; and Jacksonville, Tallahassee, Orlando, and St. Petersburg in Florida. In addition, "the aquifer system provides water for hundreds of thousands of people in smaller communities and rural areas." It is the principal source of water supply for most of the state of Florida (USGS Hydrologic Investigations Atlas 730-G).

The Floridan aquifer is a carbonate aquifer (limestone and dolomite rock). In areas where the Floridan outcrops, or where confining layers above the Floridan are thin or breached, dissolution of these carbonate rocks allows much more rapid recharge and discharge of the aquifer [see http://capp.water.usgs.gov/gwa/ch_g/jpeg/G055.jpeg]. In some regions, dissolution is sufficient to form karst topography, which is most vulnerable to contamination from the surface. Where the confining layer is missing or thin, hydraulic connection with surface drainage, or the unconsolidated surficial aquifer, is substantial.

However, the Floridan is confined by thick clay layers over much of its area. In areas of thick confinement, there is little or no hydraulic connection with the surface. The confining layer is particularly thick in southern Florida [see http://capp.water.usgs.gov/gwa/ch_g/jpeg/G050.jpeg]. The Floridan and the confining unit above underlie most of the other aquifers in the region [see http://capp.water.usgs.gov/gwa/ch_g/jpeg/G008.jpeg]. The Floridan is underlain by the Southeastern Coastal Plain aquifer in the Panhandle of Florida, Georgia, and South Carolina.

The USGS describes the **surficial aquifer system** as “a thin, widespread layer of unconsolidated sand beds that commonly contains a few beds of shell and limestone. This aquifer system generally yields small volumes of water, and primarily is used for domestic supplies” (USGS Hydrologic Investigations Atlas 730-G). This aquifer is present at the surface along the entire South Carolina and Georgia coasts, and the eastern Florida coast south to where the Biscayne aquifer overlies it, south of West Palm Beach.

The surficial aquifer is typically less than 50 feet deep, although it is as thick as 400 feet in places. The surficial aquifer is unconfined almost everywhere, except for where thin clay beds cause local confined or semi-confined conditions. Water moves quickly in and out of the surficial aquifer, moving laterally to surface water or the ocean. Some water leaks through the confining unit below to the Floridan or intermediate aquifer.

People deriving drinking water from the surficial aquifer are most likely to encounter pesticide contamination in their domestic wells. Frequent contamination of shallow ground water in Florida with pesticides has been detected in many monitoring studies. However, with the exception of fenamiphos, ground-water contamination with OPs is much less common.

An **“intermediate” aquifer** is present in the subsurface between the surficial aquifer and the Floridan below in southwestern Florida. It is separated by confining layers above and below, and seepage from above provides recharge. It is an important “municipal supply in Sarasota, Charlotte, and Glades Counties, Fla.; elsewhere, it primarily is used for domestic supplies” (USGS Hydrologic Investigations Atlas 730-G). The confinement of the intermediate aquifer makes it less vulnerable to contamination than the surficial aquifer, except where breaches in the confining layer allow recharge from the surficial aquifer above.

The **Biscayne aquifer** serves the Miami Dade area, and is a sole-source drinking water supply for about three million people (USGS Circular 1207). This aquifer is unconfined, and particularly vulnerable to contamination. It consists of highly permeable carbonate rocks that were deposited in a marine environment. It is separated from the underlying Floridan below, which contains saltwater in this region, by 1000 feet of clay. The two aquifers are not hydraulically connected.

Three-quarters of withdrawal from the Biscayne aquifer are for public supply. “Major population centers that depend on the Biscayne aquifer for water supply include Boca Raton, Pompano Beach, Fort Lauderdale, Hollywood, Hialeah, Miami, Miami Beach, and Homestead. The Florida Keys also are supplied primarily by water from the Biscayne aquifer that is transported from the mainland by pipeline” (USGS Hydrologic Investigations Atlas 730-G).

South Florida Water Management District uses methods such as canals, levees, and pumping to manage surface water flow and prevent flooding. Rapid interchange between canals and the Biscayne is possible almost everywhere because the high permeability. As a result, “aquifer contamination by any pollutants in the canal water can be both rapid and widespread" (USGS Hydrologic Investigations Atlas 730-G).

The **surficial "sand and gravel" aquifer** occurs in the western-most panhandle of Florida. It is a sand and gravel aquifer which provides moderate amounts of water. Eighty percent of withdrawal from this aquifer is in the Pensacola area. Although it can be locally confined by interbedded clay layers, it is generally unconfined, and susceptible to contamination.

The only area in the region where surface water sources of drinking water coincided with significant OP usage was in southern Florida. OP uses on vegetables, citrus, sugarcane, and sweet corn accounted for more than 95 percent of agricultural usage of OP pesticides in Palm Beach County, FL, where the drinking water assessment was based, with sugarcane being the dominant use-crop (Table II.A.4).

Table II.A.4. OP Use on Agricultural Crops in Palm Beach County, FL.

OP Usage/ Agricultural Crops				Total Cropland Acreage, Assessment Area	
Crop Group	**Crops**	**OP Usage x 1000 lb**	**Percent of Total OP Use**	**Acres x 1000**	**Pct of total Cropland**
Sugarcane	Sugarcane	263	84	431	81
Corn	Sweet corn	43	12	22	4
Vegetables	Lettuce, tomato, pepper	5	2	10	2
Citrus	Orange, tangelo, tangerine, grapefruit	0.8	<1	10	2
				474	92

Pesticide use based latest data collected by USDA National Agricultural Statistics Service (NASS).
Acreage estimates based on FL Agricultural Statistics Service and FL Cooperative Extension Service.
Details on the sources of usage information are found in Appendix III.E.8.

While only a relatively small fraction of the sugarcane acreage was treated with OP pesticides (10% of acres treated with phorate; 6% with ethoprop), this still accounts for a relatively large acreage compared to other uses in the area. The estimated 43,000 acres of sugarcane treated with phorate is still greater than the total combined acreage of the other OP use crops.

b. Cumulative OP Concentration Distribution in Surface Water

The Agency estimated drinking water concentrations for the Florida regional assessment using PRZM-EXAMS with input parameters specific to southern Florida. Table II.A.5 summarizes pesticide use information for the OP-crop combinations included in this regional assessment. Chemical-, application- and site-specific inputs are found in Appendices III.E.5-7. Sources of use information can be found in Appendix III.E.8.

Table II.A.5. OP-Crop combinations and application information for the Florida Region Assessment.

Chemical	Crop/ Use	Pct. Acres Treated	App. Rate, lb ai/A	App Meth/ Timing	Application Date(s)	Range in Dates
Chlorpyrifos	Corn, Sweet	80	0.66	Aerial; Foliar	Oct 1, Feb 15	Oct1-Dec1, Feb15-May15
Phorate	Corn, Sweet	69	1.3	Ground; At Planting	Sep. 1	Sep1-Feb1
Chlorpyrifos	Grapefruit	5	1.5	Ground; Foliar	Jan 1, Feb 15	Jan1-Mar31
Diazinon	Lettuce	51	0.69	Ground; Foliar	Oct 15, Jan 22	Oct15-Apr30
Chlorpyrifos	Oranges	5	0.57	Ground; Foliar	Jan 1, Feb 15	Jan1-Mar31
Acephate	Peppers (Bell)	28	0.76	Ground; Foliar	Oct 15, Dec 5, Jan 25	Oct15-Mar15
Ethoprop	Sugarcane	6	3.5	Ground; At Planting	Sep 1	Sep1-Jan15
Phorate	Sugarcane	10	3.9	Ground; At Planting	Sep 1	Sep1-Jan15
Chlorpyrifos	Tangelos	5	1.01	Ground; At Planting	Jan 1	Jan1-Mar31
Chlorpyrifos	Tangerines	10	0.72	Ground; Foliar	Jan 1, Feb 15	Jan1-Mar31
Diazinon	Tomatoes	7	0.58	Ground; Foliar	Nov 1, Jan 23	Nov1-Apr15
Methamidophos	Tomatoes	14	0.47	Ground; Foliar	Nov 1, Dec 26, Feb 19	Nov1-Apr15

The estimated concentrations of ethoprop, total phorate residues, and the cumulative OP load were among the highest of all the regions (Table II.A.6). Estimated maximum concentrations of phorate and the cumulative OPs was greater than 10 ppb; 99th percentile concentrations, however, were less than 1 ppb.

Table II.A.6. Predicted percentile concentrations of individual OP pesticides and of the cumulative OP distribution in the Florida Region.

Chemical	Crop/Use	Concentration in ug/L (ppb)						
		Max	99th	95th	90th	80th	75th	50th
Acephate	Peppers	7.7e-02	6.8e-03	8.5e-04	2.8e-04	8.7e-05	5.7e-05	4.3e-06
Chlorpyrifos	Corn, Citrus	2.0e-01	9.6e-02	4.9e-02	3.3e-02	2.1e-02	1.8e-02	9.1e-03
Diazinon	Lettuce, Tomato	2.9e-02	1.5e-02	9.1e-03	6.4e-03	4.0e-03	3.3e-03	1.1e-03
Ethoprop	Sugarcane	1.5e+00	5.1e-01	2.5e-01	1.7e-01	9.8e-02	8.0e-02	3.8e-02
Methamidophos	Peppers, Tomato	9.3e-03	1.7e-03	2.6e-04	8.4e-05	1.6e-05	9.9e-06	1.8e-07
Phorate	Corn, Sugarcane	1.2e+01	7.2e-01	1.8e-02	1.1e-04	5.4e-09	8.5e-11	4.4e-12
OP Cumulative (in Methamidophos Equivalents, ppb)		1.4e+01	9.0e-01	7.8e-02	3.6e-02	2.0e-02	1.7e-02	8.1e-03

Figure II.A.4 displays 35 years of predicted OP cumulative concentrations in drinking water sources for the region. Peak cumulative concentrations (in methamidophos equivalents) exceeded 10 ppb (methamidophos equivalents) during two years, and was less than 6 ppb in the remaining 33 years of simulation. During this time, pesticide usage was held constant while the weather varied according to actual patterns that spanned 35 years.

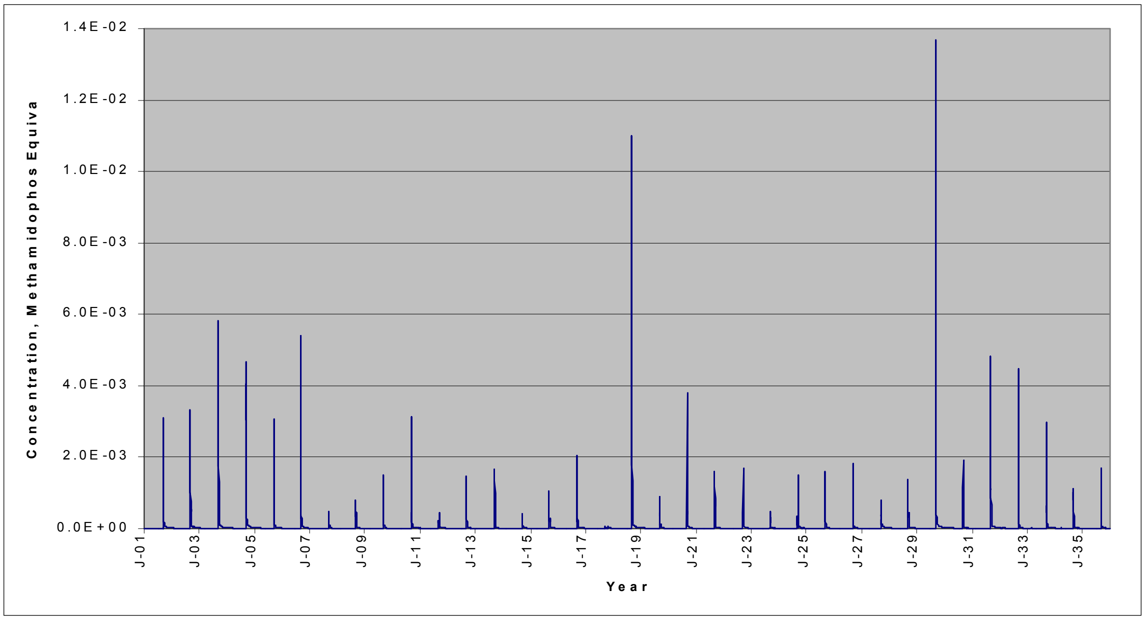

Figure II.A.4. Cumulative OP distribution in water in the Florida Region across 35 years of weather patterns.

A strong seasonal trend is evident when all 35 years of predicted values are laid out in a year span, with a sharp peak of short duration occurring in early September (Figure II.A.5). This peak is associated with phorate applications to sugarcane and corn, and ethoprop applications to sugarcane.

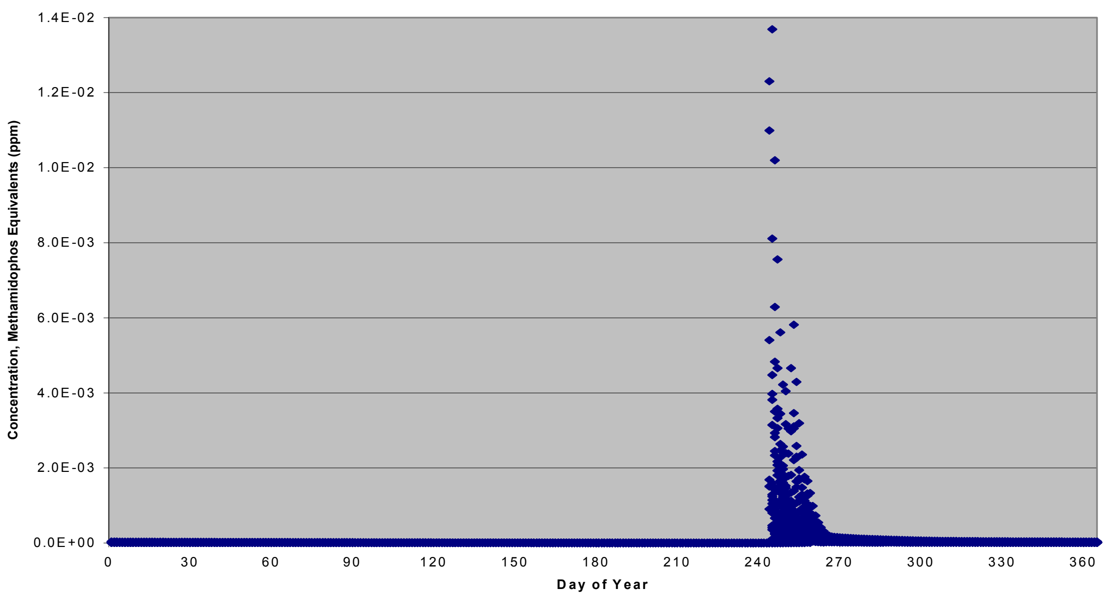

Figure II.A.5. Variations in yearly pattern of cumulative OP concentrations in water in the Florida Region (35 years of varying weather patterns).

Phorate is the major contributor to the estimated cumulative OP concentration (Figure II.A.6). Phorate use on sugarcane accounted for much of the OP cumulative concentration, more than 10 and 100 times greater than contributions from phorate use on corn and ethoprop use on sugarcane, respectively. The relative OP contributions are the result of both individual concentrations in water and their relative potency and safety factors.

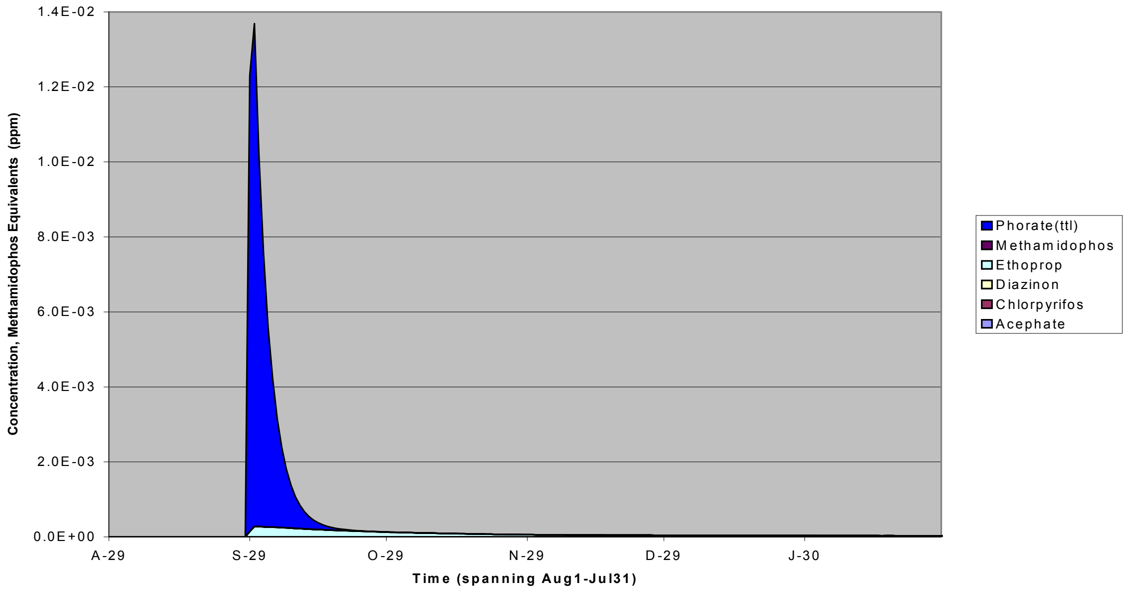

Figure II.A.6. Cumulative OP distribution spanning Aug1 (year 29) through Jan31 (year 30) showing relative contributions of the individual OPs in Florida Region.

OP uses on other crops (citrus, vegetables) in this area of Florida tend to occur at different times, although the application season is fairly long. None of the other OP pesticides contributed to the estimated cumulative OP load at the same time as phorate and ethoprop.

The estimated phorate concentrations reflect both the parent compound and two transformation products – phorate sulfoxide and phorate sulfone – that are assumed to be of equal toxicity (see I.E.3.a. for a description of how the total toxic residues were estimated). The net effect from including these more persistent and mobile transformation products is to increase the estimated peak concentrations and spread in distribution (Figure II.A.7). However, even when total phorate residues are considered, the pulse load for phorate is of relatively short duration.

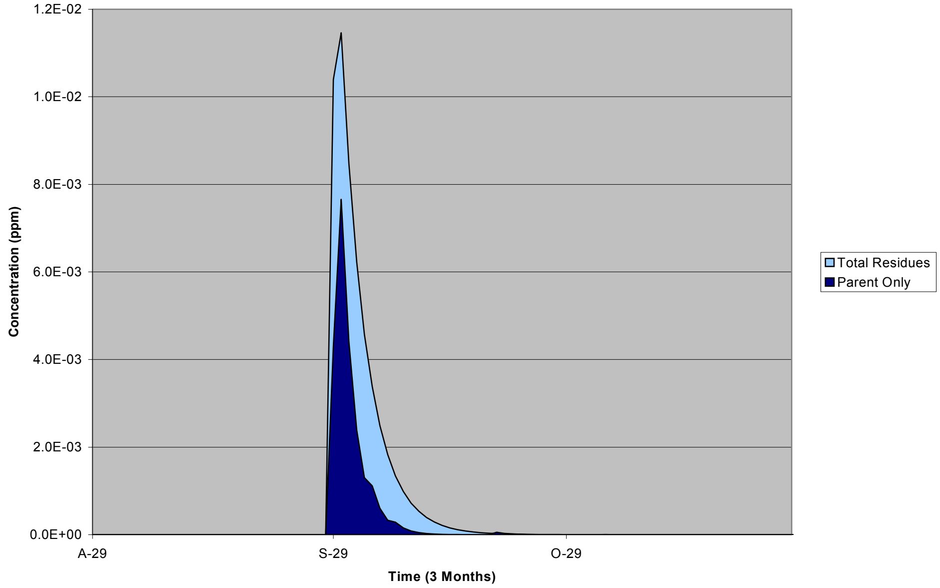

Figure II.A.7. Relative contributions of the parent (dark) and sulfoxide/sulfone transformation products (light) to the estimated phorate concentrations in drinking water sources in the Florida Region.

c. A Comparison of Monitoring Data Versus Modeling Results

The South Florida (SOFL) NAWQA study unit includes the vulnerable drinking-watersheds of the Florida Region. The estimated concentrations of chlorpyrifos were similar to the detections reported from agricultural sampling stations, with 80th percentile and greater estimated concentrations 5 to 8 times greater than similar percentiles of reported detections. Estimated 99th percentile concentrations for diazinon were similar to that measured in the SOFL unit. No comparisons could be made at lower percentiles, which extended beyond the frequencies of detection for these chemicals. While 90th and 95th percentile estimates for ethoprop were 20 to 30 times greater than similar percentiles from the SOFL unit, 99th and maximum estimates were closer (6 to 7 times greater). The study reported no detections of the parent phorate. While the estimated 99th percentile concentration of total phorate residues (including sulfone and sulfoxide) was more than two orders of magnitude greater than the limit of detection (LOD) for phorate, between 90 and 95 percent of the estimated distribution was less than the LOD.

The estimated cumulative OP concentrations used in the exposure assessment represent concentrations that would occur in a reservoir, and not in the streams and rivers represented by the NAWQA sampling. The sampling frequency of the NAWQA study (sample intervals of 1 to 2 weeks apart or less frequent) was not designed to capture peak concentrations, so it is unlikely that the monitoring data will include true peak concentrations. This may be particularly critical for phorate, where the estimated pulse load of the parent is of a relatively short duration (less than 2 weeks). No monitoring data from reservoirs are available for this region.

d. Characterization of the Vulnerable Drinking Water Source

Drainage canals from sugarcane fields are not used directly for drinking water, but water from drainage canals eventually feeds water bodies used in southern Florida for drinking water supply. Sugarcane is grown south of Lake Okeechobee in the Everglades Agricultural Area (EAA), and to the east into Palm Beach County (USDA Agricultural Census, http://www.nass.usda.gov/census/census97/atlas97/map258.htm). Three community water systems (CWS) draw from the southern end of Lake Okeechobee. The city of West Palm Beach draws water from Clear Lake, which is fed in part by drainage water from the EAA.

Water flows from Lake Okeechobee predominantly through the Caloosahatchee River to the west, the St. Lucie River to the east, and south through the EAA toward the Everglades (South Florida Water Management District, http://www.sfwmd.gov/org/wrp/wrp_okee/2_wrp_okee_info/maps/homepagemap.html). The South Florida Water Management District (SFWMD) tightly manages water in this area to direct water where it is needed or for flood control. However, water may also be flushed back from the EAA into Lake Okeechobee, perhaps once every two years (US Army Corps of Engineers, personal communication, 2002).

The SFWMD, the State of Florida, and the United States Army Corps of Engineers (USACE) have worked to control and reduce transport of agricultural chemicals (particularly phosphorus) into Lake Okeechobee and the Everglades. This is being accomplished through the adoption of Best Management Practices (BMPs) in agriculture, and through the extensive engineering involved in the Comprehensive Everglades Restoration Plan (CERP).

While the Best Management Practices are intended mainly for sediment control and phosphorus reduction, they may also serve to reduce pesticide transport. For instance, farmers in south Florida pump water from their fields during a normal rainy season (June to November) into drainage canals to prevent damage to their crops (Ken Todd, Water Resource Manager Palm Beach County, personal communication, 2002). One BMP recommends waiting for the first inch of rainfall to occur before pumping, to reduce particulates and (to some extent) phosphorus discharge. BMPs which extend holding time, or settle organic matter from agricultural water, can allow time for pesticide degradation or reduce transport of entrained pesticides.

The CERP relies on engineering solutions to filter water by greatly extending path length and residence time of agricultural runoff. Water passing through sugarcane areas of the EAA passes through some 28,000 acres of constructed wetlands meant primarily to settle out sediment and reduce phosphorus loads. Eventually, as part of the Comprehensive Everglades Restoration Plan, up to 50,000 acres of such wetlands may be constructed (see http://www.evergladesplan.org/pm/projects/proj_08.shtml).

Water that leaves the EAA flows through drainage canals to the south and east (see http://www.evergladesplan.org/the_plan/

3lev_maps_p11.shtml#flowmaps). These canals are used as water supply, flood control, and maintenance of water tables in coastal, urban areas. Water that has reached the coast to recharge the Biscayne aquifer will have traveled many miles from sugarcane areas where phorate and ethoprop may have been applied. However, rainfall, not these canals, is the predominant source of recharge for the Biscayne aquifer.

The Everglades Restoration Plan includes Water Preserve Areas in the current Water Conservation Areas, which will be used in part to redirect water away from the coast, restoring flow through the Everglades. The city of West Palm Beach derives part of its water supply from the drainage canal L-8, which passes through the Water Conservation Area. Water from this canal is diverted to M Canal, which travels through 25 square miles of water catchment and wetlands and into Clear Lake, where the CWS for West Palm Beach is located. The distance from L-8 to Clear Lake is about 22 miles.

The SFWMD has monitored several points along the leveed banks of Lake Okeechobee since 1984. SFWMD monitoring stations S-2, S-3, S-4, and S-235 are on the southern shore of Lake Okeechobee [See http://www.sfwmd.gov/org/wrp/wrp_okee/2_wrp_okee_info/maps/lomap.html].

Table II.A.7. Ethoprop concentrations, Lake Okeechobee (SFWMD Monitoring)

Station	S-2	S-3	S-4	S-235	All Sites
Min	0.025	0.05	0.02	0.02	0.02
Max	0.22	0.05	0.11	0.02	0.22
Avg	0.11	0.05	0.05	0.02	0.06
Count	3	1	5	1	10
% Detect	7	2	12	2	6

The maximum concentration of ethoprop detected at these monitoring sites since 1992 (see Table II A.7) is 0.22 ppb, which corresponds closely to the maximum concentration found by the NAWQA program. Phorate was not detected in this program. While insufficient information is available to quantify the effects of treatment on ethoprop, the CWS are developing wells to supplement its water supply. This would serve to potentially dilute any surface-water concentrations found in the lake.

e. Summary of Available Monitoring Data for the Florida Region

The **Southern Florida (SOFL) NAWQA** study unit includes the Biscayne aquifer, the Everglades, and portions of the Flatwoods and highly vulnerable Central Ridge regions of Florida. The Floridan, surficial, and intermediate aquifers are also important sources of drinking water in this study unit. Ground water supplied 94% of water used in the study unit in 1990 (USGS Circular 1207).

Intensive surface water sampling in the SOFL study unit included canals draining mixed use (vegetables), citrus, and sugarcane fields. Diazinon and chlorpyrifos were detected at low concentrations in the mixed use canal. Chlorpyrifos (max 0.023ug/l) and malathion (max 0.084 µg/l) were detected in 25% and 20% of samples from the citrus canal, with fewer detections of azinphos-methyl, methyl-parathion, and ethoprop.

Ethoprop was extensively (32%) detected in the sugarcane canal, with a maximum concentration of 0.279 µg/l. Sugarcane is the most important use for ethoprop. Chlorpyrifos, methyl parathion, diazinon, and malathion were detected less frequently and at lower concentrations.

Pesticides were detected in 85% of the wells included in this monitoring program. However, OPs were not among the pesticides detected, in spite of rapid recharge in shallow, unconfined aquifers. Three ground-water studies (two agricultural and one urban) were performed:

- Thirty one wells were installed within the row in the tree drip line of citrus groves in the Flatwoods region of Florida. Almost all the wells were less than 15 feet deep in an area where depth to ground water ranges from two to four feet. All of the wells were sampled once in early summer, 1998, and ten wells were sampled again that fall. The NAWQA SOFL report does not indicate if OP insecticides were applied to the citrus trees before sampling [http://srv3sfltpa.er.usgs.gov/gw/cbkbyparm.html].

- Thirty public supply wells in the Biscayne aquifer with depths ranging from 40 to 150 feet were sampled. Each was sampled a single time in 1998. While almost all of the wells had some kind of pesticide contamination, no OP was detected. [http://srv3sfltpa.er.usgs.gov/gw/psbyparm.html .]

- Thirty-two shallow wells (10 to 50 feet deep) were sampled once each in the SOFL urban land-use study. In addition to residential areas, wells in areas such as parks, golf courses, and parking lots were included. No OPs [http://srv3sfltpa.er.usgs.gov/gw/urbbyparm.html].

The **Georgia-Florida Coastal Plain (GAFL) NAWQA** study unit extends from central Florida south of Tampa to just north of Atlanta, Georgia. The USGS reports that 80% of the population in this area derives its drinking water from ground-water, and that 94% of that ground-water is drawn from the Upper Floridan aquifer. About 25% of this region is devoted to agriculture, and more than half to forestry.

No OP was detected in ground-water monitoring in this unit in three studies:

- Twenty-three shallow monitoring wells were installed in an area of intensive row-crop agriculture in Georgia. Crops in this area to which OPs are applied include peanuts, corn, and cotton. The study was designed to sample recently recharged ground water in the surficial aquifers. All wells were sampled once in spring 1994, and half of these wells were resampled that summer. While herbicides were detected in 11 wells, no OPs were detected.

- The GAFL program included 37 domestic wells in surficial deposits. Eighteen of these were in the Coastal Flatwoods and 19 were in the Southern Coastal Plain physiographic region. Only herbicides were detected in these wells. Previously, from 1985 to 1989, the Florida Department of Environmental Protection sampled 27 GAFL region wells in the Central Ridge region. OPs were not detected in these wells, either.

- A third ground-water study included 32 monitoring wells in urban areas. These wells, which tap the surficial and Upper Floridan aquifers, were sampled once each in 1995.

Surface-water monitoring sites in the Florida portion of the GAFL study unit included an urban stream in Tallahassee and a number of fixed stream-sampling stations. Diazinon and chlorpyrifos were detected frequently (54% and 45%) in urban and mixed land-use samples. Malathion was detected in 35% of urban stream samples, but not in mixed land-use samples, with a maximum concentration of 0.2 µg/l. Ethoprop, phorate, azinphos-methyl and diazinon were detected in 3 or fewer agricultural samples each, at concentrations <0.1 µg/l.

Doug Jones of the **Georgia 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 detected by 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 the 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; however, OP insecticides have not yet been assigned MCLs.

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. The 17 OPs and transformation products included in these three studies are azinphos-methyl, chlorpyrifos, diazinon, dichlorvos, disulfoton, ethion, ethoprop, fenamiphos, fenamiphos sulfone, fenamiphos sulfoxide, malathion, methamidophos, methyl parathion, methyl paraoxon, naled, phorate, and terbufos.

The first study, conducted by the Florida Department of Environmental Protection (FDEP) and the Florida Department of Health (FDH) included “up to 50 private drinking water wells... 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). No OPs were detected in these samples.

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 conducted by the FDEP and the FDEH on private and public drinking water supply wells included 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.

ii. Fenamiphos in Ground Water

The studies described above provide useful information on the general likelihood of pesticide contamination in Florida wells. However, the studies were not specifically targeted to OP insecticides. Limited targeted monitoring data indicate that concentrations of fenamiphos and its transformation products in ground water can exceed those of most other OPs detected in surface water or ground water. A 1989 retrospective ground-water monitoring study in the Central Ridge of Florida detected maximum concentrations of total fenamiphos in a citrus grove of up to 252.8 µg/l. The detections were a result of fenamiphos being applied at a rate of 9.9 lb a.i./A in three separate applications from 1990 to 1992.

Total fenamiphos residues were detected in a subsequent prospective ground-water monitoring study on sandy soils in the Central Ridge at concentrations up to 87.2 µg/l. Fenamiphos sulfoxide accounted for 83.3 µg/l of this total concentration, which was detected 183 days after a 4.1 lb ai/acre application to citrus. The results of this study led to the voluntary cessation of fenamphos use on citrus in the Central Ridge. Fenamiphos can still be applied in that region for other uses, such as turf.

Fenamiphos residues have also been detected in groundwater elsewhere in Florida. Maximum concentrations in groundwater of 0.71, 0.75, and 0.10 µg/l for fenamiphos, fenamiphos sulfoxide, and fenamiphos sulfone, respectively, were detected in a golf course study conducted by the USGS. Fenamiphos and its transformation products were found at five out of seven golf courses sampled, which were located on soils varying from fine sands with good drainage (citrus-growing soils) to Flatwoods soils with poor drainage.

The detections of total fenamiphos residues in these three studies were all from samples in shallow wells installed in unconsolidated surficial aquifers. As detailed above, shallow surficial aquifers are an important source of drinking water in Florida. **Available data generally do not indicate that OPs will co-occur in ground water. Therefore, the potential for unacceptable exposure to fenamiphos in ground water used as drinking water is not best considered in the cumulative risk assessment, but in the current risk management phase of the fenamiphos reregistration process.**

4. Results of Cumulative Assessment

Analyses and interpretation of the outputs of a cumulative distribution rely heavily upon examination of the results for changing patterns of exposure. Briefly, the cumulative assessment single day analysis generates multiple potential exposures (i.e., distribution of exposures for each of the 365 days of the year) for each hypothetical individual in the assessment for each of the 365 days in a year. Because multiple calculations for each individual in the CSFII population panel are conducted for each day of the year, a distribution of daily exposures is available for each route and source of exposure throughout the entire year. Each of these generated exposures is internally consistent – that is, each generated exposure appropriately considers temporal, spatial, and demographic factors such that “mismatching” (such as combining a winter drinking water exposure with an exposure that would occur through a spring lawn application) is precluded. In addition, a simultaneous calculation of MOEs for the combined risk from all routes is performed, permitting the estimation of distributions of the various percentiles of total risk across the year. Results are displayed as MOEs with the various pathways, routes, and the total exposures arrayed across the year as a time series (or time profile). Any given percentile of these (daily) exposures can be selected and evaluated as a function of time. That is, for example, a 365-day series of 95th percentile values can be arrayed, with 95th percentile exposures for each day of the year (January 1, January 2, etc.). shown. The result can be regarded as a “time-based exposure profile” in which periods of higher exposures (evidenced by low ‘Margins of Exposure’) and lower exposures (evidenced by high ‘Margins of Exposure’) can be discerned. Patterns can be observed and interpreted and exposures by different routes and pathways (e.g., dermal route through lawn application) can be seen and compared. Abrupt changes in the slope or levels of such a profile may indicate some combination of exposure conditions resulting in an altered risk profile due to a variety of factors. Factors causing this alteration may include increased pest pressure and subsequent home pesticide use, or increased use in an agricultural setting that may result in increased concentrations in water. Alternatively, a relatively stable exposure profile indicates that exposure from a given source or combination of sources is stable across time and the sources of risk may be less obvious. Different percentiles can be compared to ascertain which routes or pathways tend to be more significant contributors to total exposure at various total exposure levels for different subgroups of the Florida output distribution (e.g, those at the 95th percentile vs. 99th percentiles of exposure).

Figures III.J.2-1 through III.J.2-16 in Appendix J present the results of this cumulative risk analysis for Children, 1-2 years of the Florida output distribution for a variety of percentiles (95, 99, 99.5, and 99.9) and a variety of averaging periods (one-, seven-, fourteen, and twenty-one days). Figure III.J.2-17 through Figure III.J.2-32 present these same figures for Children 3-5. Appendix III.J.3 present the (ungraphed) data/output for Adults 20-49 and Adults 50+. The following paragraphs describe, in additional detail, the exposure profiles for each of these age groups for the 99.9th and 95th percentiles (specific information regarding the MOEs at the additional percentiles examined can be seen in the above-mentioned figures). Briefly, these figures present a series of time courses of exposure (expressed as MOEs) for various age groups at various percentiles of exposure for the population comprising that age group. For example, for the 95th percentile MOEs for children 1-2 years old, the 95th percentile (total) exposure for children 1-2 is estimated for each of the 365 days of the year, with each of these (total) exposures – expressed in terms of MOEs – arrayed as a function of time. The result is a “time course” (or “profile”) of exposures representing that portion of the Florida output distribution at the 95th percentile exposures throughout the year. In addition, the MOEs are shown for each pathway or route (e.g., oral ingestion through food, oral ingestion through hand-to-mouth activity, inhalation, dermal, etc.) for each of a variety of percentiles. This discussion represents the unmitigated exposures (i.e., exposures which have not been attempted to be reduced by discontinuing specific uses of pesticides) and no attempt is made in this assessment to evaluate potential mitigation options. The following paragraphs describe the findings and conclusions from each of the assessments performed.

a. Children 1-2 years old

Single-Day Analysis (Figure III.J.2-1 through Figure III.J.2-4): At the 99.9th percentile, a variety of exposures from the various pathways (food, water, residential) are evident. The total MOE is ~ 10-60, with exposures through residential inhalation from DDVP pest strip use (MOE ~ 10 to 110) dominant. At the 95th percentile, total MOEs are well above 100, and no exposure through the use of DDVP pest strips occurs. It is important to express these exposures as a *range* of MOEs because there may be variability across the seasons. For all percentiles examined (95th through 99.9th) , drinking water exposures continue to be low for most of year and, apart from a sharp increase in drinking water concentrations near Julian day 240 which arise from phorate application to sugarcane in September, do not contribute in any significant manner to the overall risk picture. Dermal and oral hand-to-mouth exposures appear throughout all percentiles examined, but generally remain a small fraction of total exposure.

Seven-Day Rolling Average Analysis (Figures III.J.2-5 through Figure III.J.2-8): At the 99.9th percentile, the total MOE is ~ 30-60, with exposures through residential inhalation route from DDVP pest strips dominant and responsible for virtually the entire total risk picture at this percentile. At the 95th percentile, total MOEs are all substantially above 100. It is important to express these exposures as a *range* of MOEs because there may be variability across the seasons. Throughout the percentiles examined (95 through 99.9th), drinking water exposures continue to be low and are similar to that described under the single day analysis above. Dermal and oral hand-to-mouth exposures appear throughout all percentiles examined, but generally remain a small fraction of total exposure.

Additional Averaging Periods: Fourteen and Twenty One -Day Rolling Average Analysis are shown in Figure III.J.2-9 through Figure III.J.2-12 and Figure III.J.2-13 through Figure III.J.2-16, respectively.

b. Children 3-5 years old

Single-Day Analysis (Figure III.J.2-17 through Figure III.J.2-20). As with children 1-2, a variety of exposures from the various pathways (food, water, residential) are observed at the 99.9th percentile. The total MOE at this percentile is ~ 10-60, with residential inhalation exposures from DDVP pest strips (MOE ~ 20 to 100) dominant. At the 95th percentile, total MOEs are all substantially above 100, with no exposures through the inhalation pathway present. It is important to express these exposures as a *range* of MOEs because there may be variability across the seasons. For all percentiles examined (95 through 99.9th percentiles) and as described above for children 1-2, drinking water exposures continue to be low for most of year and do not contribute in any significant manner to the overall risk picture (apart from a sharp increase in drinking water concentrations near Julian day 240). Dermal and oral hand-to-mouth exposures appear throughout all percentiles examined, but generally remain a small fraction of total exposure.

<u>Seven-Day Rolling Average Analysis (Figure III.J.2-21 through Figure III.J.2-24).</u> At the 99.9th percentile, the total MOE is ~ 30-70, with exposures from DDVP pest strips (MOE ~ 40 to 80) through the inhalation route dominant. At the 95th percentile, total MOEs are all substantially above 100 and exposures through inhalation are not present. It is important to express these exposures as a *range* of MOEs because there may be variability across the seasons. As described above for children 1-2, drinking water exposures continue to be low for most of year and do not contribute in any significant manner to the overall risk picture (apart from a sharp increase in drinking water concentrations near Julian day 240). Dermal and oral hand-to-mouth exposures appear throughout all percentiles examined, but generally remain a small fraction (<1%) of total exposure.

<u>Additional Averaging Periods:</u> Fourteen and Twenty One -Day Rolling Average Analysis are shown in Figure III.J.2-25 through Figure III.J.2-28 and Figure III.J.2-29 through Figure III.J.2-32, respectively.

c. Adults, 20-49 and Adults 50+ years old

<u>Single Day Analysis (Appendix III.J.3)</u> At the 99.9th percentile, Total MOE's are in the range of ~ 40 - 170 for these age groups. Inhalation exposures from the use of DDVP pest strips are the significant contributors to this risk. At the 95th percentile, total MOEs are all substantially above 100 and exposures through inhalation are not present. It is important to express these exposures as a *range* of MOEs because there may be variability across the seasons. Throughout all percentiles examined and apart from exposures near Day 240, drinking water exposures remain low. Similarly, dermal exposures appear throughout the year, but are consistently only a small fraction of total exposure with MOEs generally >1000.

<u>Seven Day Rolling Average Analysis (Appendix III.J.3)</u> At the 99.9th percentile, Total MOE's are in the range of ~ 90 to 200 for these age groups. Inhalation exposures from the use of DDVP pest strips are the dominant contributor. At the 95th percentile, total MOEs are all substantially above 100

and exposures through inhalation are not present. It is important to express these exposures as a *range* of MOEs because there may be variability across the seasons. Apart from exposures near Day 240 (explained above), drinking water exposures remain low. Dermal exposures appear throughout the year, but are consistently only a small fraction of total exposure with MOE's remaining above 1000.

d. Other Age Groups

Additional analyses were conducted for the remaining age groups for Region A (i.e., <1 year olds, 6-12 year olds, and 13-19 year olds). These results are presented in Appendix III.J.4.