Preliminary N-Methyl Carbamate Pesticides Cumulative Risk Assessment

II.D Appendices: Drinking Water Exposure

4 N-methyl Carbamate Usage Estimates

The Biological and Economic Analysis Division (BEAD) of the USEPA Office of Pesticide Programs compiled information on key aspects of the typical usage and timing of application of selected carbamate insecticides, as part of EPA's ongoing cumulative risk assessment of these pesticides. The Environmental Fate and Effect Division (EFED) requested this information in order to more realistically model drinking water risks posed by the carbamates.

The drinking water model requires the following information for each unique crop treated with one or more carbamates in the geographic area being modeled: acres planted; and for each carbamate used on the crop, total pounds, percent of crop treated, application rate, number of applications, and application timing. The carbamate pesticides included in this analysis are aldicarb, carbaryl, carbofuran, formetanate, methiocarb, methomyl, oxamyl, pirimicarb, propoxur, and thiodicarb.

Much of this information is not easily available, or does not exist at the geographic scale (i.e., the county level) required by the drinking water model. BEAD used the best available information, and substantial effort to compile and develop these data. The general method followed is described below.

Methods

In general, data were collected and developed sequentially in three steps. First, geographic areas of interest were identified. Next, target crops were identified and carbamate usage was estimated in each area. Finally, the timing of carbamate applications was determined. Each of these steps are described in detail below.

Identification of Geographic Areas of Interest

Chemical use information, developed from agricultural surveys, is uneven in its geographical distribution. Often counties within a given state do not appear in surveys because of the relatively small number of samples used in the surveys. Therefore to overcome this problem, data from geographic areas larger than these counties were used in this analysis to extrapolate usage from areas with data to the areas of interest that lack carbamate use data.

Thirteen subregions (comprised of 28 counties) were identified by EFED as geographic areas where this class of pesticides appeared to pose significant risks to drinking water. Next, additional geographic areas were identified in preparation to estimate carbamate usage. Counties adjacent to the 13 subregions were identified to form

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a "county cluster" and corresponding Crop Reporting Districts (CRD) were identified. The final result was a series of geographic areas of increasing size (Number) as follows: County (28), Subregion (13), County Cluster (13), Crop Reporting District (13), State (12), Region (8). The Subregion is the geographical unit that will be used by EFED in its analysis.

Determination of Crops and Carbamate Usage

The determination of the crop/carbamate combination, and the associated usage information, in each subregion was a multi-step process. After compiling the available information, adjustments were made for uneven survey coverage, multiple data sources, multiple years of data, and chemical toxicity. These adjustments are described in detail below.

1. Compile Available Usage Data – For each of the geographic areas identified above available information compiled for the following parameters: acres planted; and for each carbamate used on the crop, total pounds, percent of crop treated, application rate, and number of applications.

2. Adjust Usage for Limited Survey Coverage – Carbamate usage at the county cluster, CRD and state levels (for those crops reporting usage in the counties of interest) were adjusted by multiplying by the proportion of these crops that was grown in the counties within the regions of concern.

   For example, if 10,000 acres were grown in the counties of interest and 50,000 acres in the CRD then the usage reported for the CRD would be divided by 5 before being averaged with the acreage estimates from the other three levels. This ensured that figures were adjusted to more accurately reflect what was being used within these regions. Acres treated data were obtained from Doane's databases for all states involved, and also weighted by multiplying the proportion of crops grown within the specific regions of concern.

Table II.D.4.1. Example of estimated carbamate usage adjusted for limited survey area.

Parameter	Acres grown	Pounds used	Acreage ratio	Adjusted pounds
Subregion	10,000	5,000	1.00	5,000
County cluster	20,000	15,000	0.50	7,500
CRD	30,000	30,000	0.333	10,000
State	100,000	100,000	0.10	10,000
Estimated Usage for Subregion				8,125

3. Adjust Usage for Multiple Data Sources – USDA NASS data for state-level usage was also compiled for pounds of each carbamate used as well as application rates (in lbs applied/acre). Following this, the Doane's and NASS data on pounds of carbamate used were averaged for the state-level

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estimates of usage. After usage estimates were obtained from Doane, NASS data where available, was used to adjust the estimates, using equal weights for the Doane and NASS state usage estimates.

For example, if the procedure above estimated use in the counties of interest of 10,000 pounds, then - based on Doane's reported state-level use of 100,000 pounds and NASS's reported state-level use of 120,000 pounds - the estimated use in the counties of interest would be adjusted to 11,000 pounds.

4. Average Usage Data Over Multiple Years – Carbamate usage (in lbs of each carbamate applied) was averaged for the years 1998 - 2002 for the following geographic areas: State, Crop Reporting District, County Cluster, and Subregion.

5. Determine Crop / Carbamate Combinations of Interest – The resulting carbamate usage (in lbs of each carbamate applied) was multiplied by the Relative Potency Factor to adjust for the differing toxicities of each carbamate. The final crop/carbamate list that resulted from the above analysis was then ranked according to the "toxicity-adjusted" pounds of carbamates used.

   Those combinations comprising 95 % of the cumulative carbamate usage were selected for the tables included in this document. The complete list of all crops/chemicals identified by the usage analysis, along with all usage figures, is available in the Excel spreadsheet in Appendix 1.

6. Final Adjustments – Data from the California Department of Pesticide Regulation (CDPR) indicated that in California, tangerines and nectarines were also crop sites where some carbamates were applied. Therefore, BEAD added these sites to the final crop/carbamate list. Finally, crops with no identified carbamate use in the California data base were dropped from the analysis.

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Determination of Timing of Carbamate Applications

Once the crop / chemical combinations were identified in a given subregion, the period of the crop cycle when each carbamate is typically applied, and the dates of application were identified. Where the information was available, dates of application were further characterized as being those when carbamate applications were likely to be most frequent (or "active") and those for the total time period when the carbamate could reasonably be used (essentially, the time period when the target pests were present in the crop). It should be noted that typically, all the carbamates discussed here target multiple pests or ones that can occur multiple times during a given crop's growing season, so applications often occur over a broad time period. Where possible, the number of applications that might occur and the type of formulation that is likely to be used has been noted in the "Comments" column. It should also be noted that the number of carbamate applications for all crop/chemical combinations was also estimated using available databases. These estimates are also included in the tables that follow. For the crop/chemical combinations of interest, BEAD analysts used a variety of methods to determine most likely application dates for each chemical on each crop in each location. Biologists frequently combined information from several sources and used their best professional judgement to estimate dates of application.

For the California carbamate/crop use patterns, actual application dates from the California Department of Pesticide Regulation Pesticide Information Portal (CalPIP) for the counties of interest were used. In other states, biologists relied on a wide variety of references, including those listed in the table below:

Table II.D.4.2. Data Sources Used to Determine Carbamate Dates of Application.

Data Source	Use
Usage Data	Used to determine major pests and approximate time of application (e.g., preplant, at plant, at cultivation, pinhead to squaring). Doane data and various state surveys were frequently used.
Efficacy Data	Dates of application from efficacy studies used as surrogates for actual application dates. Efficacy studies were frequently obtained from Arthropod Management Tests
USDA Planting, Bloom, and Harvest Dates	Used to define limits of application dates. Often used in conjunction with crop phenology information to approximate dates of application and to extrapolate the dates of application from one state to another.
Crop Profiles	Used to identify major pests and approximate timing of applications.
Crop Timelines	Used to approximate timing of applications.
Crop Weather Reports	Used to estimate dates of phenological events (e.g., planting, squaring) for localized areas.
Pest Biology Information	Dates of pest emergence used to estimate timing of applications.

Carbamate Usage from 1998-2002 Doanes & NASS usage data (10/20/04, BEAD)											
Crop	**Active Ingredient**	**lb A.I.**	**RPF-adj lb ai**	**Planted acres**	**% crop treated**	**App Rate**	**No. apps**	**% rpf-adj lb**	**% non-adj lb**	**Most active app dates**	**Ttl Range**
1a: Southest Region: NC East - Edgecombe, Halifax and Northampton Counties											
Cotton	**Aldicarb**	**40,000**	**40,000**	**110,000**	**42.7**	0.73	**1.00**	**56.9%**	**54.6%**	May1-15	Apr21-Jun8
Peanuts	**Aldicarb**	**30,000**	**30,000**	**40,000**	**62.1**	**1.08**	**1.00**	**42.6%**	**40.9%**	Apr10-Apr20	Apr10-May10
Peanuts	Oxamyl	800	177	40,000	1.6	1.25	1.00	0.3%	1.1%		
Tobacco	Aldicarb	100	100	8,600	0.6	1.64	1.03	0.1%	0.1%		
Peanuts	Methomyl	500	33	40,000	3.0	0.38	1.00	0.0%	0.7%	May30-Sep15	May30-Oct15
Tobacco	Carbofuran	100	24	8,600	0.1	4.00	2.00	0.0%	0.1%		
Beans, Snap	Methomyl	100	7	1,100	39.7	0.23	1.37	0.0%	0.1%	Apr15-Jun30	Mar30-Jun30
Tobacco	Methomyl	100	7	8,600	2.4	0.35	1.32	0.0%	0.1%	Apr30-Aug15	Apr15-Sep30
Cucumber	Carbaryl	700	6	3,600	6.7	1.00	2.89	0.0%	1.0%	Apr25-Jun1; May30-Jul15	Apr25-Jun1; May30-Jul15
Cotton	Carbaryl	300	2	110,000	0.4	0.75	1.00	0.0%	0.4%		
Beans, Snap	Carbaryl	200	2	1,100	19.2	1.00	0.84	0.0%	0.3%		
Peanuts	Carbaryl	200	2	40,000	0.7	0.57	1.00	0.0%	0.3%		
Cotton	Thiodicarb	100	1	110,000	0.2	0.60	1.00	0.0%	0.1%		
Tobacco	Carbaryl	100	1	8,600	0.5	1.09	2.49	0.0%	0.1%		
1b: Southest Region: Georgia East - Burke County											
Cotton	**Aldicarb**	**4,500**	**4,500**	**40,000**	**21.9**	**0.59**	**1.00**	**69.2%**	**65.2%**	May1-15	Apr21-Jun8
Peanuts	**Aldicarb**	**2,000**	**2,000**	**5,800**	**33.5**	**0.99**	**1.03**	**30.8%**	**29.0%**	Apr10-Apr20	Apr10-May10
Pecans	**Carbaryl**	400	3	1,500	7.7	1.84	1.80	0.0%	**5.8%**	Aug1-Sep20	Aug1-Sep20
2a: Florida Region: South Florida - Palm Beach County											
Oranges	**Aldicarb**	20,000	20,000	20,000	14.3	3.85	1.46	**73.4%**	**27.4%**	Bloom-fruit maturity	Apr-Nov
Grapefruit	**Aldicarb**	2,700	2,700	5,200	8.7	3.89	1.50	**9.9%**	**3.7%**	Bloom-fruit maturity	Apr-Nov
Sweet Corn	**Methomyl**	20,000	1,300	20,000	40.4	0.35	7.63	**4.8%**	**27.4%**	Apr1-Jul30; Nov15-Dec30	Apr1-Jul30; Nov15-Dec30
Sugarcane	**Carbofuran**	3,800	912	280,000	1.9	0.72	1.00	**3.3%**	**5.2%**	Jun20-Aug20	May22-Oct12
Peppers	**Oxamyl**	2,900	641	6,000	14.9	0.51	6.42	**2.4%**	**4.0%**	Mar-Jun	Feb-Nov
Cucumber	**Oxamyl**	2,000	442	4,600	50.4	0.55	1.58	**1.6%**	**2.7%**	Oct-May	Oct-May

Carbamate Usage from 1998-2002 Doanes & NASS usage data (10/20/04, BEAD)											
Crop	**Active Ingredient**	**lb A.I.**	**RPF-adj lb ai**	**Planted acres**	**% crop treated**	**App Rate**	**No. apps**	**% rpf-adj lb**	**% non-adj lb**	**Most active app dates**	**Ttl Range**
Cucumber	**Carbofuran**	1,700	408	4,600	30.5	1.20	1.00	1.5%	**2.3%**	Oct20-Mar15	Sep1-Apr30
Sweet Corn	**Carbofuran**	1,100	264	20,000	6.7	1.00	1.00	1.0%	1.5%	Aug1-Apr30	Aug1-Apr30
Peppers	**Methomyl**	3,700	241	6,000	15.7	0.62	6.20	0.9%	**5.1%**	Apr1-Jun15	Jan15-Jun30
Cucumber	**Methomyl**	2,600	169	4,600	21.5	0.58	4.48	0.6%	**3.6%**	Apr15-Jun15	Jan30-Jun15
Sweet Corn	**Thiodicarb**	9,700	116	20,000	23.4	0.58	4.38	0.4%	**13.3%**	Apr1-Jul30; Nov15-Dec30	Apr1-Jul30; Nov15-Dec30
Oranges	Oxamyl	100	22	20,000	0.2	0.96	2.53	0.1%	0.1%	Apr,Jun,Aug, Oct	Apr-Aug,Oct
Oranges	Carbaryl	1,300	10	20,000	1.2	3.54	1.44	0.0%	**1.8%**	Mar1-Jun1	Feb1-Dec1
Grapefruit	Carbaryl	1,200	10	5,200	7.0	3.13	1.02	0.0%	1.6%	Mar1-Dec30	can't narrow
Tomatoes	Methomyl	100	7	2,500	2.0	0.48	2.97	0.0%	0.1%		
Cucumber	Carbaryl	200	2	4,600	1.5	0.58	4.70	0.0%	0.3%		
2b: Florida Region: Central Florida - Polk County											
Oranges	**Aldicarb**	30,000	30,000	80,000	7.8	3.85	1.46	**91.0%**	**75.6%**	Bloom-fruit maturity	Apr-Nov
Grapefruit	**Aldicarb**	2,400	2,400	5,800	7.0	3.89	1.50	**7.3%**	**6.0%**	Bloom-fruit maturity	Apr-Nov
Oranges	**Oxamyl**	1,400	309	80,000	0.7	0.96	2.53	0.9%	**3.5%**	Apr,Jun,Aug, Oct	Apr-Aug,Oct
Potatoes	**Aldicarb**	200	200	1,000	6.5	2.55	1.01	0.6%	0.5%	Oct1-Mar1	Sep15-Mar1
Oranges	**Carbaryl**	5,100	41	80,000	1.3	3.54	1.44	0.1%	**12.8%**	Mar1-Jun1	Feb1-Dec1
Grapefruit	Carbaryl	500	4	5,800	2.8	3.13	1.02	0.0%	1.3%	Mar1-Dec30	can't narrow
Watermelon	Carbaryl	100	1	1,600	1.8	0.76	2.64	0.0%	0.3%		
3: Midsouth Region: Louisiana Northeast - Franklin, Madison, and Tensas Counties											
Cotton	**Aldicarb**	40,000	40,000	280,000	25.2	0.53	1.00	**96.2%**	**76.9%**	May1-15	Apr21-Jun8
Cotton	**Carbofuran**	4,100	984	280,000	3.1	0.44	1.08	2.4%	**7.9%**	Jun24-Aug6	Apr12-Aug21
Cotton	**Oxamyl**	1,000	221	280,000	1.8	0.19	1.11	0.5%	1.9%	May4-Jul20	Apr15-Aug15
Corn	**Carbofuran**	800	192	50,000	1.8	0.85	1.00	0.5%	1.5%	Mar31-Apr21	Mar24-Apr28
Sorghum	**Carbofuran**	500	120	70,000	1.3	0.50	1.00	0.3%	1.0%	Apr20-May22	Apr6-Jun23

Carbamate Usage from 1998-2002 Doanes & NASS usage data (10/20/04, BEAD)											
Crop	**Active Ingredient**	**lb A.I.**	**RPF-adj lb ai**	**Planted acres**	**% crop treated**	**App Rate**	**No. apps**	**% rpf-adj lb**	**% non-adj lb**	**Most active app dates**	**Ttl Range**
Rice	Carbaryl	3,900	31	20,000	15.2	1.45	1.00	0.1%	**7.5%**		
Rice	Carbofuran	100	24	20,000	0.4	0.83	1.00	0.1%	0.2%		
Cotton	**Thiodicarb**	1,600	19	280,000	0.8	0.53	1.42	0.0%	**3.1%**	Jun1-Sep15	May15-Oct1
4: Lower Midwest Region: Texas tip - Cameron and Hidalgo Counties											
Grapefruit	**Aldicarb**	80,000	80,000	20,000	73.1	4.69	1.17	**77.0%**	**52.4%**	Jan1-Apr1	Jan1-Apr1
Cotton	**Aldicarb**	10,000	10,000	130,000	18.6	0.49	1.00	**9.6%**	**6.5%**	Mar10-Jun6	Mar10-Jun30
Grapefruit	**Formetanate**	6,700	4,020	20,000	35.0	0.92	1.00	**3.9%**	**4.4%**	Apr20-May30	Apr1-Jul30
Cotton	**Oxamyl**	10,000	2,210	130,000	18.6	0.23	2.12	**2.1%**	**6.5%**	Mar15-Aug1	Feb20-Sep20
Carrots	**Oxamyl**	8,700	1,923	3,400	91.1	1.25	2.28	**1.9%**	**5.7%**	Aug10-Jan15	Aug10-Jan15
Cotton	**Carbofuran**	7,500	1,800	130,000	8.8	0.55	1.18	**1.7%**	**4.9%**	May28-Jul10	Mar16-Jul25
Peppers	**Oxamyl**	4,300	950	2,800	77.3	1.00	2.00	0.9%	**2.8%**	Jan1-Jun1, Jul1-Oct1	Jan1-Jul1, Jun15-Dec1
Onions	**Oxamyl**	2,500	553	10,000	26.8	0.48	1.42	0.5%	**1.6%**	Oct1-31, Nov1-Apr1	Sep20-Nov30, Oct1-May1
Onions	**Methomyl**	6,200	403	10,000	32.9	0.49	2.83	0.4%	**4.1%**		
Cantaloupe	**Oxamyl**	1,600	354	3,500	22.5	1.76	1.17	0.3%	**1.0%**	Feb15-May15	Feb1-May30
Watermelon	**Oxamyl**	1,600	354	10,000	25.1	0.51	1.04	0.3%	**1.0%**	Jan15-Mar15	Jan15-Apr1
Cucumber	**Oxamyl**	1,100	243	5,200	31.1	0.66	1.00	0.2%	**0.7%**	Feb1-Mar15, Jul15-Aug15	Jan15-Mar15, Jul1-Aug31
Corn	**Carbofuran**	1,000	240	120,000	1.2	0.71	1.00	0.2%	**0.7%**	Feb10-Mar10; Apr11-May5	Feb1-Mar20; Apr4-May12
Cucumber	**Methomyl**	2,500	163	5,200	34.0	0.47	3.06	0.2%	**1.6%**		
Spinach	**Methomyl**	2,400	156	3,100	85.5	0.45	2.00	0.2%	**1.6%**		

Carbamate Usage from 1998-2002 Doanes & NASS usage data (10/20/04, BEAD)											
Crop	**Active Ingredient**	**lb A.I.**	**RPF-adj lb ai**	**Planted acres**	**% crop treated**	**App Rate**	**No. apps**	**% rpf-adj lb**	**% non-adj lb**	**Most active app dates**	**Ttl Range**
Grapefruit	Oxamyl	700	155	20,000	4.2	0.59	1.39	0.1%	0.5%		
Sorghum	Carbofuran	300	72	250,000	0.3	0.50	1.00	0.1%	0.2%		
Cantaloupe	Methomyl	1,100	72	3,500	47.7	0.39	1.67	0.1%	**0.7%**		
Cabbage	Methomyl	800	52	5,400	13.7	0.57	1.86	0.1%	0.5%		
Peppers	Methomyl	800	52	2,800	3.0	0.60	15.00	0.1%	0.5%		
Carrots	Methomyl	500	33	3,400	33.2	0.45	1.00	0.0%	0.3%		
Watermelon	Carbofuran	100	24	10,000	1.9	0.49	1.00	0.0%	0.1%		
Beans, Snap	Methomyl	300	20	400	51.7	0.49	3.07	0.0%	0.2%		
Watermelon	Methomyl	300	20	10,000	2.2	0.41	2.63	0.0%	0.2%		
Cotton	Methomyl	100	7	130,000	0.2	0.36	1.00	0.0%	0.1%		
Cotton	Carbaryl	700	6	130,000	1.0	0.53	1.01	0.0%	0.5%		
Peppers	Carbaryl	400	3	2,800	3.8	1.00	4.00	0.0%	0.3%		
Watermelon	Carbaryl	200	2	10,000	1.9	0.86	1.25	0.0%	0.1%		
Cotton	Thiodicarb	100	1	130,000	0.1	0.32	1.29	0.0%	0.1%		
Cantaloupe	Carbaryl	100	1	3,500	0.6	0.94	5.24	0.0%	0.1%		
Squash	Carbaryl	100	1	200	35.5	0.78	1.00	0.0%	0.1%		
5a: North/North Central Region: Pennsylvania Central - Adams, Lancaster and York Counties											
Corn	**Carbofuran**	2,200	528	370,000	0.7	0.89	1.00	**32.6%**	**11.7%**	May10-May25; Jun30-Aug26	Apr30-Jun15; Jun15-Sep10
Apples	**Methomyl**	4,700	306	20,000	26.1	0.39	2.86	**18.9%**	**25.0%**	May30-Aug15	May15-Aug30
Alfalfa	**Carbofuran**	1,200	288	70,000	2.8	0.61	1.00	**17.8%**	**6.4%**	Mar15-Apr15; Mar9-May15; Jun16-Aug8	Mar15-Sep15; Mar1-Jul20; Apr1-Nov10
Sweet Corn	**Methomyl**	2,200	143	3,800	33.9	0.38	4.47	**8.8%**	**11.7%**	Jul15-Sep30	Jun15-Oct15
Pumpkin	**Carbofuran**	300	72	1,500	24.8	0.81	1.01	**4.4%**	**1.6%**	Jun15-Jul1	Jun10-Jul6
Sweet Corn	**Carbofuran**	300	72	3,800	7.8	1.00	1.00	**4.4%**	**1.6%**	Apr25-Jun5	Apr15-Jun15
Apples	**Oxamyl**	300	66	20,000	2.9	0.60	1.19	**4.1%**	**1.6%**	Apr20-Aug30	Apr10-Aug30
Apples	**Formetanate**	100	60	20,000	0.7	0.85	1.15	**3.7%**	0.5%	Apr24-May20	Apr16-May24

Carbamate Usage from 1998-2002 Doanes & NASS usage data (10/20/04, BEAD)											
Crop	**Active Ingredient**	**lb A.I.**	**RPF-adj lb ai**	**Planted acres**	**% crop treated**	**App Rate**	**No. apps**	**% rpf-adj lb**	**% non-adj lb**	**Most active app dates**	**Ttl Range**
Apples	**Carbaryl**	4,700	38	20,000	17.3	1.12	1.52	**2.3%**	**25.0%**	Apr20-Aug30	Apr10-Aug30
Peaches	**Methomyl**	200	13	1,800	9.4	0.43	3.33	0.8%	1.1%	Apr15-Sep5	Apr15-Sep10
Potatoes	**Methomyl**	200	13	1,900	3.8	0.45	5.00	0.8%	1.1%	Jun15-Sep30	Apr30-Oct30
Sweet Corn	**Carbaryl**	700	6	3,800	7.4	0.98	2.45	0.3%	**3.7%**	Jun15-Sep15	Jun15-Oct15
Peaches	**Carbaryl**	500	4	1,800	9.8	1.33	2.35	0.2%	**2.7%**	Jun15-Sep30	Apr1-Oct15
Sweet Corn	**Thiodicarb**	300	4	3,800	5.5	0.58	2.34	0.2%	**1.6%**	Jul15-Sep30	Jun15-Oct15
Grapes, Wine	Carbaryl	400	3	200	106.9	1.34	1.83	0.2%	**2.1%**		
Pumpkin	Carbaryl	300	2	1,500	7.5	0.86	3.17	0.1%	**1.6%**		
Potatoes	Carbaryl	200	2	1,900	9.4	0.75	1.77	0.1%	1.1%		
5b: North/North Central Region: Illinios Central - LaSalle, Livingston and McLean Counties											
Corn	**Carbofuran**	2,700	648	940,000	0.4	0.67	1.04	**86.5%**	**40.3%**	Jun20-Aug16	Jun1-Aug30
Alfalfa	**Carbofuran**	100	24	10,000	0.6	0.71	1.00	**3.2%**	1.5%	Apr15-May15	Apr1-Jun1
Sweet Corn	**Carbofuran**	100	24	4,600	6.2	0.35	1.00	**3.2%**	1.5%	May1-Jun15	Apr20-Jul1
Beans, Lima	**Methomyl**	300	20	1,800	13.3	1.05	1.00	**2.6%**	**4.5%**	Jun15-Sep30	May20-Oct10
Corn	**Carbaryl**	2,200	18	940,000	0.2	1.00	1.00	2.3%	**32.8%**	May15-Sep30	May15-Sep30
Sweet Corn	**Carbaryl**	1,100	9	4,600	6.4	1.49	2.61	1.2%	**16.4%**	Jul15-Sep15	Jun15-Oct15
Sweet Corn	Methomyl	100	7	4,600	1.8	0.37	3.00	0.9%	1.5%		
Alfalfa	Carbaryl	100	1	10,000	1.1	0.78	1.16	0.1%	1.5%		
6: North Great Plains Region: Red River Valley - Polk (Minnesota), and Grand Forks and Walsh (North Dakota) Counties											
Potatoes	**Aldicarb**	3,200	3,200	70,000	2.0	2.30	1.00	**44.4%**	**14.7%**	1-Jun	May15-Jun1
Sugar Beets	**Aldicarb**	2,900	2,900	190,000	1.0	1.50	1.00	**40.2%**	**13.4%**	Apr30-Jul20	Apr22-Jul30
Sugar Beets	**Carbofuran**	1,900	456	190,000	1.0	1.00	1.00	6.3%	**8.8%**	Jun1-30	May15-Jul15
Potatoes	**Carbofuran**	1,100	264	70,000	1.0	0.80	2.00	**3.7%**	**5.1%**	May13-24; Jun14-Aug23	May5-Jun1; Jun1-Sep7
Potatoes	**Oxamyl**	800	177	70,000	1.0	0.60	2.00	2.5%	**3.7%**	May30-Aug30	MAy15-Sep15

Carbamate Usage from 1998-2002 Doanes & NASS usage data (10/20/04, BEAD)											
Crop	**Active Ingredient**	**lb A.I.**	**RPF-adj lb ai**	**Planted acres**	**% crop treated**	**App Rate**	**No. apps**	**% rpf-adj lb**	**% non-adj lb**	**Most active app dates**	**Ttl Range**
Sunflowers	**Carbofuran**	500	120	90,000	1.0	0.60	1.00	1.7%	2.3%	May23-Jun4; Jun15-Aug15	May15-Jun13; Jun1-Sep1
Wheat, Spring	**Carbaryl**	11,000	88	690,000	2.0	0.80	1.00	1.2%	**50.7%**	Jun1-Jul15	May15-Jul30
Sunflowers	Carbaryl	100	1	90,000	#N/A	#N/A	#N/A	0.0%	0.5%		
Alfalfa	Carbaryl	100	1	80,000	#N/A	#N/A	#N/A	0.0%	0.5%		
Sugar Beets	Carbaryl	100	1	190,000	#N/A	#N/A	#N/A	0.0%	0.5%		
7: Northwest Region: Washington Central - Franklin and Grant Counties											
Potatoes	**Aldicarb**	120,000	120,000	110,000	36.1	2.89	1.08	**90.3%**	**63.0%**	1-Jun	May15-Jun1
Dry Beans/Peas	**Aldicarb**	6,600	6,600	30,000	17.2	1.20	1.00	**5.0%**	**3.5%**	Apr1-Jul20	beans May10-Jul20; peas Apr1-Jun20
Potatoes	**Carbofuran**	6,100	1,464	110,000	6.9	0.66	1.28	1.1%	**3.2%**		
Onions	**Oxamyl**	6,500	1,437	8,800	36.5	0.97	2.09	1.1%	**3.4%**	Mar15-Apr30; Jun15-Aug30	Mar15-Apr30; May30-Sep30
Apples	**Formetanate**	1,900	1,140	30,000	5.1	0.97	1.20	0.9%	1.0%		
Potatoes	**Oxamyl**	5,000	1,105	110,000	1.7	1.04	2.65	0.8%	**2.6%**	Apr10-May5; MAy30-Oct15	Mar15-May15; May30-Oct30
Carrots	**Oxamyl**	2,100	464	6,500	8.8	0.99	3.68	0.3%	**1.1%**	Apr1-Jun15	Apr1-Jun15
Beans, Lima	**Methomyl**	3,800	247	4,900	43.3	0.90	2.00	0.2%	**2.0%**	May30-Sep30	May15-Oct15
Apples	**Carbaryl**	20,000	160	30,000	42.1	1.22	1.41	0.1%	**10.5%**	Apr15-Aug31	Apr1-Oct1
Sweet Corn	**Methomyl**	1,100	72	60,000	0.6	0.44	6.91	0.1%	0.6%	Jun30-Sep30	Jun10-Sep25
Cherries	**Carbaryl**	7,500	60	4,900	50.3	1.82	1.68	0.0%	**3.9%**	Mar20-Aug10	Mar20-Aug10
Onions	Methomyl	900	59	8,800	7.2	0.90	1.53	0.0%	0.5%		
Asparagus	Carbaryl	5,400	43	8,300	47.2	1.18	1.17	0.0%	**2.8%**		
Alfalfa	Carbofuran	100	24	70,000	0.3	0.50	1.00	0.0%	0.1%		
Corn	Carbofuran	100	24	7,200	1.3	1.00	1.00	0.0%	0.1%		

Carbamate Usage from 1998-2002 Doanes & NASS usage data (10/20/04, BEAD)											
Crop	**Active Ingredient**	**lb A.I.**	**RPF-adj lb ai**	**Planted acres**	**% crop treated**	**App Rate**	**No. apps**	**% rpf-adj lb**	**% non-adj lb**	**Most active app dates**	**Ttl Range**
Apples	Oxamyl	100	22	30,000	0.2	1.20	1.07	0.0%	0.1%		
Potatoes	Carbaryl	1,400	11	110,000	0.5	0.95	3.07	0.0%	0.7%		
Pears	Carbaryl	1,100	9	1,100	28.7	1.10	3.11	0.0%	0.6%		
Asparagus	Methomyl	100	7	8,300	2.3	0.60	1.00	0.0%	0.1%		
Carrots	Methomyl	100	7	6,500	6.0	0.30	1.00	0.0%	0.1%		
Beans, Lima	Carbaryl	200	2	4,900	2.7	1.37	1.00	0.0%	0.1%		
Peaches	Carbaryl	200	2	300	15.1	2.07	1.85	0.0%	0.1%		
Grapes, Wine	Carbaryl	100	1	2,200	2.3	1.13	1.44	0.0%	0.1%		
8: Southwest Region: Fresno, Kern, Kings and Tulare Counties											
Cotton	**Aldicarb**	270,000	270,000	670,000	29.6	1.13	1.21	**81.6%**	**44.0%**	15-Apr	Jan1-Jul31
Nectarine	**Formetanate**	30,000	18,000	40,000	46.0	0.70	1.00	**5.4%**	**4.9%**		
Cotton	**Oxamyl**	60,000	13,260	670,000	12.5	0.66	1.08	**4.0%**	**9.8%**	Jun1-Aug28	Apr2-Sep21
Oranges	**Formetanate**	10,000	6,000	170,000	5.8	1.02	1.15	**1.8%**	**1.6%**	Apr22-Jun30	Apr2-Oct10
Cotton	**Carbofuran**	20,000	4,800	670,000	5.1	0.48	1.30	**1.5%**	**3.3%**	Aug14-Sep21	Jul20-Nov16
Potatoes	**Aldicarb**	2,700	2,700	8,800	10.1	3.00	1.00	**0.8%**	**0.4%**	n/a	n/a
Tomatoes	**Methomyl**	40,000	2,600	100,000	40.1	0.70	1.53	**0.8%**	**6.5%**	May15-Sep30	May5-Oct20
Alfalfa	**Carbofuran**	9,200	2,208	270,000	5.6	0.60	1.00	0.7%	**1.5%**	Feb18-Mar29	Dec28-May27
Garlic	**Oxamyl**	6,200	1,370	20,000	13.6	2.00	1.00	0.4%	**1.0%**	Mar24-29	Feb7-May8
Cantaloupe	**Oxamyl**	4,700	1,039	30,000	16.1	0.95	1.00	0.3%	**0.8%**	Apr19-Jun1	Feb27-Sep25
Peaches	**Formetanate**	1,500	900	30,000	5.5	0.80	1.02	0.3%	**0.2%**	Mar6-23	Mar6-Jul27
Grapes, Wine	**Carbofuran**	3,000	720	110,000	0.4	6.03	1.18	0.2%	**0.5%**	na	na
Dry Beans/Peas	**Aldicarb**	700	700	30,000	2.7	0.95	1.00	0.2%	0.1%		
Cantaloupe	**Methomyl**	10,000	650	30,000	35.8	0.62	1.70	0.2%	**1.6%**	Jul1-Sep15	Jun16-Oct6
Lettuce	**Methomyl**	10,000	650	10,000	73.1	0.70	1.76	0.2%	**1.6%**	Jun15-NOv30	Jun15-NOv30

Carbamate Usage from 1998-2002 Doanes & NASS usage data (10/20/04, BEAD)											
Crop	**Active Ingredient**	**lb A.I.**	**RPF-adj lb ai**	**Planted acres**	**% crop treated**	**App Rate**	**No. apps**	**% rpf-adj lb**	**% non-adj lb**	**Most active app dates**	**Ttl Range**
Grapes, Table	**Methomyl**	9,500	618	70,000	16.8	0.75	1.01	0.2%	**1.5%**	May1-Aug15	Mar3-Oct9
Grapes, Raisin	**Carbofuran**	2,400	576	290,000	0.3	2.80	1.00	0.2%	**0.4%**		
Nectarine	**Methomyl**	5,500	358	40,000	12.0	0.75	2.00	0.1%	0.9%		
Tangerine	**Formetanate**	500	300	4,000	14.0	0.81	1.10	0.1%	0.1%		
Lemons	**Formetanate**	500	300	9,300	3.2	1.06	1.60	0.1%	0.1%	May1-4	Apr26-Aug12
Plums/Prunes	**Formetanate**	500	300	50,000	0.9	1.15	1.00	0.1%	0.1%	Mar1-22	Feb12-MAr24
Grapefruit	**Formetanate**	400	240	3,400	6.3	1.13	1.82	0.1%	0.1%	Apr26-May5	Apr26-May24
Oranges	**Carbaryl**	30,000	240	170,000	3.2	4.40	1.24	0.1%	**4.9%**	May17-Nov3	Jan1-Dec21
Sugar Beets	**Methomyl**	3,100	202	9,200	53.7	0.52	1.19	0.1%	**0.5%**	Jun15-Oct10	May30-Oct18
Oranges	**Oxamyl**	700	155	170,000	0.2	0.50	4.01	0.0%	0.1%	Feb3-16; May27-Jun23; Aug15-Sep22	Feb3-Sep22
Tomatoes	**Oxamyl**	700	155	100,000	1.2	0.59	1.00	0.0%	0.1%	Apr20-Jul7	Mar27-Aug18
Peaches	**Oxamyl**	600	133	30,000	0.5	2.00	2.00	0.0%	0.1%	Jan3-Feb15	Jan3-Feb15
Carrots	**Methomyl**	1,900	124	50,000	4.1	0.57	1.56	0.0%	**0.3%**	Aug15-Sep25	May31-Oct12
Garlic	**Methomyl**	1,600	104	20,000	5.5	0.45	2.90	0.0%	**0.3%**	Apr29-May19	Apr29-May19
Watermelon	**Methomyl**	1,600	104	5,700	21.9	0.62	2.05	0.0%	**0.3%**	Jun10-Aug31	May19-Sep11
Peaches	**Carbaryl**	10,000	80	30,000	5.4	4.02	1.39	0.0%	**1.6%**	May15-Sep4	Jan2-Oct19
Asparagus	**Methomyl**	1,200	78	3,900	36.5	0.82	1.05	0.0%	0.2%	Jun30-Aug30	Jun30-Sep14
Pistachios	**Carbaryl**	9,100	73	70,000	3.0	4.00	1.15	0.0%	**1.5%**	Feb5-Jul4	Jan22-Sep30
Alfalfa	**Methomyl**	1,100	72	270,000	1.4	0.29	1.00	0.0%	0.2%	Jun15-Sep5	Mar14-Sep27
Grapes, Raisin	**Methomyl**	1,100	72	290,000	0.4	0.74	1.42	0.0%	0.2%	May1-Aug15	Mar3-Oct9

Carbamate Usage from 1998-2002 Doanes & NASS usage data (10/20/04, BEAD)											
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Onions	**Methomyl**	1,000	65	20,000	3.8	0.72	1.58	0.0%	0.2%	May11-Jul20	Mar30-Aug14
Broccoli	**Methomyl**	800	52	8,200	11.2	0.57	1.63	0.0%	0.1%	Aug1-Oct30	Mar24-Nov8
Oranges	**Methomyl**	800	52	170,000	0.8	0.61	1.00	0.0%	0.1%	Apr20-Jun15; Nov4-30	Mar2-Dec29
Potatoes	**Methomyl**	700	46	8,800	8.6	0.71	1.33	0.0%	0.1%	May7-Jun28	Mar25-Oct19
Onions	Oxamyl	200	44	20,000	0.3	1.00	2.00	0.0%	0.0%		
Cotton	**Carbaryl**	4,900	39	670,000	1.5	0.50	1.00	0.0%	**0.8%**	Apr4-Jul8	Mar24-Oct8
Peaches	**Methomyl**	600	39	30,000	2.4	0.66	1.22	0.0%	0.1%	Apr10-Sep15	Mar4-Oct10
Plums/Prunes	**Carbaryl**	4,800	38	50,000	3.3	2.97	1.00	0.0%	**0.8%**	Jan13-Aug28	Jan2-Oct23
Lettuce	Thiodicarb	2,900	35	10,000	19.4	0.63	1.66	0.0%	**0.5%**		
Cantaloupe	**Carbaryl**	4,300	34	30,000	17.5	0.78	1.04	0.0%	**0.7%**	Apr9-Aug21	Apr4-Jul8
Nectarine	**Carbaryl**	4,200	34	40,000	4.0	3.20	1.00	0.0%	**0.7%**		
Apples	Carbaryl	4,200	34	7,900	20.4	1.81	1.45	0.0%	**0.7%**		Apr10-Sep15
Grapes, Wine	Methomyl	500	33	110,000	0.4	0.74	1.22	0.0%	0.1%		Jan13-Aug28
Cotton	Methomyl	400	26	670,000	0.1	0.48	1.00	0.0%	0.1%		
Peppers	Methomyl	400	26	4,500	9.9	0.56	1.70	0.0%	0.1%		Apr9-Aug21
Plums/Prunes	Methomyl	400	26	50,000	0.8	0.78	1.35	0.0%	0.1%		
Walnuts	Methomyl	400	26	50,000	0.7	0.83	1.50	0.0%	0.1%		
Tomatoes	Carbaryl	3,200	26	100,000	3.2	0.95	1.02	0.0%	**0.5%**		
Potatoes	Oxamyl	100	22	8,800	1.1	0.73	1.00	0.0%	0.0%		
Grapes, Wine	Carbaryl	2,500	20	110,000	0.8	1.56	1.72	0.0%	**0.4%**		
Watermelon	Carbaryl	2,500	20	5,700	30.7	0.96	1.46	0.0%	**0.4%**		
Beans, Snap	Methomyl	300	20	1,900	15.6	0.46	1.99	0.0%	0.0%		
Cucumber	Methomyl	300	20	1,200	28.3	0.59	1.79	0.0%	0.0%		
Grapefruit	Carbaryl	2,300	18	3,400	8.4	6.46	1.25	0.0%	**0.4%**		
Almonds	Carbaryl	1,800	14	210,000	0.2	3.13	1.39	0.0%	0.3%		
Almonds	Methomyl	200	13	210,000	0.1	0.62	1.00	0.0%	0.0%		
Apricots	Carbaryl	1,300	10	4,900	7.8	2.85	1.16	0.0%	0.2%		

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Crop	**Active Ingredient**	**lb A.I.**	**RPF-adj lb ai**	**Planted acres**	**% crop treated**	**App Rate**	**No. apps**	**% rpf-adj lb**	**% non-adj lb**	**Most active app dates**	**Ttl Range**
Lemons	Carbaryl	1,200	10	9,300	2.6	4.78	1.00	0.0%	0.2%		
Grapes, Raisin	Carbaryl	1,100	9	290,000	0.3	1.28	1.00	0.0%	0.2%		
Grapes, Table	Carbaryl	1,000	8	70,000	1.1	1.21	1.00	0.0%	0.2%		
Dry Beans/Peas	Methomyl	100	7	30,000	1.3	0.33	1.09	0.0%	0.0%		
Strawberries	Methomyl	100	7	800	6.5	0.67	2.89	0.0%	0.0%		
Corn	Carbaryl	800	6	110,000	1.2	0.60	1.00	0.0%	0.1%		
Walnuts	Carbaryl	800	6	50,000	0.8	2.26	1.00	0.0%	0.1%		
Carrots	Carbaryl	400	3	50,000	0.6	0.52	2.41	0.0%	0.1%		
Sugar Beets	Carbaryl	400	3	9,200	5.4	0.70	1.08	0.0%	0.1%		
Asparagus	Carbaryl	200	2	3,900	3.0	1.51	1.15	0.0%	0.0%		
Cherries	Carbaryl	200	2	1,700	2.9	2.63	1.17	0.0%	0.0%		
Strawberries	Carbaryl	200	2	800	8.1	1.21	2.38	0.0%	0.0%		
Beans, Lima	Carbaryl	100	1	600	8.2	1.42	1.00	0.0%	0.0%		
Beans, Snap	Carbaryl	100	1	1,900	4.5	1.20	1.00	0.0%	0.0%		
Lettuce	Carbaryl	100	1	10,000	0.5	0.95	1.43	0.0%	0.0%		
Onions	Carbaryl	100	1	20,000	0.3	0.75	1.00	0.0%	0.0%		
Peppers	Carbaryl	100	1	4,500	0.8	1.10	1.80	0.0%	0.0%		
Squash	Carbaryl	100	1	500	7.2	0.95	1.99	0.0%	0.0%		