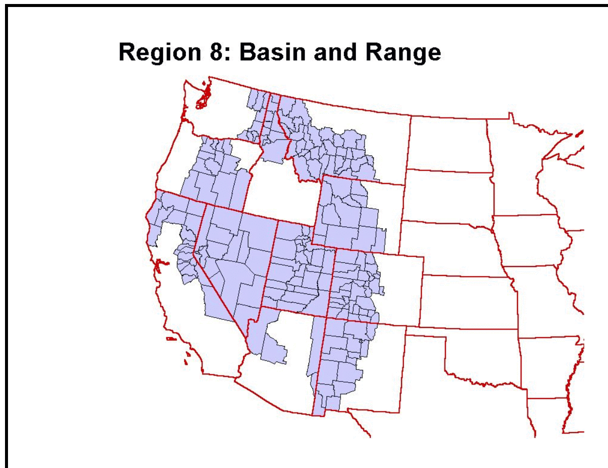
II. Regional Assessments

I. Region 8 - Basin and Range

1. Executive Summary



This module of the Organophosphate (OP) cumulative risk assessment focuses on risks from OP uses in the Basin and Range (area shown to the right). Information is included in this module only if it is specific to the Basin and Range, or is necessary for clarifying the results of the Basin and Range 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.I.1. below. The OP uses included in the drinking water assessment generally accounted for 95% or more of the total OPs applied in that 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.I.1. Pesticides and Use Sites/Scenarios Considered in Basin and Range Residential/Non-Occupational and Drinking Water Assessment

Pesticide	OP Residential Use Scenarios	OP Drinking Water Scenarios
Acephate	Ornamentals	None
Azinphos Methyl	None	Potatoes
Bensulide	Golf Courses	None
Chlorpyrifos	None	Sugarbeets, Wheat
DDVP	Pest Strips, Crack/Crevice	None
Dimethoate	None	Potatoes

Pesticide	OP Residential Use Scenarios	OP Drinking Water Scenarios
Disulfoton	Ornamentals	None
Malathion	Lawns, Ornamentals, Vegetable Gardens	None
Phorate	None	Sugarbeets
Terbufos	None	Sugarbeets
Trichlorfon	Golf Courses, 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 the Basin and Range 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 Basin and Range region is presented, focusing on aspects which are specific to this region.

In general, the risks estimated for the Basin and Range 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 population exposure, residential exposures are the major source of risk - in particular inhalation exposure. These patterns occur for all population sub-groups, although potential risks appear to be higher for children than for adults regardless of the population percentile considered.

2. Development of Residential Exposure Aspects of Basin and Range Region

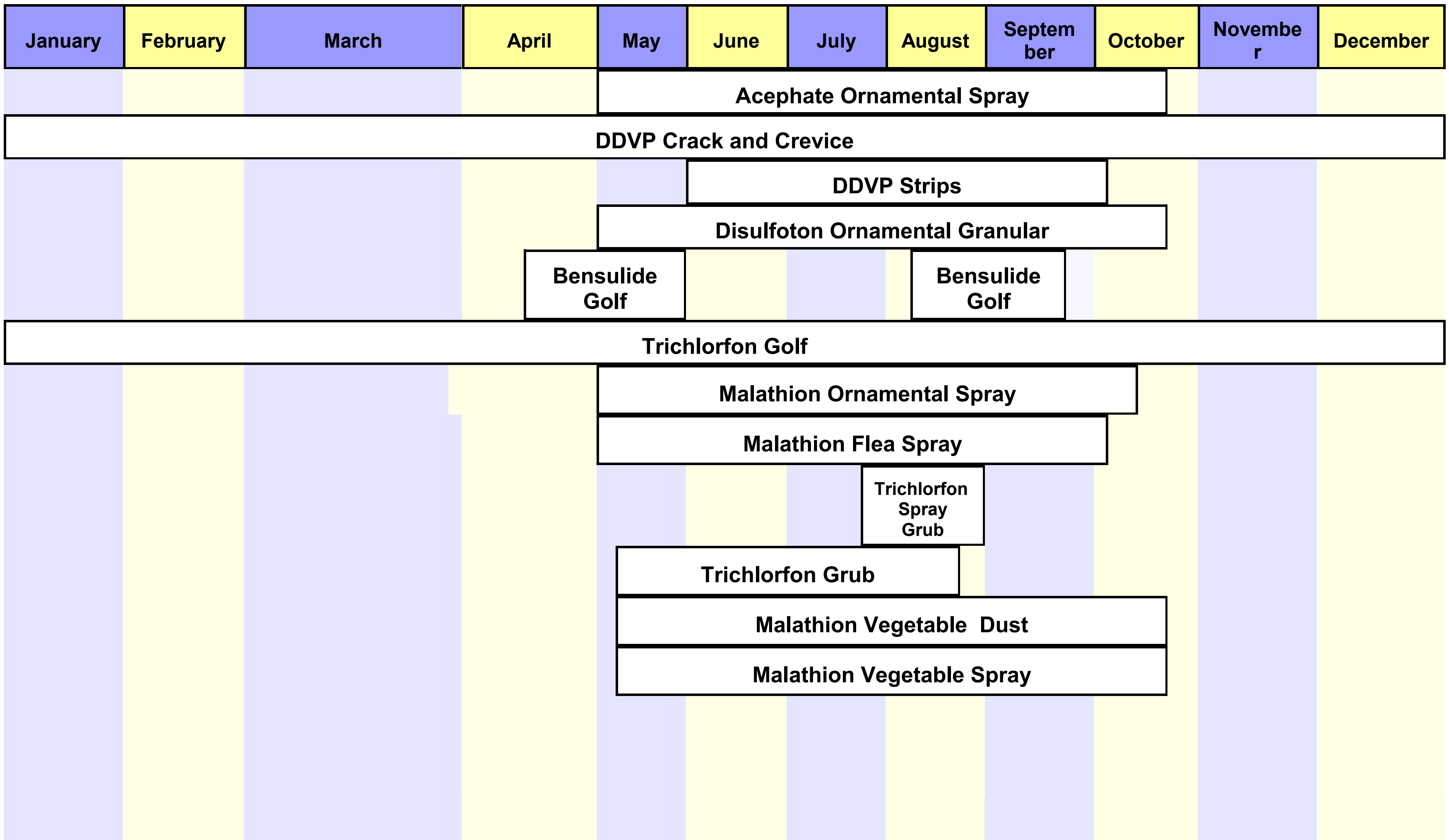
In developing this aspect of the assessment, the residential exposure component of Calendex was used to evaluate predicted exposures from residential uses. Except for golf course uses, this assessment is limited to the home as are most current single chemical assessments. The residential component of 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, and indoor uses. 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 was required for this assessment of the Basin and Range region. This information includes region-specific data on pesticide application rates and timing, pesticide use practices, and seasonal applications patterns, among others. The Gaant chart shown in Figure II.I.1 displays and summarizes the various region-specific residential applications and their timing (including repeated applications) over the course of a year which were used in this assessment. Specific information and further details regarding these scenarios, the Calendex input parameters, and the pesticides for which these scenarios were used are presented in Table II.I.2 which summarizes all relevant region-specific scenarios.

Table II.I.2. Use Scenarios and Calendex Input Parameters for Basin and Range Residential Exposure Assessment

Chemical	Use Scenario and Pest	Appln. Method	Amount Applied lb ai/A or other	Number and Frequency of Applns.	Seasonal Use	% use LCO	% use HO	% users	Active Exposure Period (days)	Exposure Routes
Acephate	Ornamentals	hand pump sprayer	0.934-2	4/yr	May-Oct.	--	100	7	1	dermal, inhalation
Bensulide	Golf Courses	NA	12.5	2/yr	April-May Aug-Sept.	100	--	1.83	14	dermal
DDVP	Pest Strips	strip	NA	2/yr	May-Oct.	NA	100	2.5	90	inhalation
	Crack/Crevice	spray can	0.72-2.5 mg	1/mth	Jan-Dec.	--	100	6	1	inhalation
Disulfoton	Ornamentals	granular	8.7	3/yr	May-Oct.	--	100	7	1	dermal, inhalation
Malathion	Lawns Fleas	hose end spray	5 lb ai	2/yr	May-Oct.	13	87	4	4 1	dermal, oral inhalation
	Ornamentals	hand pump spray	0.94-2 lb/A	2/mth	May-Oct.	--	100	3.7	1	dermal, inhalation
	Vegetable Gardens	hand duster	1.5 lb/A	5/yr	May-Oct.	--	100	1.1	14 1	dermal, inhalation
		hand pump sprayer	1.5 lb/A	5/yr	May-Oct.	--	100	1.1	14 1	dermal inhalation
Trichlorfon	Golf Courses	NA	8 lb ai	1/wk	Jan-Dec.	100	--	12.2	1	dermal
	Lawns Granular	rotary spreader	8 lb ai	1/yr	May-Aug.	19	81	2	1 2	inhalation dermal, oral
	Lawns Spray	hose end sprayer	8 lb ai	1/yr	Jul-Aug.	13	87	1	1 2	inhalation dermal, oral

Figure II.I.1 Residential Scenario Application and Usage Schedules for the Basin & Range Region (Region 8)



a. Dissipation Data Sources and Assumptions

i. 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

ii. Malathion

For western regions a residue degradation study was based on a 3 day study conducted in California (application rate of 5 lb ai/acre). These measured residue values were entered into the Calendex software as a time series distribution of 4 values (Days 0, 1, 2, and 3). For use on home lawns for assessing non-dietary ingestion for children, 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 the vegetable gardening scenario in western regions 7,8, and 10, a residue dissipation study was conducted in California with multiple residue measurements collected up to 14 days after treatment. A uniform distribution bounded by the low and high residue measurements was used for each day after the application. The study was conducted a one pound ai per acre. The residues were adjusted upwards to account for the 1.5 pound ai per acre rate for vegetables.

iii. 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. A uniform distribution bounded by the low and high residue measurements was used, with these residue values adjusted proportionately 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 directions to water in the product. For use on home lawns for assessing non-dietary ingestion for children, these values were multiplied by a value selected from a uniform distribution bounded by 1.5 and 3 to account for wet hand transfer.

3. Development of Water Exposure Aspects of Basin and Range Region

Because of low OP use in the Basin and Range, the Agency did not conduct a separate water exposure assessment for this region. The majority of OP use in this region occurs in the northern end, adjacent to the Northern Great Plains and the Northwest Fruitful Rim regions. Based on location and use combinations, the Agency used the water assessment for the Northern Great Plains as a protective surrogate for the Basin and Range. An extensive discussion of the methods used to identify a specific location within the region is included in the main document. Details specific to the Northern Great Plains regional assessment can be found in that regional assessment (II.C). The discussion here briefly summarizes OP usage in the Basin and Range and the rationale for selecting the Red River Valley (Minnesota and North Dakota) as a surrogate for the drinking water assessment for the Basin and Range. A brief summary of the inputs and results of the model (predicted cumulative concentrations of OPs in surface water) for those OP-crop uses included in the Red River water exposure assessment are presented here.

a. Selection of the Red River Valley as a Surrogate for Drinking Water Assessment

OP usage in the Basin and Range is low, focused primarily in two areas in the northern end – one adjacent to the Northwest Fruitful Rim and one adjacent to the Northern Great Plains. Because of similarities in the OP use crops, the Agency used the drinking water exposure assessment from the Northern Great Plains as a surrogate for the Basin and Range. The Red River Valley in eastern North Dakota and western Minnesota was used as the specific location for the cumulative OP drinking water exposure assessment for the Northern Great Plains region. Details on the selection of this site can be found in the Northern Great Plains assessment (II.C.). Because of the lower OP usage, and lesser vulnerability of drinking water sources, this surrogate assessment is expected to overestimate potential drinking water exposures in the Basin and Range.

The major OP use crops in the Basin and Range are alfalfa (44% of total OP use in the entire region), orchards (21%), wheat (12%), sugar beets (6%), vegetables (6%), and potatoes (3%) (Table II.I.3). In 1997, approximately 1.1 million pounds (ai) of OPs were applied in on agricultural crops in this region.

Table II.I.3. General Overview of OP Usage in the Basin and Range

Crops	Primary Production Areas	Total Pounds Applied	Percent of Total OP Use
Alfalfa	Throughout the region	469,000	44%
Orchard		223,000	21%
Wheat	Northern region	127,000	12%
Sugar beet	Northern region	66,000	6%
Potatoes	Northern region	30,000	3%
Vegetables		61,000	6%
Total		1.1 Million	92%

(1) Source: NCFAP, 1997.

Figure II.C.2 shows the areas of relatively high OP-use areas adjacent to the Northwest Fruitful Rim and the Northern Great Plains.

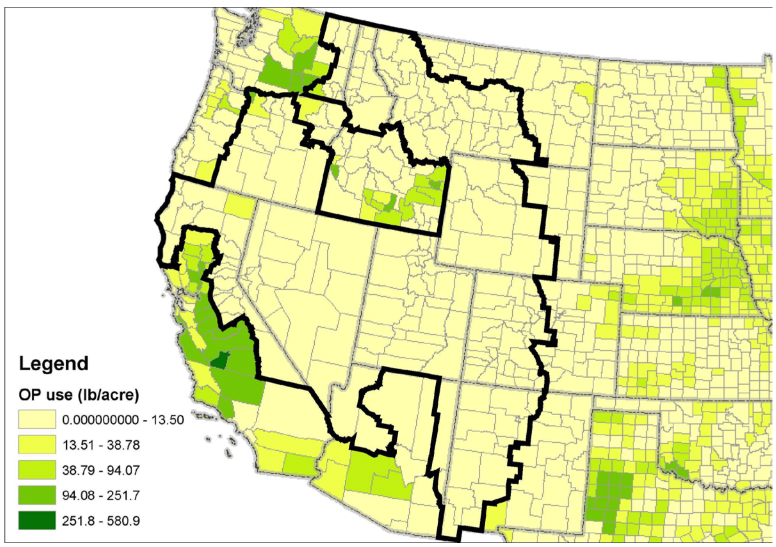


Figure II.I.2. Total OP usage (pounds per area) in the Northern Great Plains (source: NCFAP, 1997)

Three OP use crops in the Basin and Range – sugar beets, potatoes, and wheat – are included in the Red River Valley assessment. While this doesn't cover all of the crops in the Basin and Range, it covers three that are likely to co-occur. The major OP use-crop in the region is spread throughout the region; the orchards tend to occur near the Northwest Fruitful Rim. While the uses listed in Table II.I.4 do not necessarily reflect the same combinations expected in the Basin and Range, this assessment is expected to overestimate any exposure expected in the Basin and Range because the drinking water sources in this region are less vulnerable to OP contamination.

Table II.I.4. OP Usage on Agricultural Crops in the Red River Valley.

OP Usage/ Agricultural Crops				Cropland Acreage, Red River Valley Assessment Area	
Crop Group	**Crops**	**OP Usage**	**Percent of Total OP Use**	**Acres**	**Pct of total Cropland**
Vegetables, tuber	Sugar beets	Chlorpyrifos, phorate, terbufos	59	101,000	3 (1-5)
	Potatoes	Azinphos methyl, dimethoate	33	345,500	9 (7-11)
Grains	Wheat	Chlorpyrifos	4	1,502,100	39 (35-43)
Total			96	1,948,600	55 (52-59)

Pesticide use based latest data collected by USDA National Agricultural Statistics Service (NASS). Acreage estimates based on ND and MN Agricultural Statistics Service. The range of percent of total cropland reflect differences reported in each state. Details on the sources of usage information are found in Appendix III.E.7.

Surface water sources of drinking water are scattered throughout the region (Figure II.I.3). However, because of low rainfall in the region, the intakes tend to occur in watersheds which have a low runoff potential.

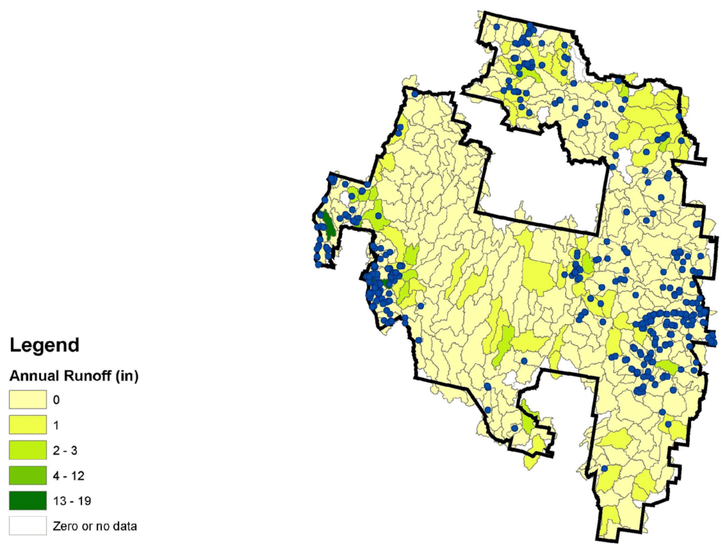


Figure II.I.3. Locations of surface water intakes of drinking water (shown as dots) in relation to average annual runoff (color gradation) in the Basin and Range Region

Similarly, most of the Basin and Range has a low vulnerability to pesticide leaching due to both low pesticide usage and low rainfall in the region. The exceptions occur in the portion of the region within the Columbia Plateau (Figure II.I.4). As described in the Northwest Fruitful Rim assessment, the potential for OP contamination in ground water resources in this area is not expected to be great.

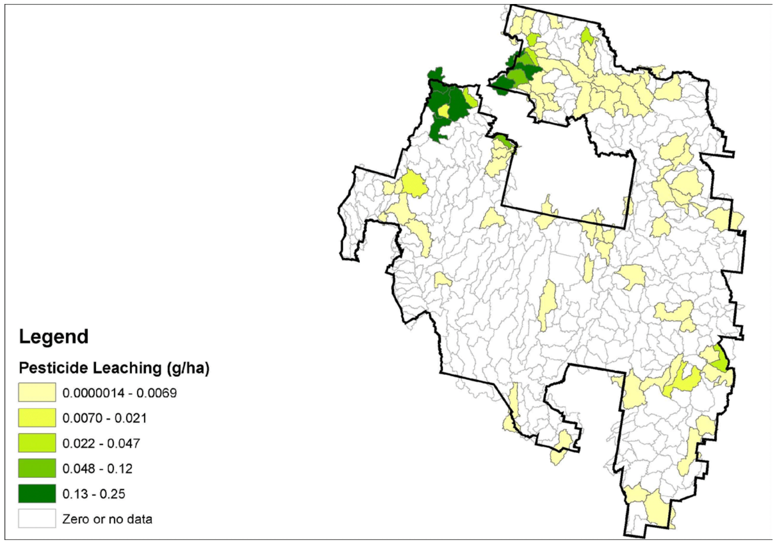


Figure II.I.4. Vulnerability of ground water resources to pesticide leaching in the Basin and Range, adapted from USDA (Kellogg, 1998)

When OP usage, drinking water sources, vulnerability of those sources to OP pesticide contamination, and available monitoring data (described below) are considered together, the surface water sources of drinking water are likely to be more vulnerable than ground water sources.

b. Cumulative OP Concentration Distribution in Surface Water

Table II.I.5 presents pesticide use statistics for the OP-crop combinations which were modeled in the surrogate regional assessment. Chemical-, application- and site-specific inputs into the assessments are found in Appendices III.E.5-7. Sources of usage information can be found in Appendix III.E.8. Additional details can be found in the Northern Great Plains assessment (II.C).

Table II.I.5. OP-Crop Combinations Included in the Red River Valley Assessment, With Application Information Used in the Assessment

Chemical	Crop/ Use	Pct. Acres Treated	App. Rate, lb ai/A	App Meth/ Timing	Application Date(s)	Range in Dates (most active dates)
Azinphos-methyl	Potato	11-19	0.39-0.48	Aerial; Foliar	July 31	Jul1-Aug30
Dimethoate	Potato	23-24	0.27	Aerial; Foliar	July 31	Jul1-Aug30
Chlorpyrifos	Sugarbeet	9-13	0.98-1.25	Ground; Planting	May 10	Apr22-May30 (Apr 30-May 30)
Phorate	Sugarbeet	0-4	0-1.03	Ground; Planting	May 10	Apr22-May30 (Apr 30-May 30)
Terbufos	Sugarbeet	51-69	1.75-1.97	Ground; Planting	May 10	Apr22-May30 (Apr 30-May 30)
Chlorpyrifos	Wheat	4	0.5	Aerial; Foliar	July 3	Jun15-Jul21

Figure II.I.5 displays 35 years of predicted OP cumulative concentrations for the drinking water assessment. This chart depicts a single peak occurring each year, with year 33 having a higher peak than others. These variations are the result of year-to-year differences in precipitation from the weather data for the region. The OP cumulative concentration levels exceeded 1 ppb in methamidophos equivalents in three of the thirty-five years simulated.

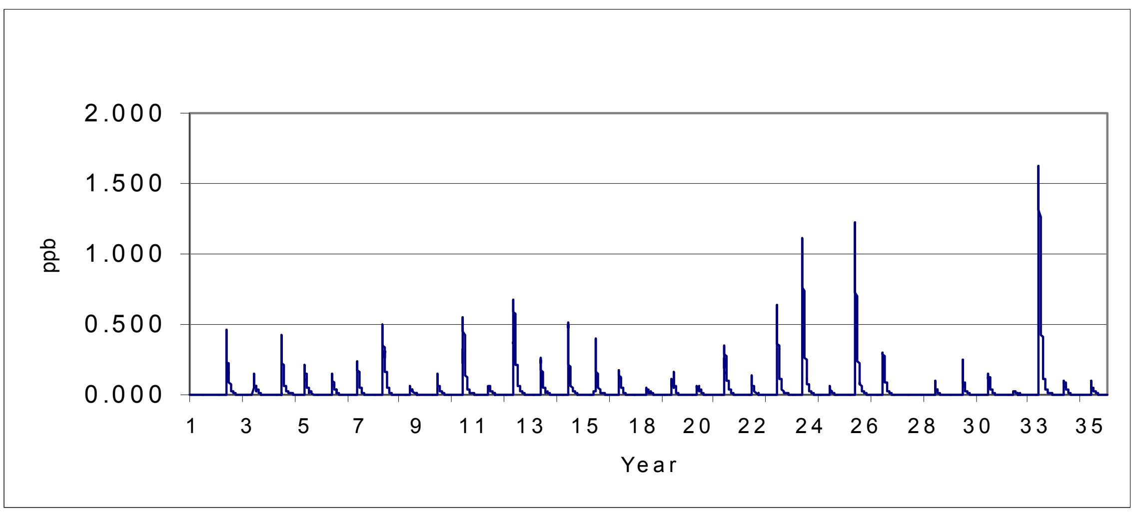


Figure II.I.5. Cumulative OP Distribution in Water in the Red River Valley (Methamidophos equivalents)

Figure II.I.6 overlays all 35 years of predicted values over the Julian calendar. Here, for example, each of the 35 yearly values associated with February 1st (i.e., Julian Day 32) are graphed such that the spread of concentration associated with February 1st (over all years) can readily be seen. This chart indicates that OP concentrations follow a recurring pattern each year, with a peak occurring around day 150.

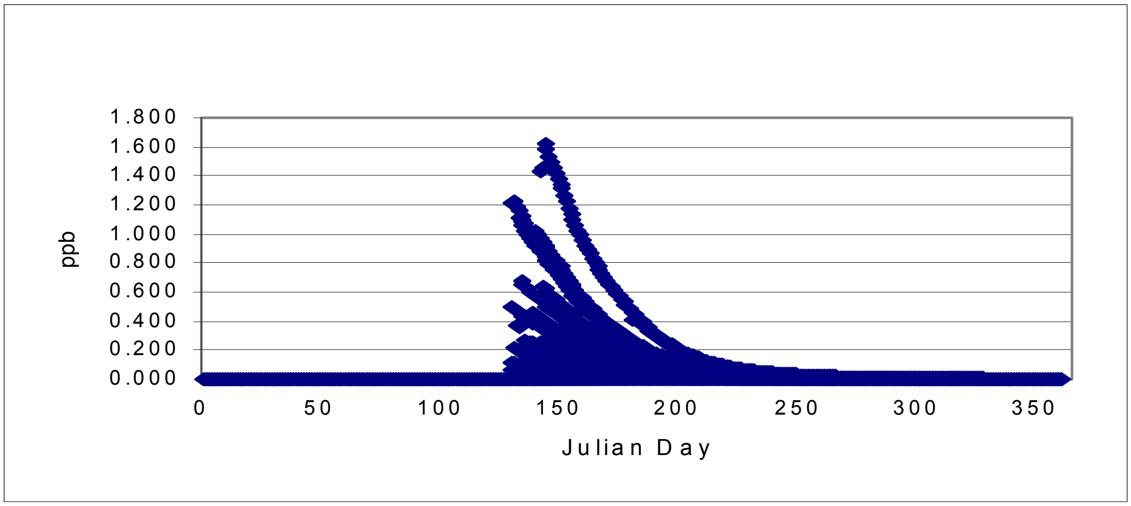


Figure II.I.6. Cumulative OP Distribution in Water (Methamidophos Equivalents) in the Red River Valley, summarized on a daily basis over 35 years

Figure II.I.7 depicts the estimated OP cumulative concentration for uses that made significant contributions to during Year 33, the year in which the highest modeled concentration occurred. Terbufos use on sugarbeets is the primary use contributing to that peak. Terbufos was applied to corn on May 10th (week 19). It is important to note that these concentrations are converted to methamidophos equivalents based on relative potency factors. Thus, the relative contributions are the result of both individual chemical concentrations in water and the relative potency factor of each of the OP chemicals found in the water.

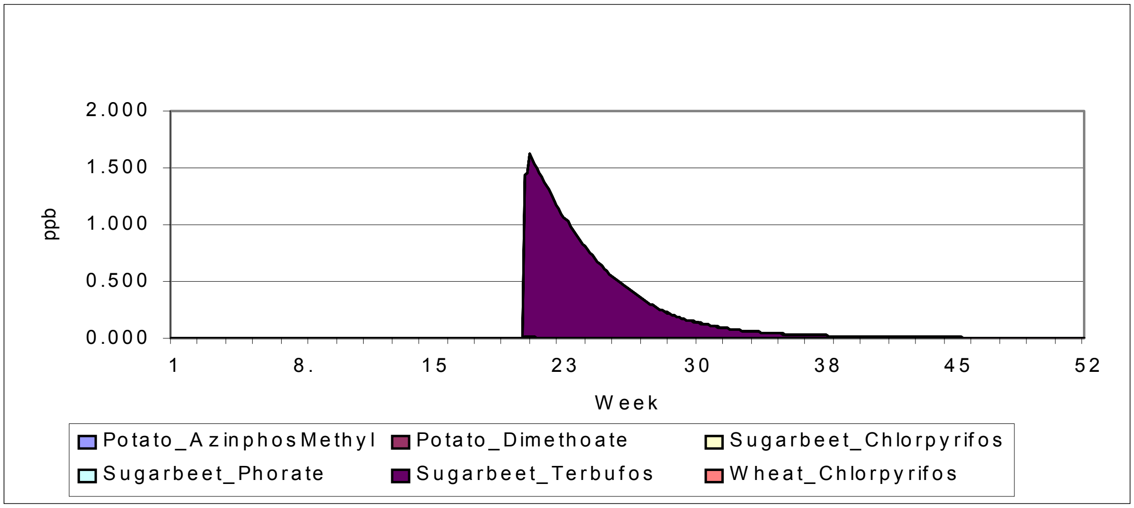


Figure II.I.7. Cumulative OP Distribution for an Example Year (Year 33) in the Red River Valley Showing Relative Contributions of the Individual OPs in Methamidophos Equivalents

c. A Comparison of Monitoring Data versus Modeling Results

The Northern Great Plains assessment compared estimated concentrations for individual OP pesticides (Table II.I.6) with NAWQA monitoring in that region. This comparison showed that the predicted concentrations of OPs in surface water in the Red River Valley are generally within the same range as reported monitoring data. Based on the results of NAWQA study units in the vicinity of the high-use areas of the Basin and Range, these estimated concentrations are generally greater than those reported in the NAWQA studies.

Table II.I.6. Percentile Concentrations of Individual OP Pesticides and of the Cumulative OP Distribution, 35 Years of Weather

Chemical	Crop/Use	Concentrations in ug/L (ppb)						
		Max	99th	95th	90th	80th	75th	50th
AzinphosMethyl	Potato	0.049	0.022	0.012	0.007	0.004	0.003	0.001
Chlorpyrifos	Sugarbeet, Wheat	0.047	0.026	0.015	0.011	0.006	0.005	0.001
Dimethoate	Potato	0.038	0.007	0.003	0.001	0.000	0.000	0.000
Phorate	Sugar beet	0.056	0.003	0.000	0.000	0.000	0.000	0.000
Terbufos	Sugar beet	1.909	0.591	0.188	0.079	0.020	0.011	0.002
OP Cumulative Concentrations (in Methamidophos Equivalents, ppb)		1.6	0.5	0.16	0.068	0.02	0.01	0.002

It is important to note that the estimated 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.

d. Summary of Available Monitoring Data for the Basin and Range

The Lower Snake River and Central Columbia Plateau NAWQA study units are closest to the high OP-use areas in the Basin and Range. The results of these monitoring studies are discussed in the Northwest Fruitful Rim regional assessment (II.K).

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. To this end, graphical presentation of the data provides a useful method of examining the outputs for patterns and was selected here to be the most appropriate means of presenting the results of this cumulative assessment. Briefly, the cumulative assessment 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. As demonstrated in the graphical presentations of analytical outputs for this section, 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 plotted as a function of time. That is, for example, a 365-day series of 95th percentile values can be plotted, 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 plot” 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) 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 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 Basin and Range population (e.g, those at the 95th percentile vs. 99th percentiles of exposure).

Figures III.Q.2-1 through III.Q.2-5 in Appendix Q present the results of this cumulative risk analysis for Children, 1-2 years for a variety of percentiles of the Basin and Range population (95th, 97.5th, 99th, 99.5th, and 99.9th). Figure III.Q2-.6 through Figure III.Q.2-10, Figure III.Q.2-11 through III.Q.2-15, and Figure III.Q.2-16 through III.Q.2-20 present these same figures for Children 3-5, Adults 20-49, and Adults 50+, respectively. The following paragraphs describe, in additional detail, the exposure profiles for each of these population age groups for these percentiles (i.e., 95th, 97.5th, 99th, 99.5th, and 99.9th). Briefly, these figures present a series of time course 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 graphs 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 MOE's – plotted as a function of time. The result is a “time course” (or “profile”) of exposures representing that portion of the Basin and Range population at the 95th percentile exposures throughout the year. Each “component” of this 95th percentile total exposure for children 1-2 (i.e., the dermal, inhalation, non-dietary oral, food, and water, etc. “component” exposures which, together, make up the total exposure) can also be seen – each as its own individual time profile plot. 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

(Figure III.Q.2-1 through Figure III.Q.2-5): At the 95th percentile, exposures from the residential applications of OP pesticides do not contribute to the overall exposure. This is true for all of the routes of exposure examined: dermal and hand-to-mouth exposure from lawn treatment applications and inhalation exposure from crack and crevice and pest strip treatments. There are increases in drinking water concentrations Julian days 130 to 160 which corresponds to May applications of terbuphos to sugarbeets. However, drinking water at this percentile does not contribute to substantial exposure. At the higher percentiles, the exposure profile and relative contributions begin to change. The residential exposures (via inhalation) become an increasingly dominant portion of the total exposure profile. This corresponds to use of DDVP pest strips and crack and crevice treatments. By the 99.9th percentile, one sees that residential exposures via inhalation pathway from the use of these DDVP products (pest strips and crack and crevice treatments) are the most significant contributors to the overall risk picture throughout the year. This is not true for drinking water exposures. These continue to be low and do not contribute in any significant manner to the overall risk picture. By the 97.5th percentile dermal and hand-to-mouth exposures appear but continue to be a small fraction (<1%) of total exposure.

b. Children 3-5 years old

(Figure III.Q.2-6 through Figure III.B.2-10). At the 95th percentile, exposures from the residential applications of OP pesticides do not contribute to the overall exposure. This is true for all of the routes of exposure examined: dermal and hand-to-mouth exposure from lawn treatment applications and inhalation exposure from crack and crevice and pest strip treatments. There are increases in drinking water concentrations Julian days 130 to 160 which corresponds to May applications of terbuphos to sugarbeets. However, drinking water at this percentile does not contribute to substantial exposure. At the higher percentiles, the exposure profile and relative contributions begin to change. The residential exposures (via inhalation) become an increasingly dominant portion of the total exposure profile. This corresponds to use of DDVP pest strips and crack and crevice treatments. By the 99.9th percentile, residential exposures via inhalation pathway from the use of these DDVP products (pest strips and crack and crevice treatments) are the most significant contributors to the overall risk picture throughout the year. Drinking water exposures continue to be low and do not contribute in any significant manner to the overall risk picture. This is true, too, for dermal and hand-to-mouth exposures which begin to appear in the overall risk picture at the 99.9th percentile but continue to be a small fraction (<1%) of total exposure

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

(Figure III.Q.2-11 through Figure III.Q.2-15 and Figure III.Q.2-16 through III.Q.2-20) At the 95th percentile, exposures from the residential applications of OP pesticides do not contribute to the overall exposure. This is true for all of the routes of exposure examined: dermal exposure from lawn and garden and golf course treatment applications and inhalation exposure from lawn and gardening activities and indoor crack and crevice and pest strip treatments. Exposure from drinking water at this percentile also does not contribute to substantial exposure. At the higher percentiles the exposure profile and relative contributions begin to change. The residential inhalation exposures become an increasingly dominant portion of the total exposure profile. This corresponds to use of DDVP pest strips and crack and crevice treatments. By the 99.9th percentile, one sees that residential exposures via inhalation pathway from the use of DDVP products (pest strips and crack and crevice treatments) are consistently the most significant contributors to the overall risk picture. This is not true for drinking water exposures. These continue to be low and do not contribute in any significant manner to overall risk. Dermal exposures begin to consistently appear in the overall risk picture at the 99.5th but continue to be a small fraction (<ca.1%) of total exposure.