

MISCELLANEOUS PROCESS METHODOLOGY 7.5

Agricultural Harvest Operations

(Revised and Updated, December 2013)

EMISSION INVENTORY SOURCE CATEGORY

Miscellaneous Processes / Farming Operations

EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION

620-615-5400-0000 (83980) Agricultural Harvest Operations

METHODS AND SOURCES

Particulate matter (PM) emissions from soil and plant material, also known as fugitive dust emissions, are entrained into the air during the harvesting of agricultural commodities. Emissions occur during a variety of harvest operations, including vehicle travel over soil, harvesting activities, and the processing of plant material and the underlying soil. Emissions vary during the year according to the intensity of harvest activities taking place, with the highest emissions occurring during the peak harvest months of summer and fall. The agricultural harvest operations source category includes estimates of emissions produced during harvest and the first post-harvest processing stage (packing houses, nut hullers and processors, cotton gins, dehydrators, feed and grain mills). This methodology does not estimate emissions from subsequent processing, canning or other similar activities.

ESTIMATION METHODOLOGY

ARB estimates harvesting PM emissions by multiplying the number of harvested acres (activity) by a crop specific emission factor. Harvested acreage data were subdivided by crop type and county/air basin/air district (COABDIS) for the entire state. The emission factors were developed from harvest emissions measurements in three crops, then scaled and assigned to all other crops. Crop specific PM₁₀ emissions are estimated directly from the activity and emission factors. The individual crop emissions are then summed to produce estimates of PM₁₀ emissions for each COABDIS. The fractions for the other PM components (PM_{2.5} and total PM) are calculated from a particle speciation profile.

Activity Data. For this update, 2005 harvested acreage from the U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS) was used for all regions except for the San Joaquin Valley Air Basin (SJV Air Basin). NASS data are compiled from county level reports provided by the California County Agricultural Commissioners for more than 200 commodities identified by the California Department of Food and Agriculture (CDFA). For the SJV Air Basin, 2007 farmland acreage from the California Department of Conservation's Farmland Mapping and Monitoring Program

(FMMP) was allocated to the various crops based on the 2007 harvested acreage reports compiled by NASS. For all regions, acreage for pasture lands, mushrooms, greenhouse, nursery and flower crops, and forest firewood was excluded. Also excluded was crop specific acreage that was aggregated statewide as “Sum of Others”. These data, representing less than 1% of statewide harvested acreage, could not be reported due to disclosure of confidential business information. For counties split among two or more air basins, acreage was apportioned based on land surface areas [CARB, 2009 Almanac], except for Kern County, which was assigned 98% to the SJV Air Basin and 2% to the Mojave Desert Air Basin. Complete listings of the California crop acreage by COABDIS are provided in Appendix A

Crop Calendars. In the early 2000’s, ARB staff and a group of agricultural experts in the SJV Air Basin developed 21 representative profiles that characterized the monthly distribution of annual land preparation and harvest activities for about 90 percent of California’s crop acreage. Crops that were not specifically addressed were assigned a crop profile from a similar crop. More information on how crop profiles were developed is available in the background documents [CARB, April 2003].

Crop Specific Emission Factors. The three harvesting emission factors (lbs PM₁₀/acre/year), shown below in Table A, are based on testing conducted in California in almonds, cotton and wheat. The almond harvesting emission factor is revised in this update, based on studies conducted between 2002 and 2010 [Faulkner, 2010; Jones, 2008]. The emission factor for almond shaking is based on the average of shaking results from the Jones study, which used two testing methodologies. The emission factors for almond sweeping and pickup are from the Faulkner study. The cotton and wheat harvesting emission factors are from a 1994-1998 study performed by the University of California, Davis, under contract to the USDA [Flocchini, 2001]. Based on assumptions about the emission generation potential of crop specific harvesting practices, ARB developed nine scaled emission factors and assigned them to over 200 commodities.

Table A
Emission Factors for California Harvesting Operations

Agricultural Harvest Operation	Emission Factor (lbs PM₁₀/acre/year)
Almond	
Almond Shaking	3.47
Almond Sweeping	4.15
Almond Pickup	23.6
Almond Total	31.2
Cotton	
Cotton Picking	1.685
Cotton Stalk Cutting	1.685
Cotton Total	3.37
Wheat	
Combining	5.8

Crop Emissions. Crop emissions (lbs PM₁₀/year) are calculated by multiplying the annual number of crop specific harvested acres by the harvest emission factor for the associated crop:

$$PM_{10} \text{ Emissions}_{\text{crop}} = \text{Acres Harvested}_{\text{crop}} \times PM_{10} \text{ Emission Factor}_{\text{crop}}$$

Crop emissions are summed for total annual county emissions. Table B provides crop profiles, emission factor assumptions and harvesting emission factor assignments for each commodity harvested in 2005 (non-SJV Air Basin) and 2007 (SJV Air Basin).

Table B
Crop Emission Factor Assumption and PM₁₀ Harvest Emission Factor

CDFA Commodity Code	CDFA Crop Description	ARB Crop Profile	Assumption	Harvest EF (lbs PM ₁₀ /acre/year)
101999	WHEAT ALL	Wheat	Wheat/1	5.80
104999	RYE FOR GRAIN	Wheat	Wheat/1	5.80
106199	RICE, FOR MILLING	Rice	Cotton/2	1.68
106269	FIELD CROP BY PRODUCTS	Cotton	Cotton/20	0.17
108999	FOOD GRAINS, MISC	Corn	Cotton/2	1.68
111559	CORN, WHITE	Corn	Cotton/40	0.08
111991	CORN FOR GRAIN	Corn	Cotton/2	1.68
111992	CORN FOR SILAGE	Corn	Cotton/20	0.17
112999	OATS FOR GRAIN	Wheat	Wheat/1	5.80
113994	BARLEY, MALTING	Wheat	Wheat/1	5.80
113995	BARLEY, FEED	Wheat	Wheat/1	5.80
113999	BARLEY, UNSPECIFIED	Wheat	Wheat/1	5.80
114991	SORGHUM, GRAIN	Wheat	Wheat/1	5.80
114992	SORGHUM SILAGE	Wheat	Wheat/1	5.80
115991	TRITICALE	Wheat	Wheat/1	5.80
121219	COTTON LINT, UPLAND	Cotton	Cotton/1	3.37
121229	COTTON LINT, PIMA	Cotton	Cotton/1	3.37
121299	COTTON LINT, UNSPEC	Cotton	Cotton/1	3.37
132999	SUGAR BEETS	Sugar Beets	Cotton/2	1.68
151999	COTTONSEED	Cotton	Cotton/1	3.37
153999	PEANUTS, ALL	Safflower	Cotton/2	1.68
158269	SAFFLOWER	Safflower	Wheat/1	5.80
158316	SUNFLOWER SEED, PLANTING	Corn	Wheat/1	5.80
158319	SUNFLOWER SEED	Corn	Wheat/1	5.80
158499	JOJOBA	Melon	Cotton/40	0.08
161131	BEANS, LIMAS, LG. DRY	DryBeans	Cotton/2	1.68
161132	BEANS, LIMAS, BABY DRY	DryBeans	Cotton/2	1.68
161199	LIMA BEANS, UNSPECIFIED	DryBeans	Cotton/2	1.68
161717	BEANS, RED KIDNEY	DryBeans	Cotton/2	1.68
161721	BEANS, PINK	DryBeans	Cotton/2	1.68
161741	BEANS, BLACKEYE (PEAS)	DryBeans	Cotton/2	1.68
161742	BEANS, GARBANZO	Garbanzo	Cotton/2	1.68
162399	BEANS, FAVA	DryBeans	Cotton/2	1.68
163999	PEAS, DRY EDIBLE	DryBeans	Cotton/20	0.17
169999	BEANS, UNSPEC. DRY EDIBLE	DryBeans	Cotton/2	1.68
171019	SEED WHEAT	Wheat	Wheat/1	5.80
171049	SEED RYE	Wheat	Wheat/1	5.80
171069	SEED RICE	Rice	Cotton/2	1.68
171129	SEED OATS	Wheat	Wheat/1	5.80
171139	SEED BARLEY	Wheat	Wheat/1	5.80
171519	SEED, COTTON FOR PLANTING	Cotton	Cotton/1	3.37
171582	SEED, SAFFLOWER, PLANTING	Safflower	Wheat/1	5.80
171619	SEED BEANS	DryBeans	Cotton/2	1.68
171639	SEED PEAS	DryBeans	Cotton/20	0.17
171949	SEED, MISC FIELD CROP	Corn	Cotton/20	0.17
171959	SEED, VEG & VINECROP	Vegetables	Cotton/20	0.17
172119	SEED, ALFALFA	Alfalfa	Zero/1	0.00
172289	CLOVER, UNSPECIFIED SEED	Alfalfa	Zero/1	0.00
173079	SEED, BERMUDA GRASS	Alfalfa	Zero/1	0.00
173669	SEED, SUDAN GRASS	Alfalfa	Zero/1	0.00

Table B
Crop Emission Factor Assumption and PM₁₀ Harvest Emission Factor

CDFA Commodity Code	CDFA Crop Description	ARB Crop Profile	Assumption	Harvest EF (lbs PM ₁₀ /acre/year)
173999	SEED, GRASS, UNSPECIFIED	Alfalfa	Zero/1	0.00
178999	SEED, OTHER (NO FLOWERS)	Alfalfa	Cotton/20	0.17
181999	HAY, ALFALFA	Alfalfa	Zero/1	0.00
188499	HAY, GRAIN	Alfalfa	Cotton/2	1.68
188799	HAY, WILD	Alfalfa	Cotton/2	1.68
188899	HAY, SUDAN	Alfalfa	Zero/1	0.00
188999	HAY, OTHER UNSPECIFIED	Alfalfa	Cotton/2	1.68
194599	PASTURE, IRRIGATED	No Land Prep.	Zero/1	0.00
194699	PASTURE, RANGE	No Land Prep.	Zero/1	0.00
194799	PASTURE, MISC. FORAGE	No Land Prep.	Zero/1	0.00
195199	SILAGE	Wheat	Cotton/20	0.17
195299	HAY, GREEN CHOP	Alfalfa	Zero/1	0.00
195399	STRAW	Alfalfa	Wheat/1	5.80
198199	RICE, WILD	Rice	Cotton/2	1.68
198999	FIELD CROPS, UNSPEC.	Corn	Cotton/20	0.17
201119	ORANGES, NAVEL	Citrus	Cotton/40	0.08
201519	ORANGES, VALENCIAS	Citrus	Cotton/40	0.08
201999	ORANGES, UNSPECIFIED	Citrus	Cotton/40	0.08
202999	GRAPEFRUIT, ALL	Citrus	Cotton/40	0.08
203999	TANGERINES & MANDARINS	Citrus	Cotton/40	0.08
204999	LEMONS, ALL	Citrus	Cotton/40	0.08
205999	LIMES, ALL	Citrus	Cotton/40	0.08
206999	TANGELOS	Citrus	Cotton/40	0.08
207999	KUMQUATS	Citrus	Cotton/40	0.08
208059	CITRUS, MISC BY-PROD	Citrus	Cotton/40	0.08
209999	CITRUS, UNSPECIFIED	Citrus	Cotton/40	0.08
211999	APPLES, ALL	Citrus	Cotton/40	0.08
212199	PEACHES, FREESTONE	Citrus	Cotton/40	0.08
212399	PEACHES, CLINGSTONE	Citrus	Cotton/40	0.08
212999	PEACHES, UNSPECIFIED	Citrus	Cotton/40	0.08
213199	CHERRIES, SWEET	Citrus	Cotton/40	0.08
214199	PEARS, BARLETT	Citrus	Cotton/40	0.08
214899	PEARS, ASIAN	Citrus	Cotton/40	0.08
214999	PEARS, UNSPECIFIED	Citrus	Cotton/40	0.08
215199	PLUMS	Citrus	Cotton/40	0.08
215399	PLUMCOTS	Citrus	Cotton/40	0.08
215999	PRUNES, DRIED	Citrus	Cotton/40	0.08
216199	GRAPES, TABLE	Grapes-Table	Cotton/20	0.17
216299	GRAPES, WINE	Grapes-Wine	Cotton/20	0.17
216399	GRAPES, RAISIN	Grapes-Raisin	Cotton/20	0.17
216999	GRAPES, UNSPECIFIED	Grapes-Wine	Cotton/20	0.17
217999	APRICOTS, ALL	Citrus	Cotton/40	0.08
218199	NECTARINES	Citrus	Cotton/40	0.08
218299	PERSIMMONS	Citrus	Cotton/40	0.08
218399	POMEGRANATES	Citrus	Cotton/40	0.08
218499	QUINCE	Citrus	Cotton/40	0.08
218839	CHERIMOYAS	Citrus	Cotton/40	0.08
218889	ORCHARD BIOMASS	Almonds	Cotton/40	0.08

Table B
Crop Emission Factor Assumption and PM₁₀ Harvest Emission Factor

CDFA Commodity Code	CDFA Crop Description	ARB Crop Profile	Assumption	Harvest EF (lbs PM ₁₀ /acre/year)
218899	FRUITS & NUTS, UNSPEC.	Citrus	Cotton/40	0.08
221999	AVOCADOS, ALL	Citrus	Cotton/40	0.08
224999	DATES	Citrus	Almonds/20	1.56
225999	FIGS, DRIED	Citrus	Almonds/20	1.56
226999	OLIVES	Citrus	Cotton/40	0.08
228019	GUAVAS	Citrus	Cotton/40	0.08
229999	KIWIFRUIT	Citrus	Cotton/40	0.08
230639	BERRIES, BLACKBERRIES	Grapes-Table	Cotton/40	0.08
230869	BERRIES, BOYSENBERRIES	Grapes-Table	Cotton/40	0.08
234799	BERRIES, LOGANBERRIES	Grapes-Table	Cotton/40	0.08
236199	BERRIES, RASPBERRIES	Grapes-Table	Cotton/40	0.08
237199	STRAWBERRIES, FRESH MKT	Melon	Cotton/40	0.08
237299	STRAWBERRIES, PROC	Melon	Cotton/40	0.08
237999	STRAWBERRIES, UNSPECIFIED	Melon	Cotton/40	0.08
238199	BERRIES BUEBERRIES	Grapes-Table	Cotton/40	0.08
239999	BUSHBERRIES UNSPECIFIED	Grapes-Table	Cotton/40	0.08
261999	ALMONDS, ALL	Almonds	Almonds/1	31.2
263999	WALNUTS, ENGLISH	Almonds	Almonds/1	31.2
264999	PECANS	Almonds	Almonds/10	3.12
265999	WALNUTS, BLACK	Almonds	Almonds/1	31.2
266999	CHESTNUTS	Almonds	Almonds/10	3.12
267999	MACADAMIA NUT	Almonds	Almonds/10	3.12
268079	PISTACHIOS	Almonds	Almonds/10	3.12
268099	ALMOND HULLS	Almonds	Almonds/1	31.2
301999	ARTICHOKES	Melon	Cotton/40	0.08
302199	ASPARAGUS, FRESH MKT	Melon	Cotton/2	1.68
302299	ASPARAGUS, PROC	Melon	Cotton/2	1.68
302999	ASPARAGUS, UNSPECIFIED	Melon	Cotton/2	1.68
303999	BEANS, GREEN LIMAS	DryBeans	Cotton/2	1.68
304199	BEANS, SNAP FR MKT	DryBeans	Cotton/20	0.17
304299	BEANS, SNAP PROC	DryBeans	Cotton/20	0.17
304399	BEANS FRESH UNSPECIFIED	DryBeans	Cotton/20	0.17
304999	BEANS, UNSPECIFIED SNAP	DryBeans	Cotton/20	0.17
305999	BEETS, GARDEN	Sugar Beets	Cotton/2	1.68
306999	RAPINI	Sugar Beets	Cotton/40	0.08
307189	BROCCOLI, FOOD SERV	Vegetables	Cotton/40	0.08
307199	BROCCOLI, FR MKT	Vegetables	Cotton/40	0.08
307299	BROCCOLI, PROC	Vegetables	Cotton/40	0.08
307919	BROCCOLI, UNSPECIFIED	Vegetables	Cotton/40	0.08
308999	BRUSSELS SPROUTS	Melon	Cotton/40	0.08
309999	CABBAGE, CH. & SPECIALTY	Lettuce	Cotton/40	0.08
310999	CABBAGE, HEAD	Lettuce	Cotton/40	0.08
313189	CARROTS, FOOD SERV	Sugar Beets	Cotton/20	0.17
313199	CARROTS, FR MKT	Sugar Beets	Cotton/20	0.17
313299	CARROTS, PROC	Sugar Beets	Cotton/20	0.17
313999	CARROTS, UNSPECIFIED	Sugar Beets	Cotton/20	0.17
314189	CAULIFLOWER, FOOD SERV	Vegetables	Cotton/40	0.08
314199	CAULIFLOWER, FR MKT	Vegetables	Cotton/40	0.08
314299	CAULIFLOWER, PROC	Vegetables	Cotton/40	0.08
314999	CAULIFLOWER, UNSPECIFIED	Vegetables	Cotton/40	0.08

Table B
Crop Emission Factor Assumption and PM₁₀ Harvest Emission Factor

CDFA Commodity Code	CDFA Crop Description	ARB Crop Profile	Assumption	Harvest EF (lbs PM ₁₀ /acre/year)
316189	CELERY, FOOD SERV	Lettuce	Cotton/40	0.08
316199	CELERY, FR MKT	Lettuce	Cotton/40	0.08
316299	CELERY, PROC	Lettuce	Cotton/40	0.08
316999	CELERY, UNSPECIFIED	Lettuce	Cotton/40	0.08
318999	RADICCHIO	Lettuce	Cotton/40	0.08
320999	CHIVES	Lettuce	Cotton/40	0.08
322999	COLLARD GREENS	Lettuce	Cotton/40	0.08
323999	CORN, SWEET ALL	Corn	Cotton/40	0.08
325999	CUCUMBERS	Vegetables	Cotton/40	0.08
330999	EGGPLANT, ALL	Vegetables	Cotton/40	0.08
331999	ENDIVE, ALL	Lettuce	Cotton/40	0.08
332999	ESCAROLE, ALL	Lettuce	Cotton/40	0.08
333999	ANISE (FENNEL)	Lettuce	Cotton/2	1.68
335999	GARLIC, ALL	Garlic	Cotton/2	1.68
337999	KALE	Lettuce	Cotton/40	0.08
338999	KOHLRABI	Lettuce	Cotton/40	0.08
339196	LETTUCE, BULK SALAD PRODS.	Lettuce	Cotton/40	0.08
339999	LETTUCE, UNSPECIFIED	Lettuce	Cotton/40	0.08
340999	LETTUCE, HEAD	Lettuce	Cotton/40	0.08
341999	LETTUCE, ROMAINE	Lettuce	Cotton/40	0.08
342999	LETTUCE, LEAF	Lettuce	Cotton/40	0.08
343999	MELON, CANTALOUPE	Melon	Cotton/40	0.08
348999	MELON, HONEYDEW	Melon	Cotton/40	0.08
354299	MELON, UNSPECIFIED	Melon	Cotton/40	0.08
354999	MELON, WATER MELONS	Melon	Cotton/40	0.08
355999	MUSHROOMS	No Land Prep.	Zero/1	0.00
356999	MUSTARD	Lettuce	Cotton/40	0.08
357999	OKRA	Lettuce	Cotton/40	0.08
358999	ONIONS	Onions	Cotton/2	1.68
359999	PARSLEY	Lettuce	Cotton/40	0.08
361299	PEAS, GREEN, PROCESSING	DryBeans	Cotton/20	0.17
361999	PEAS, GREEN, UNSPECIFIED	DryBeans	Cotton/20	0.17
363999	PEPPERS, BELL	Tomatoes	Cotton/40	0.08
364999	PEPPERS, CHILI, HOT	Tomatoes	Cotton/40	0.08
366999	PUMPKINS	Melon	Cotton/20	0.17
367999	RADISHES	Sugar Beets	Cotton/40	0.08
368999	RHUBARB	Lettuce	Cotton/40	0.08
370999	RUTABAGAS	Sugar Beets	Cotton/2	1.68
372999	ONIONS, GREEN & SHALLOTS	Onions	Cotton/40	0.08
374189	SPINACH, FOOD SERV	Lettuce	Cotton/40	0.08
374199	SPINACH, FR MKT	Lettuce	Cotton/40	0.08
374299	SPINACH, PROC	Lettuce	Cotton/40	0.08
374999	SPINACH UNSPECIFIED	Lettuce	Cotton/40	0.08
375999	SQUASH	Melon	Cotton/20	0.17
376999	SWISSCHARD	Lettuce	Cotton/40	0.08
378199	TOMATOES, FRESH MARKET	Tomatoes	Cotton/40	0.08
378299	TOMATOES, PROCESSING	Tomatoes	Cotton/20	0.17
378999	TOMATOES, UNSPECIFIED	Tomatoes	Cotton/20	0.17

Table B
Crop Emission Factor Assumption and PM₁₀ Harvest Emission Factor (cont.)

CDFA Commodity Code	CDFA Crop Description	ARB Crop Profile	Assumption	Harvest EF (lbs PM ₁₀ /acre/year)
380999	TURNIPS, ALL	Sugar Beets	Cotton/2	1.68
381999	GREENS, TURNIP & MUSTARD	Lettuce	Cotton/40	0.08
387999	LEEKs	Onions	Cotton/40	0.08
391999	POTATOES, IRISH ALL	Sugar Beets	Cotton/2	1.68
392999	SWEET POTATOES	Sugar Beets	Cotton/2	1.68
393999	HORSERADISH	Onions	Cotton/40	0.08
394199	SALAD GREENS NEC	Lettuce	Cotton/40	0.08
394999	PEAS, EDIBLE POD (SNOW)	DryBeans	Cotton/20	0.17
395999	VEGETABLES, ORIENTAL, ALL	Vegetables	Cotton/40	0.08
396999	SPROUTS, ALFALFA & BEAN	Lettuce	Cotton/40	0.08
398199	CUCUMBERS, GREENHOUSE	No Land Prep.	Zero/1	0.00
398299	TOMATOES, GREENHOUSE	No Land Prep.	Zero/1	0.00
398399	TOMATOES, CHERRY	Tomatoes	Cotton/40	0.08
398499	TOMATILLO	Tomatoes	Cotton/40	0.08
398559	CILANTRO	Lettuce	Cotton/40	0.08
398599	SPICES AND HERBS	Lettuce	Cotton/40	0.08
398899	VEGETABLES, BABY	Vegetables	Cotton/40	0.08
398999	VEGETABLES, UNSPECIFIED	Vegetables	Cotton/20	0.17
832919	POTATOES SEED	Sugar Beets	Cotton/2	1.68
892999	NURSERY TURF	No Land Prep.	Zero/1	0.00

Total PM and PM_{2.5} are derived from calculated PM₁₀ emissions using ARB's speciation profile #417 for agricultural tilling dust [Houck, 1989; Cowherd, 2005]. Particle size fractions are based on an average of dust measurements from 8 fields in the San Joaquin Valley and on 2006 updates to ARB PM_{2.5} speciation profiles [Gaffney, 2006] that apportioned more of the fine PM (<2.5 microns) into the coarse PM (>2.5 microns) category. Compared to the previous methodology, the updated particle size profile reduces the PM_{2.5}/PM₁₀ fraction from 22.2% to 15% and reduces the PM_{2.5}/total PM fraction from 10% to 6.8%.

Total PM emissions are back-calculated by dividing computed PM₁₀ emissions by the particle size fraction for <PM₁₀:

$$\text{Total PM} = \text{PM}_{10} / 0.4543$$

PM_{2.5} emissions are calculated by multiplying total PM emissions by the particle size fraction for <PM_{2.5}:

$$\text{PM}_{2.5} = (\text{PM}_{10} / 0.4543) \times 0.0681$$

Table 1 presents updated PM₁₀, PM_{2.5} and total PM emissions from agricultural harvest operations for 2005 (all regions except the SJV Air Basin) and Table 2 presents emissions for 2007 (SJV Air Basin). Emissions are summarized by COABDIS, along with associated harvested crop acreage.

Compared to the previous update [Gaffney, 2003], harvested acreage is essentially unchanged, while PM₁₀ harvest emissions have increased by 42% [Gaffney, 2003]. The increase is attributable to a comparable (43%) increase in almond and walnut acreage since 2000. These two crops are assigned the highest harvesting emission factor (almonds, 31.2 lbs PM₁₀/acre), due to the dust generated during harvest operations, primarily during first pick up.

TEMPORAL ACTIVITY

Monthly temporal activity profiles allocate emissions based on crop specific profiles that reflect the percentage of harvesting activities occurring each month. Temporal activity for each county is derived by summing the monthly harvesting emissions from all crops. Because the crop composite differs by county, each county's monthly profile is unique. No adjustments are made for rainfall as the crop calendars are assumed to reflect seasonal activity patterns.

Crop Activity Profiles. Each crop profile indicates the percentage of annual harvest operations that take place each month. Table 3 shows the temporal activity for all 20 crop profiles.

Emissions Activity Profiles. The activity profiles are used to distribute annual harvesting emissions to the summer months (May - October) and winter months (November - April). Table 4 presents the monthly temporal emissions profiles developed for each COABDIS, based on the composite of crop profiles and associated harvested acreage. Monthly emissions are calculated by multiplying annual county emissions by the monthly fraction.

GROWTH FORECASTING

In the prior update, this category had been grown by the projected county acreage for irrigated and non-irrigated agricultural lands, excluding native grazing land, as reported by the FMMP. Growth projections were revised for this update [Griffin, 2011]. For all regions of the state except the SJV Air Basin, growth reflects linear regressions of the 2000-2009 NASS harvested crop acreage for regions showing a definite trend (-3% to +3% annually) and no growth when the regression analysis showed either no observable trend or an unsustainable trend. For the SJV Air Basin, growth reflects linear regressions of 2000-2009 FMMP farmland acreage by COABDIS, applied to NASS harvested crop acreage for base year 2007. Growth for all regions is projected to 2020.

ASSUMPTIONS AND LIMITATIONS

1. The harvest operations emission factors developed in the SJV Air Basin are assumed to accurately represent emissions statewide.
2. Based on the relative geologic PM₁₀ generation potential of various harvest practices, three emission factors measured in almond, cotton and wheat were scaled and assigned to all harvest activities.
3. Crop calendar data collected for SJV crops and practices were extrapolated to the same crops in the remainder of the state. Existing crop profiles were used for the small percentage of crops for which updated information was not collected.
4. The current harvest emission factors assume that, for each crop, harvesting produces the same level of emissions under all conditions for all equipment.
5. SJV soils are assumed to accurately represent the particle size distribution of PM in agricultural fields statewide.
6. It is assumed that ARB's particle size speciation profile #417 (agricultural tilling dust) provides adequate size fractions for calculating PM_{2.5} and total PM emissions throughout California.

CHANGES IN METHOD AND EMISSION ESTIMATES

The significant changes in the harvesting emissions estimates for this update include:

- Harvested crop acreage data compiled by California County Agricultural Commissioners was updated for 2005 (non-SJV Air Basin regions) and 2007 (SJV Air Basin).
- The almond harvesting emission factor was reduced from 40.77 lbs PM₁₀/acre/year to 31.2 lbs PM₁₀/acre/year, based on recent emissions testing.
- An updated particle size fraction is used for ARB speciation profile #417 that reduces the PM_{2.5}/PM₁₀ fraction from 22.2% to 15%, and reduces the PM_{2.5}/total PM from 1.0% to 0.068%.
- PM_{2.5} emissions are reported for the first time.
- County specific temporal profiles were updated, based on estimated PM₁₀ emissions for harvest operations and on crop specific activity profiles.
- New growth surrogates were adopted based on linear regressions of 2000-2009 harvested acreage.
- Compared to the prior update, estimated 2005 harvesting emissions have increased by about 42% due to a comparable increase in almond and walnut acreage since 2000.

COMMENTS AND RECOMMENDATIONS

Emission Factors. ARB, in consultation with agricultural experts from the SJV, used a subjective scaling approach to assign the three available PM emission factors to over 200 California crops. As additional harvest emissions data are collected, they will be incorporated into the methodology and the emissions estimates will be recalculated.

Environmental Conditions. Incorporation of environmental factors, such as relative humidity and soil moisture, into harvesting emission factors is still under exploration and may be considered for future methodology updates.

Speciation Profiles. Currently, ARB uses SJV test data as a statewide default. If available, future updates could include regional or county-specific particle size speciation profiles.

Growth. The assumptions concerning growth should be periodically reviewed to ensure that the growth surrogate accurately reflects the current status of California's agricultural lands.

SAMPLE CALCULATIONS

The following steps, along with the information in Table F, below, summarize the data computations needed to estimate PM emissions from agricultural harvest operations for 2007 in Fresno County.

Step 1: Acreage. Using the data in Appendix A, enter the acreage for the crop of interest.

Step 2: Crop specific emission factor. Using the data in Table 1, assign the appropriate emission factor for each crop.

Step 3: Calculate Crop PM₁₀ emissions. Multiply the acres for each crop by the appropriate emission factor, and divide by 2000 lbs/ton to compute annual tons of PM₁₀ emissions.

$$\text{Emissions} = (\text{Acres} \times \text{Emission Factor}) / 2000$$

Step 4: County total emissions. Sum the emissions for each crop to compute the total PM₁₀ emissions from harvest operations.

Step 5: Calculate total PM emissions. Divide computed PM₁₀ emissions by the particle size fraction provided in ARB speciation profile #417 for < PM₁₀:

$$\text{Total PM} = \text{PM}_{10} / 0.4543$$

Step 6: Calculate PM_{2.5} emissions. Multiply total PM emissions by the particle size fraction for < PM_{2.5} provided in ARB speciation profile #417:

$$\text{PM}_{2.5} = (\text{PM}_{10} / 0.4543) \times 0.0681$$

Table F
PM Emissions from 2007 Harvest Operations in Fresno County (Selected Crops)

Crop	Acres	Emission Factor (lbs PM ₁₀ /acre)	PM Emissions (tons/year)		
			PM ₁₀	Total PM	PM _{2.5}
Almonds, All	149,889.48	31.2	2,338.28	5,146.99	350.51
Cotton Lint, Pima,	126,256.52	3.37	212.74	468.29	31.89
Tomatoes, Processing	160,550.00	0.17	13.65	30.04	2.05
Wheat, All	43,027.40	5.80	124.78	274.66	18.70
Etc....					
Total	1,380,839		3,127.09	6,883.31	468.75

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Table 1
2005 Emissions from Agricultural Harvest Operations

Year	Air Basin	County	Air District	Harvested Acres	Emissions, tons/year		
					PM10	PM2.5	Total PM
2005	GBV	Alpine	GBU	7.00	0.01	0.00	0.01
2005	GBV	Inyo	GBU	4,830.00	1.27	0.19	2.78
2005	GBV	Mono	GBU	11,956.00	1.98	0.30	4.37
2005	LC	Lake	LAK	16,426.00	43.09	6.46	94.85
2005	LT	El Dorado	ED	322.47	0.37	0.06	0.83
2005	LT	Placer	PLA	1,073.05	0.78	0.12	1.72
2005	MC	Amador	AMA	6,038.00	7.45	1.12	16.39
2005	MC	Calaveras	CAL	1,750.00	10.44	1.57	22.99
2005	MC	El Dorado	ED	3,260.53	3.79	0.57	8.35
2005	MC	Mariposa	MPA	981.00	0.08	0.01	0.17
2005	MC	Nevada	NSI	350.00	0.03	0.00	0.06
2005	MC	Placer	PLA	13,949.65	10.16	1.52	22.35
2005	MC	Plumas	NSI	10,000.00	3.37	0.51	7.42
2005	MC	Sierra	NSI	3,500.00	1.94	0.29	4.27
2005	MC	Tuolumne	TUO	600.00	0.51	0.08	1.11
2005	MD	Kern	KER	17,406.02	42.64	6.39	93.86
2005	MD	Los Angeles	AV	9,535.36	2.46	0.37	5.42
2005	MD	Riverside	MOJ	31,823.83	18.98	2.84	41.77
2005	MD	Riverside	SC	46,799.75	27.91	4.18	61.42
2005	MD	San Bernardino	MOJ	27,628.48	2.31	0.35	5.09
2005	NC	Del Norte	NCU	1,950.00	1.64	0.25	3.62
2005	NC	Humboldt	NCU	3,000.00	1.73	0.26	3.81
2005	NC	Mendocino	MEN	18,743.00	1.47	0.22	3.23
2005	NC	Sonoma	NS	48,291.56	12.05	1.81	26.53
2005	NC	Trinity	NCU	564.00	0.39	0.06	0.86
2005	NCC	Monterey	MBU	331,025.00	67.84	10.17	149.33
2005	NCC	San Benito	MBU	56,414.00	51.67	7.75	113.74
2005	NCC	Santa Cruz	MBU	20,146.00	1.14	0.17	2.51
2005	NEP	Lassen	LAS	67,605.00	41.04	6.15	90.33
2005	NEP	Modoc	MOD	89,248.00	65.85	9.87	144.94
2005	NEP	Siskiyou	SIS	97,644.00	92.71	13.90	204.06
2005	SC	Los Angeles	SC	10,752.64	2.78	0.42	6.11
2005	SC	Orange	SC	6,817.00	1.26	0.19	2.78
2005	SC	Riverside	SC	52,415.72	31.25	4.69	68.80
2005	SC	San Bernardino	SC	1,763.52	0.15	0.02	0.33
2005	SCC	San Luis Obispo	SLO	111,623.00	77.28	11.58	170.11
2005	SCC	Santa Barbara	SB	123,654.00	13.27	1.99	29.21
2005	SCC	Ventura	VEN	90,861.00	6.58	0.99	14.49
2005	SD	San Diego	SD	53,458.00	9.97	1.49	21.95

Table 1
2005 Emissions from Agricultural Harvest Operations

Year	Air Basin	County	Air District	Harvested Acres	Emissions, tons/year		
					PM10	PM2.5	Total PM
2005	SF	Alameda	BA	7,742.00	4.24	0.64	9.34
2005	SF	Contra Costa	BA	25,940.00	24.86	3.73	54.72
2005	SF	Marin	BA	5,827.00	3.16	0.47	6.95
2005	SF	Napa	BA	42,385.00	5.24	0.79	11.53
2005	SF	San Francisco	BA	0	0	0	0
2005	SF	San Mateo	BA	3,447.00	1.32	0.20	2.91
2005	SF	Santa Clara	BA	21,522.00	7.57	1.13	16.66
2005	SF	Solano	BA	53,404.82	108.16	16.21	238.09
2005	SF	Sonoma	BA	22,725.44	5.67	0.85	12.48
2005	SS	Imperial	IMP	524,679.00	237.94	35.67	523.75
2005	SS	Riverside	SC	56,159.70	33.49	5.02	73.71
2005	SV	Butte	BUT	194,893.00	1,141.06	171.05	2,511.68
2005	SV	Colusa	COL	256,544.00	679.55	101.87	1,495.82
2005	SV	Glenn	GLE	212,733.00	765.04	114.68	1,683.99
2005	SV	Placer	PLA	6,438.30	4.69	0.70	10.32
2005	SV	Sacramento	SAC	131,189.00	94.04	14.10	207.01
2005	SV	Shasta	SHA	29,305.00	33.06	4.96	72.78
2005	SV	Solano	YS	87,134.18	176.48	26.45	388.46
2005	SV	Sutter	FR	224,428.00	543.32	81.44	1,195.94
2005	SV	Tehama	TEH	52,936.00	372.62	55.86	820.20
2005	SV	Yolo	YS	301,242.00	520.09	77.96	1,144.82
2005	SV	Yuba	FR	72,694.00	197.08	29.54	433.80

Table 2
2007 Emissions from Agricultural Harvest Operations

Year	Air Basin	County	Air District	Harvested Acres	Emissions, tons/year		
					PM10	PM2.5	Total PM
2007	SJV	Fresno	SJU	1,380,839.17	3,127.09	468.75	6,883.31
2007	SJV	Kern	SJU	950,705.13	2,765.39	414.53	6,087.15
2007	SJV	Kings	SJU	579,771.60	1,010.07	151.41	2,223.36
2007	SJV	Madera	SJU	364,080.25	1,412.27	211.70	3,108.66
2007	SJV	Merced	SJU	591,529.49	1,892.20	283.64	4,165.08
2007	SJV	San Joaquin	SJU	617,864.25	1,595.49	239.17	3,511.98
2007	SJV	Stanislaus	SJU	397,908.34	2,301.25	344.96	5,065.48
2007	SJV	Tulare	SJU	866,209.89	1,136.24	170.32	2,501.08

Table 3
 Monthly Agricultural Harvest Activity by Crop
Sum of monthly values may not equal 1.0 due to rounding.

Crop Profile	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Alfalfa	0.000	0.000	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.000	0.000	0.000
Almonds	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.500	0.000	0.000
Citrus	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
Corn	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.500	0.000	0.000
Cotton	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.500	0.000
DryBeans	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.500	0.000
Garbanzo	0.000	0.000	0.000	0.000	0.000	0.500	0.500	0.000	0.000	0.000	0.000	0.000
Garlic	0.000	0.000	0.000	0.000	0.000	0.200	0.200	0.200	0.200	0.200	0.000	0.000
Grapes-Raisin	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
Grapes-Table	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
Grapes-Wine	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
Lettuce	0.000	0.000	0.250	0.250	0.000	0.000	0.000	0.000	0.000	0.250	0.250	0.000
Melon	0.000	0.000	0.000	0.000	0.000	0.250	0.250	0.250	0.250	0.000	0.000	0.000
Onions	0.000	0.000	0.000	0.000	0.000	0.200	0.200	0.200	0.200	0.200	0.000	0.000
Rice	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.333	0.333	0.333	0.000
Safflower	0.000	0.000	0.000	0.000	0.000	0.000	0.333	0.333	0.333	0.000	0.000	0.000
Sugar Beets	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
Tomatoes	0.000	0.000	0.000	0.000	0.000	0.000	0.333	0.333	0.333	0.000	0.000	0.000
Vegetables	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
Wheat	0.000	0.000	0.000	0.000	0.000	0.500	0.500	0.000	0.000	0.000	0.000	0.000

Table 4
 PM₁₀ Emissions Temporal Profiles for Agricultural Harvesting Operations
 Monthly % of annual emissions, normalized to 1.0; sum of monthly values may not equal 1.0 due to rounding.

Year	Air Basin	County	Air District	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2005	GBV	Alpine	GBU	0.000	0.000	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.000	0.000	0.000
2005	GBV	Inyo	GBU	0.000	0.000	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.000	0.000	0.000
2005	GBV	Mono	GBU	0.000	0.000	0.133	0.133	0.133	0.147	0.147	0.147	0.147	0.013	0.000	0.000
2005	LC	Lake	LAK	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.492	0.492	0.015	0.000
2005	LT	El Dorado	ED	0.001	0.001	0.009	0.009	0.009	0.009	0.009	0.009	0.456	0.448	0.040	0.001
2005	LT	Placer	PLA	0.001	0.001	0.018	0.018	0.018	0.058	0.058	0.018	0.282	0.264	0.263	0.001
2005	MC	Amador	AMA	0.000	0.000	0.019	0.019	0.019	0.019	0.019	0.019	0.429	0.410	0.044	0.000
2005	MC	Calaveras	CAL	0.000	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.489	0.486	0.004	0.000
2005	MC	El Dorado	ED	0.001	0.001	0.009	0.009	0.009	0.009	0.009	0.009	0.456	0.448	0.040	0.001
2005	MC	Mariposa	MPA	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.420	0.420	0.103	0.006
2005	MC	Nevada	NSI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
2005	MC	Placer	PLA	0.001	0.001	0.018	0.018	0.018	0.058	0.058	0.018	0.282	0.264	0.263	0.001
2005	MC	Plumas	NSI	0.000	0.000	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.000	0.000	0.000
2005	MC	Sierra	NSI	0.000	0.000	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.000	0.000	0.000
2005	MC	Tuolumne	TUO	0.000	0.000	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.000	0.000	0.000
2005	MD	Kern	KER	0.001	0.001	0.004	0.004	0.004	0.066	0.066	0.005	0.370	0.420	0.058	0.001
2005	MD	Los Angeles	AV	0.009	0.009	0.071	0.071	0.071	0.157	0.157	0.157	0.168	0.106	0.014	0.009
2005	MD	Riverside	MOJ	0.007	0.007	0.014	0.014	0.014	0.326	0.327	0.015	0.016	0.123	0.129	0.007
2005	MD	Riverside	SC	0.007	0.007	0.014	0.014	0.014	0.326	0.327	0.015	0.016	0.123	0.129	0.007
2005	MD	San Bernardino	MOJ	0.008	0.008	0.070	0.070	0.059	0.074	0.075	0.062	0.280	0.237	0.048	0.008
2005	NC	Del Norte	NCU	0.000	0.000	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.000	0.000	0.000
2005	NC	Humboldt	NCU	0.000	0.000	0.136	0.136	0.136	0.161	0.161	0.136	0.136	0.000	0.000	0.000
2005	NC	Mendocino	MEN	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.930	0.006
2005	NC	Sonoma	NS	0.001	0.001	0.034	0.034	0.034	0.208	0.208	0.034	0.104	0.070	0.272	0.001
2005	NC	Trinity	NCU	0.000	0.000	0.139	0.139	0.139	0.139	0.139	0.139	0.139	0.000	0.025	0.000
2005	NCC	Monterey	MBU	0.006	0.006	0.037	0.037	0.013	0.308	0.309	0.032	0.056	0.085	0.104	0.006
2005	NCC	San Benito	MBU	0.001	0.001	0.037	0.037	0.033	0.103	0.104	0.040	0.330	0.301	0.011	0.001
2005	NCC	Santa Cruz	MBU	0.026	0.026	0.103	0.103	0.048	0.090	0.090	0.090	0.090	0.082	0.227	0.026
2005	NEP	Lassen	LAS	0.000	0.000	0.112	0.112	0.112	0.220	0.220	0.112	0.112	0.000	0.000	0.000
2005	NEP	Modoc	MOD	0.005	0.005	0.062	0.062	0.062	0.327	0.327	0.065	0.065	0.008	0.005	0.005
2005	NEP	Siskiyou	SIS	0.001	0.001	0.017	0.017	0.017	0.449	0.449	0.021	0.021	0.005	0.001	0.001
2005	SC	Los Angeles	SC	0.009	0.009	0.071	0.071	0.071	0.157	0.157	0.157	0.168	0.106	0.014	0.009
2005	SC	Orange	SC	0.009	0.009	0.009	0.009	0.009	0.022	0.026	0.026	0.026	0.423	0.423	0.009
2005	SC	Riverside	SC	0.007	0.007	0.014	0.014	0.014	0.326	0.327	0.015	0.016	0.123	0.129	0.007
2005	SC	San Bernardino	SC	0.008	0.008	0.070	0.070	0.059	0.074	0.075	0.062	0.280	0.237	0.048	0.008
2005	SCC	San Luis Obispo	SLO	0.002	0.002	0.019	0.019	0.018	0.318	0.318	0.018	0.129	0.115	0.040	0.002
2005	SCC	Santa Barbara	SB	0.019	0.019	0.071	0.071	0.053	0.064	0.065	0.059	0.062	0.186	0.311	0.019
2005	SCC	Ventura	VEN	0.031	0.031	0.060	0.060	0.031	0.068	0.079	0.079	0.088	0.232	0.213	0.031
2005	SD	San Diego	SD	0.019	0.019	0.038	0.038	0.037	0.335	0.338	0.043	0.054	0.033	0.025	0.019

Table 4
 PM₁₀ Emissions Temporal Profiles for Agricultural Harvesting Operations
 Monthly % of annual emissions, normalized to 1.0; sum of monthly values may not equal 1.0 due to rounding.

Year	Air Basin	County	Air District	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2005	SF	Alameda	BA	0.000	0.000	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.000	0.043	0.000
2005	SF	Contra Costa	BA	0.001	0.001	0.008	0.008	0.008	0.098	0.131	0.042	0.368	0.327	0.008	0.001
2005	SF	Marin	BA	0.000	0.000	0.134	0.134	0.134	0.161	0.161	0.134	0.134	0.000	0.003	0.000
2005	SF	Napa	BA	0.000	0.000	0.004	0.004	0.004	0.004	0.004	0.004	0.152	0.148	0.674	0.000
2005	SF	San Francisco	BA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2005	SF	San Mateo	BA	0.005	0.005	0.060	0.060	0.060	0.291	0.291	0.071	0.071	0.038	0.044	0.005
2005	SF	Santa Clara	BA	0.003	0.003	0.060	0.060	0.054	0.068	0.074	0.074	0.306	0.261	0.035	0.003
2005	SF	Solano	BA	0.000	0.000	0.005	0.005	0.005	0.152	0.174	0.028	0.323	0.301	0.007	0.000
2005	SF	Sonoma	BA	0.001	0.001	0.034	0.034	0.034	0.208	0.208	0.034	0.104	0.070	0.272	0.001
2007	SJV	Fresno	SJU	0.000	0.000	0.001	0.001	0.001	0.032	0.033	0.006	0.408	0.457	0.059	0.000
2007	SJV	Kern	SJU	0.001	0.001	0.003	0.003	0.003	0.060	0.060	0.004	0.402	0.430	0.034	0.001
2007	SJV	Kings	SJU	0.000	0.000	0.017	0.017	0.017	0.118	0.118	0.018	0.236	0.338	0.120	0.000
2007	SJV	Madera	SJU	0.000	0.000	0.001	0.001	0.001	0.006	0.006	0.001	0.484	0.488	0.010	0.000
2007	SJV	Merced	SJU	0.001	0.001	0.003	0.003	0.003	0.013	0.014	0.004	0.453	0.477	0.028	0.001
2007	SJV	San Joaquin	SJU	0.000	0.000	0.002	0.002	0.002	0.018	0.021	0.008	0.472	0.467	0.008	0.000
2007	SJV	Stanislaus	SJU	0.000	0.000	0.002	0.002	0.002	0.003	0.004	0.002	0.491	0.492	0.003	0.000
2007	SJV	Tulare	SJU	0.001	0.001	0.001	0.001	0.001	0.059	0.059	0.001	0.410	0.436	0.032	0.001
2005	SS	Imperial	IMP	0.009	0.009	0.047	0.047	0.045	0.268	0.268	0.053	0.058	0.099	0.087	0.009
2005	SS	Riverside	SC	0.007	0.007	0.014	0.014	0.014	0.326	0.327	0.015	0.016	0.123	0.129	0.007
2005	SV	Butte	BUT	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.000	0.485	0.485	0.025	0.000
2005	SV	Colusa	COL	0.000	0.000	0.001	0.001	0.001	0.030	0.037	0.008	0.428	0.428	0.067	0.000
2005	SV	Glenn	GLE	0.000	0.000	0.001	0.001	0.001	0.021	0.021	0.001	0.456	0.460	0.039	0.000
2005	SV	Placer	PLA	0.001	0.001	0.018	0.018	0.018	0.058	0.058	0.018	0.282	0.264	0.263	0.001
2005	SV	Sacramento	SAC	0.001	0.001	0.005	0.005	0.005	0.196	0.272	0.086	0.230	0.145	0.053	0.001
2005	SV	Shasta	SHA	0.000	0.000	0.064	0.064	0.064	0.064	0.064	0.064	0.321	0.257	0.039	0.000
2005	SV	Solano	YS	0.000	0.000	0.005	0.005	0.005	0.152	0.174	0.028	0.323	0.301	0.007	0.000
2005	SV	Sutter	FR	0.000	0.000	0.003	0.003	0.003	0.042	0.063	0.024	0.408	0.391	0.062	0.000
2005	SV	Tehama	TEH	0.000	0.000	0.002	0.002	0.002	0.009	0.009	0.002	0.487	0.485	0.001	0.000
2005	SV	Yolo	YS	0.000	0.000	0.002	0.002	0.002	0.099	0.125	0.028	0.375	0.346	0.020	0.000
2005	SV	Yuba	FR	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.471	0.470	0.050	0.000