MISCELLANEOUS PROCESS METHODOLOGY 7.4
Agricultural Land Preparation

(Revised and Updated, December 2013)

EMISSION INVENTORY SOURCE CATEGORY
Miscellaneous Processes / Farming Operations

EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION
620-614-5400-0000 (47332) Agricultural Land Preparation

METHODS AND SOURCES

The land preparation (agricultural tilling) source category includes estimates of the airborne soil particulate emissions produced during the preparation of agricultural lands for planting and during post-harvest land cultivation activities. Emissions vary during the year according to the level of activity, with the majority of soil preparation activities taking place from fall to spring. This methodology accounts for emissions from mechanical soil preparation activities that require large equipment and have the potential to generate significant dust emissions, such as discing, shaping, chiseling, and leveling.

ESTIMATION METHODOLOGY

ARB estimates the particulate matter (PM) emissions produced by agricultural land preparation by multiplying the number of harvested acres for each crop by crop specific emission factors that take into consideration the emission rates for each of the land preparation activities associated with each crop, and an estimate of the number of equipment passes per acre performed per year for each operation. PM_{10} emissions are estimated directly from the activity (harvested acres) and emission factors. 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 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 as no land preparation activities are associated with these commodities. 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 at the county level 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 specific crop acreage used for this update are provided at: https://www.arb.ca.gov/ei/areasrc/fullpdf/2007sjv_acreage.pdf and https://www.arb.ca.gov/ei/areasrc/fullpdf/2005non-sjv_acreage.pdf

Land Preparation Emission Factors. Land preparation emission factors are based on crop specific emission factors, which account for the following:

- The number and type of annual land preparation operations specified in crop calendars for each crop type,
- The number of annual equipment passes per acre, or acre-passes, that are typically required to conduct all land preparation operations for each crop, and
- Operation-specific emission factors (i.e., discing, chiseling).

Crop Calendars. Many land preparation activities take place close to planting or following harvest. In addition, various operations can occur at other times of the year, with frequencies of several times per year to less than once per year. 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.

Acre-passes. For each crop, each type of land preparation activity includes an estimate of annual acre-passes, which are the total number of equipment passes that are typically performed each year, for each operation, to prepare land for planting. For some operations and crops, this number was less than one.

Operation Specific Emission Factors. Five operation specific emission factors, expressed as pounds of PM_{10} per acre-pass (lbs PM_{10}/acre-pass), were developed for agricultural land preparation operations, based on 1994-1998 UC Davis measurements conducted in cotton and wheat fields in the San Joaquin Valley [Flocchini, 2001]. Emissions testing was conducted for root cutting, discing, ripping and subsoiling, land planing and floating, and weeding. Following discussion with a stakeholder group of

regulators, researchers, and agricultural industry representatives, the emission factors were adjusted based on a combination of scientific applicability, general experience and observations. The emission factors determined from tests were then assigned to the more than thirty different land preparation operations commonly used in California, based on similar potentials for dust emissions. The final emission factors are summarized in Table A, below. The complete list of land preparation operations and their assigned emission factors is presented in Table B, below.

Table A
Results of Land Preparation Operation Emission Testing

Land Preparation Operations	Emission Factor (lbs PM_{10}/acre-pass)
Root cutting	0.3
Discing, Tilling, Chiseling	1.2
Ripping, Subsoiling	4.6
Land Planing & Floating	12.5
Weeding	0.8

Table B
Summary of Land Preparation Operations and Assigned Operation Categories[1]

Operation	**Category**	**Emission Factor** (lbs/acre-pass)
Chisel	Discing	1.2
Disc	Discing	1.2
Disc & Furrow-out	Discing	1.2
Disc & Roll	Discing	1.2
Finish Disc	Discing	1.2
Harrow Disc	Discing	1.2
Land Preparation	Discing	1.2
Mulch Beds	Discing	1.2
Plow	Discing	1.2
Post Burn/Harvest Disc	Discing	1.2
Stubble Disc	Discing	1.2
Unspecified	Discing	1.2
3 Wheel Plane	Land Planing	1.1
Float	Land Planing	12.5
Land Plane	Land Planing	12.5
Laser Level	Land Planing	12.5
Level	Land Planing	12.5
Level (new vineyard)	Land Planing	12.5
Plane	Land Planing	12.5
Land Maintenance	Land Planing	12.5
Subsoil	Ripping	4.6
Subsoil-deep chisel	Ripping	4.6
Bed Preparation	Weeding	0.8
List	Weeding	0.8
List & Fertilize	Weeding	0.8
Listing	Weeding	0.8
Roll	Weeding	0.8
Seed Bed Preparation	Weeding	0.8
Shape Beds	Weeding	0.8
Shape Beds & Roll	Weeding	0.8
Shaping	Weeding	0.8
Spring Tooth	Weeding	0.8
Terrace	Weeding	0.8
Sulfur Dusting	None	0

1 For detailed information on emission factor derivation, see California Air Resources Board's Detailed Documentation for Fugitive Dust and Ammonia Emission Inventory Changes for the SJVUAPCD Particulate Matter SIP. April 2003.
http://www.valleyair.org/Air_Quality_Plans/docs/2003%20PM10%20Plan/PDF%202003%20PM10%20Plan%20adpt%20ref/R12-Inventory%20Doc%20Memos%20SJV%204_2003.pdf

Crop Specific Emission Factors*.* Crop specific emission factors were developed using emission factors for the land preparation operations and the number of annual acre-passes associated with each operation. First, weighted emission factors (lbs PM_{10}/year) were computed for each crop by multiplying each operation specific emission factor (lbs PM_{10}/acre-pass) by the respective number of annual acre-passes (acre-passes/year). Then, crop specific emission factors (lbs PM_{10}/acre/year) were calculated by summing all the weighted emission factors associated with each crop. Using alfalfa as an example, crop specific emission factors are developed as follows:

1. Calculate weighted emission factors for land preparation operations applicable to alfalfa by multiplying the emission factors for discing (1.2 lbs/acre-pass) and land planing (12.5 lbs/acre-pass) by the respective acre-passes/year. The typical annual land preparation activities for one acre of alfalfa include 1.25 acre-passes of discing and 0.2 acre-passes of land planing.

2. Calculate the crop-specific emission factor for alfalfa by summing the associated weighted emission factors for discing and land planing.

The equation below calculates the PM_{10} emission factor for alfalfa using the operation specific emission factors for discing and land planing and the associated acre-passes per year:

PM_{10} Emission Factor$_{(alfalfa)}$ = [(1.25 acre-passes/acre/year x 1.2 1bs PM_{10}/acre-pass$_{(discing)}$) + (0.2 acre-passes/acre/year x 12.5 lbs PM_{10}/acre-pass$_{(land\ planing)}$)] =4 lbs PM_{10}/acre/year

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PM_{10} Emission Factor$_{(alfalfa)}$ = [(1.25 acre-passes/acre/year x 1.2 1bs PM_{10}/acre-pass$_{(discing)}$) + (0.2 acre-passes/acre/year x 12.5 lbs PM_{10}/acre-pass$_{(land\ planing)}$)] =4 lbs PM_{10}/acre/year

Table C displays the crop specific number of annual acre-passes associated with each land preparation operation as well as the operation specific and crop specific emission factors. Table D presents the crop profiles and crop specific emission factors for each commodity harvested in 2005 (non-SJV Air Basin) and 2007 (SJV Air Basin).

Table C
Acre-Passes and Emission Factors by Crop Profile

Crop profile	Land Preparation Operations	Category	Acre-Passes	Emission Factors	
				Operation (lbs/acre-pass)	Crop (lbs/acre/year)
Alfalfa	Unspecified	Discing	1.25	1.2	
	Land Maintenance	Land Planing	0.2	12.5	4
Almonds	Float	Land Planing	0.25	12.5	3.13
Citrus	Unspecified	Discing	0.06	1.2	0.07
Corn	List & Fertilize	Weeding	1	0.8	
	Mulch Beds	Discing	1	1.2	
	Finish Disc	Discing	1	1.2	
	Land Maintenance	Land Planing	0.2	12.5	
	Stubble Disc	Discing	1	1.2	6.9
Cotton	Land Preparation	Discing	4	1.2	
	Land Maintenance	Land Planing	0.2	12.5	
	Seed Bed Preparation	Weeding	2	0.8	8.9
DryBeans	Land Maintenance	Land Planing	0.2	12.5	
	Chisel	Discing	1	1.2	
	Shaping	Weeding	1	0.8	
	Disc	Discing	2	1.2	
	Listing	Weeding	1	0.8	7.7
Garbanzo	Chisel	Discing	1	1.2	
	Listing	Weeding	1	0.8	
	Shaping	Weeding	1	0.8	
	Disc	Discing	2	1.2	
	Land Maintenance	Land Planing	0.2	12.5	7.7
Garlic	Land Maintenance	Land Planing	0.2	12.5	
	Disc & Roll	Discing	1	1.2	
	Chisel	Discing	1	1.2	
	List	Weeding	1	0.8	
	Shape Beds	Weeding	1	0.8	6.5
Grapes-Raisin	Terrace	Weeding	1	0.8	
	Spring Tooth	Weeding	0.2	0.8	
	Subsoil	Ripping	0.05	4.6	
	Disc & Furrow-out	Discing	1	1.2	
	Level (new vineyard)	Land Planing	0.02	12.5	2.6
Grapes-Table	Subsoil	Ripping	0.05	4.6	
	Disc & Furrow-out	Discing	0.5	1.2	0.83
Grapes-Wine	Level (new vineyard)	Land Planing	0.02	12.5	
	Spring Tooth	Weeding	0.2	0.8	
	Subsoil	Ripping	0.05	4.6	1.5

Table C
Acre-Passes and Emission Factors by Crop Profile

Crop profile	Land Preparation Operations	Category	Acre-Passes	Emission Factors	
				Operation (lbs/acre-pass)	Crop (lbs/acre/year)
Lettuce(1)	Land Maintenance	Land Planing	0.2	12.5	
	Disc & Roll	Discing	2/2	1.2	
	Chisel	Discing	2/2	1.2	
	List	Weeding	2/2	0.8	
	Plane	Land Planing	1/2	12.5	
	Shape Beds & Roll	Weeding	2/2	0.8	12.75
Melon	Plow	Discing	1	1.2	
	Shape Beds	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	
	Disc	Discing	1	1.2	5.7
No Land Prep.	Unspecified	Discing	0	1.2	0
Onions	List	Weeding	1	0.8	
	Shape Beds	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	
	Chisel	Discing	1	1.2	
	Disc & Roll	Discing	1	1.2	6.5
Rice, non SV AB	Chisel	Discing	1	1.2	
	Land Maintenance	Land Planing	0.2	12.5	
	Post Burn/Harvest Disc	Discing	0.5	1.2	
	Roll	Weeding	1	0.8	
	3 Wheel Plane	Land Planing	1	12.5	
	Harrow Disc	Discing	1	1.2	
	Stubble Disc	Discing	1	1.2	20.0
Rice, SV AB	Chisel	Discing	1	1.2	
	Land Maintenance	Land Planing	0.2	1.1	
	Post Burn/Harvest Disc	Discing	0.5	1.2	
	Roll	Weeding	1	0.8	
	3 Wheel Plane	Land Planing	1	1.1	
	Harrow Disc	Discing	1	1.2	
	Stubble Disc	Discing	1	1.2	6.32
Safflower	List	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	
	Stubble Disc	Discing	1	1.2	4.5
Sugar Beets	Disc	Discing	1	1.2	
	Land Plane	Land Planing	1	12.5	
	Subsoil-deep chisel	Ripping	1	4.6	
	Stubble Disc	Discing	1	1.2	
	List	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	22.8
Tomatoes	Bed Preparation	Weeding	2	0.8	
	Land Preparation	Discing	5	1.2	
	Land Maintenance	Land Planing	0.2	12.5	10.1
Vegetables	Land Maintenance	Land Planing	0.2	12.5	
	Unspecified	Discing	5	1.2	8.5
Wheat	Stubble Disc	Discing	1	1.2	
	Land Maintenance	Land Planing	0.2	12.5	3.7

Table D
ARB Assigned Crop Profile and Crop PM_{10} Emission Factor for Land Preparation by CDFA Commodity Code

CDFA Commodity Code	CDFA Crop Name	ARB Crop Profile	LP Emission Factor (lbs PM_{10}/acre/year)
101999	WHEAT ALL	Wheat	3.70
104999	RYE GRAIN	Wheat	3.70
106199	RICE MILLING	Rice	20.00
106269	FIELD CROP BY-PRODUCTS	Cotton	8.90
108999	FOOD GRAINS MISC.	Corn	6.90
111559	CORN WHITE	Corn	6.90
111991	CORN GRAIN	Corn	6.90
111992	CORN SILAGE	Corn	6.90
112999	OATS GRAIN	Wheat	3.70
113994	BARLEY MALTING	Wheat	3.70
113995	BARLEY FEED	Wheat	3.70
113999	BARLEY UNSPECIFIED	Wheat	3.70
114991	SORGHUM GRAIN	Wheat	3.70
115991	TRITICALE	Wheat	3.70
121219	COTTON LINT UPLAND	Cotton	8.90
121229	COTTON LINT PIMA	Cotton	8.90
121299	COTTON LINT UNSPECIFIED	Cotton	8.90
132999	SUGAR BEETS	Sugar Beets	22.80
151999	COTTONSEED	Cotton	8.90
153999	PEANUTS ALL	Safflower	4.50
158269	SAFFLOWER	Safflower	4.50
158316	SUNFLOWER SEED PLANTING	Corn	6.90
158319	SUNFLOWER SEED	Corn	6.90
158499	JOJOBA	Melon	5.70
161131	BEANS LIMA LG. DRY	DryBeans	7.70
161132	BEANS LIMA BABY DRY	DryBeans	7.70
161199	BEANS LIMA UNSPECIFIED	DryBeans	7.70
161717	BEANS KIDNEY RED	DryBeans	7.70
161721	BEANS PINK	DryBeans	7.70
161741	BEANS BLACKEYE (PEAS)	DryBeans	7.70
161742	BEANS GARBANZO	Garbanzo	7.70
162399	BEANS FAVA	DryBeans	7.70
163999	PEAS DRY EDIBLE	DryBeans	7.70
169999	BEANS DRY EDIBLE UNSPEC.	DryBeans	7.70
171019	WHEAT SEED	Wheat	3.70
171049	RYE SEED	Wheat	3.70
171069	RICE SEED	Rice	20.00
171129	OATS SEED	Wheat	3.70
171139	BARLEY SEED	Wheat	3.70
171519	COTTON SEED PLANTING	Cotton	8.90
171582	SAFFLOWER SEED PLANTING	Safflower	4.50
171619	BEANS SEED	DryBeans	7.70
171639	PEAS SEED	DryBeans	7.70
171949	FIELD CROPS SEED MISC.	Corn	6.90
171959	SEED VEG & VINECROP	Vegetables	8.50
172119	SEED ALFALFA	Alfalfa	4.00
172289	SEED CLOVER UNSPECIFIED	Alfalfa	4.00
173079	SEED BERMUDA GRASS	Alfalfa	4.00
173669	SEED SUDAN GRASS	Alfalfa	4.00
173999	SEED GRASS UNSPECIFIED	Alfalfa	4.00
178999	SEED OTHER (NO FLOWERS)	Alfalfa	4.00

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ARB Assigned Crop Profile and Crop PM_{10} Emission Factor for Land Preparation by CDFA Commodity Code

CDFA Commodity Code	CDFA Crop Name	ARB Crop Profile	LP Emission Factor (lbs PM_{10}/acre/year)
181999	HAY ALFALFA	Alfalfa	4.00
188499	HAY GRAIN	Alfalfa	4.00
188799	HAY WILD	Alfalfa	4.00
188899	HAY SUDAN	Alfalfa	4.00
188999	HAY OTHER UNSPECIFIED	Alfalfa	4.00
194599	PASTURE IRRIGATED	No Land Prep.	0.00
194699	PASTURE RANGE	No Land Prep.	0.00
194799	PASTURE FORAGE MISC.	No Land Prep.	0.00
195199	SILAGE	Wheat	3.70
195299	HAY GREEN CHOP	Alfalfa	4.00
195399	STRAW	Alfalfa	4.00
198199	RICE WILD	Rice	20.00
198999	FIELD CROPS UNSPECIFIED	Corn	6.90
201119	ORANGES NAVEL	Citrus	0.07
201519	ORANGES VALENCIA	Citrus	0.07
201999	ORANGES UNSPECIFIED	Citrus	0.07
202999	GRAPEFRUIT ALL	Citrus	0.07
203999	TANGERINES & MANDARINS	Citrus	0.07
204999	LEMONS ALL	Citrus	0.07
205999	LIMES ALL	Citrus	0.07
206999	TANGELOS	Citrus	0.07
207999	KUMQUATS	Citrus	0.07
208059	CITRUS BY-PRODUCTS MISC.	Citrus	0.07
209999	CITRUS UNSPECIFIED	Citrus	0.07
211999	APPLES ALL	Citrus	0.07
212199	PEACHES FREESTONE	Citrus	0.07
212399	PEACHES CLINGSTONE	Citrus	0.07
212999	PEACHES UNSPECIFIED	Citrus	0.07
213199	CHERRIES SWEET	Citrus	0.07
214199	PEARS BARTLETT	Citrus	0.07
214899	PEARS ASIAN	Citrus	0.07
214999	PEARS UNSPECIFIED	Citrus	0.07
215199	PLUMS	Citrus	0.07
215399	PLUMCOTS	Citrus	0.07
215999	PLUMS DRIED	Citrus	0.07
216199	GRAPES TABLE	Grapes-Table	0.83
216299	GRAPES WINE	Grapes-Wine	1.50
216399	GRAPES RAISIN	Grapes-Raisin	2.60
216999	GRAPES UNSPECIFIED	Grapes-Wine	1.50
217999	APRICOTS ALL	Citrus	0.07
218199	NECTARINES	Citrus	0.07
218299	PERSIMMONS	Citrus	0.07
218499	QUINCE	Citrus	0.07
218399	POMEGRANATES	Citrus	0.07
218839	CHERIMOYAS	Citrus	0.07
218889	BIOMASS ORCHARD	Almonds	3.13
218899	FRUITS & NUTS UNSPECIFIED	Citrus	0.07
221999	AVOCADOS ALL	Citrus	0.07
224999	DATES	Citrus	0.07
225999	FIGS DRIED	Citrus	0.07

Table D
ARB Assigned Crop Profile and Crop PM_{10} Emission Factor for Land Preparation by CDFA Commodity Code

CDFA Commodity Code	CDFA Crop Name	ARB Crop Profile	LP Emission Factor (lbs PM_{10}/acre/year)
226999	OLIVES	Citrus	0.07
228019	GUAVAS	Citrus	0.07
229999	KIWIFRUIT	Citrus	0.07
230639	BERRIES BLACKBERRIES	Grapes-Table	0.83
230869	BERRIES BOYSENBERRIES	Grapes-Table	0.83
234799	BERRIES LOGANBERRIES	Grapes-Table	0.83
236199	BERRIES RASPBERRIES	Grapes-Table	0.83
237199	BERRIES STRAWBERRIES F MKT	Melon	5.70
237299	BERRIES STRAWBERRIES PROC.	Melon	5.70
237999	BERRIES STRAWBERRIES UNSPEC	Melon	5.70
238199	BERRIES BLUEBERRIES	Grapes-Table	0.83
239999	BERRIES BUSHBERRIES UNSPEC.	Grapes-Table	0.83
261999	ALMONDS ALL	Almonds	3.13
263999	WALNUTS ENGLISH	Almonds	3.13
264999	PECANS	Almonds	3.13
265999	WALNUTS BLACK	Almonds	3.13
266999	CHESTNUTS	Almonds	3.13
267999	MACADAMIA NUTS	Almonds	3.13
268079	PISTACHIOS	Almonds	3.13
268099	ALMOND HULLS	Almonds	3.13
301999	ARTICHOKES	Melon	5.70
302199	ASPARAGUS FRESH MARKET	Melon	5.70
302299	ASPARAGUS PROCESSING	Melon	5.70
302999	ASPARAGUS UNSPECIFIED	Melon	5.70
303999	BEANS LIMA GREEN	DryBeans	7.70
304199	BEANS SNAP FRESH MARKET	DryBeans	7.70
304299	BEANS SNAP PROCESSING	DryBeans	7.70
304399	BEANS FRESH UNSPECIFIED	DryBeans	7.70
304999	BEANS SNAP UNSPECIFIED	DryBeans	7.70
305999	BEETS GARDEN	Sugar Beets	22.80
306999	RAPPINI	Sugar Beets	22.80
307189	BROCCOLI FOOD SERVICE	Vegetables	8.50
307199	BROCCOLI FRESH MARKET	Vegetables	8.50
307299	BROCCOLI PROCESSING	Vegetables	8.50
307919	BROCCOLI UNSPECIFIED	Vegetables	8.50
308999	BRUSSELS SPROUTS	Melon	5.70
309999	CABBAGE CH. & SPECIALTY	Lettuce	12.75
310999	CABBAGE HEAD	Lettuce	12.75
313189	CARROTS FOOD SERVICE	Sugar Beets	22.80
313199	CARROTS FRESH MARKET	Sugar Beets	22.80
313299	CARROTS PROCESSING	Sugar Beets	22.80
313999	CARROTS UNSPECIFIED	Sugar Beets	22.80
314189	CAULIFLOWER FOOD SERVICE	Vegetables	8.50
314199	CAULIFLOWER FRESH MARKET	Vegetables	8.50
314299	CAULIFLOWER PROCESSING	Vegetables	8.50
314999	CAULIFLOWER UNSPECIFIED	Vegetables	8.50
316189	CELERY FOOD SERVICE	Lettuce	12.75
316199	CELERY FRESH MARKET	Lettuce	12.75
316299	CELERY PROCESSING	Lettuce	12.75
316999	CELERY UNSPECIFIED	Lettuce	12.75

Table D
ARB Assigned Crop Profile and Crop PM_{10} Emission Factor for Land Preparation by CDFA Commodity Code

CDFA Commodity Code	CDFA Crop Name	ARB Crop Profile	LP Emission Factor (lbs PM_{10}/acre/year)
318999	RADICCHIO	Lettuce	12.75
320999	CHIVES	Lettuce	12.75
322999	COLLARD GREENS	Lettuce	12.75
323999	CORN SWEET ALL	Corn	6.90
325999	CUCUMBERS	Vegetables	8.50
330999	EGGPLANT ALL	Vegetables	8.50
331999	ENDIVE ALL	Lettuce	12.75
332999	ESCAROLE ALL	Lettuce	12.75
333999	ANISE (FENNEL)	Lettuce	12.75
335999	GARLIC ALL	Garlic	6.50
337999	KALE	Lettuce	12.75
338999	KOHLRABI	Lettuce	12.75
339196	LETTUCE BULK SALAD PRODS.	Lettuce	12.75
339999	LETTUCE UNSPECIFIED	Lettuce	12.75
340999	LETTUCE HEAD	Lettuce	12.75
341999	LETTUCE ROMAINE	Lettuce	12.75
342999	LETTUCE LEAF	Lettuce	12.75
343999	MELONS CANTALOUPE	Melon	5.70
348999	MELONS HONEYDEW	Melon	5.70
354299	MELONS UNSPECIFIED	Melon	5.70
354999	MELONS WATERMELON	Melon	5.70
355999	MUSHROOMS	No Land Prep.	0.00
356999	MUSTARD	Lettuce	12.75
357999	OKRA	Lettuce	12.75
358999	ONIONS	Onions	6.50
359999	PARSLEY	Lettuce	12.75
361299	PEAS GREEN PROCESSING	DryBeans	7.70
361999	PEAS GREEN UNSPECIFIED	DryBeans	7.70
363999	PEPPERS BELL	Tomatoes	10.10
364999	PEPPERS CHILI HOT	Tomatoes	10.10
366999	PUMPKINS	Melon	5.70
367999	RADISHES	Sugar Beets	22.80
368999	RHUBARB	Lettuce	12.75
370999	RUTABAGAS	Sugar Beets	22.80
372999	ONIONS GREEN & SHALLOT	Onions	6.50
374189	SPINACH FOOD SERVICE	Lettuce	12.75
374199	SPINACH FRESH MARKET	Lettuce	12.75
374299	SPINACH PROCESSING	Lettuce	12.75
374999	SPINACH UNSPECIFIED	Lettuce	12.75
375999	SQUASH	Melon	5.70
376999	SWISS CHARD	Lettuce	12.75
378199	TOMATOES FRESH MARKET	Tomatoes	10.10
378299	TOMATOES PROCESSING	Tomatoes	10.10
378999	TOMATOES UNSPECIFIED	Tomatoes	10.10
380999	TURNIPS ALL	Sugar Beets	22.80
381999	GREENS TURNIP & MUSTARD	Lettuce	12.75
387999	LEEKS	Onions	6.50
391999	POTATOES IRISH ALL	Sugar Beets	22.80
392999	POTATOES SWEET	Sugar Beets	22.80
393999	HORSERADISH	Onions	6.50

Table D
ARB Assigned Crop Profile and Crop PM_{10} Emission Factor for Land Preparation by CDFA Commodity Code

CDFA Commodity Code	CDFA Crop Name	ARB Crop Profile	LP Emission Factor (lbs PM_{10}/acre/year)
394199	SALAD GREENS NEC.	Lettuce	12.75
394999	PEAS EDIBLE POD (SNOW)	DryBeans	7.70
395999	VEGETABLES ORIENTAL ALL	Vegetables	8.50
396999	SPROUTS ALFALFA & BEAN	Lettuce	12.75
398199	CUCUMBERS GREENHOUSE	No Land Prep.	0.00
398299	TOMATOES GREENHOUSE	No Land Prep.	0.00
398399	TOMATOES CHERRY	Tomatoes	10.10
398499	TOMATILLO	Tomatoes	10.10
398559	CILANTRO	Lettuce	12.75
398599	SPICES AND HERBS	Lettuce	12.75
398899	VEGETABLES BABY	Vegetables	8.50
398999	VEGETABLES UNSPECIFIED	Vegetables	8.50
824999	NURSERY FRT/VINE/NUT N-BEAR	None	
825379	NURSERY PLANTS STRAWBERRY	None	
834999	NURSERY PLANTS VEG. BEDDING	None	
851999	CHRISTMAS TREES & CUT GREENS	None	
861999	NURSERY FLOWER SEEDS	None	
862480	NURSERY BULBS LILY	None	
862999	NURSERY FL BLBS./CRMS./RHZ.	None	
863999	NURSERY FL. PROPG. MTRLS	None	
864663	NURSERY PLANTS ROSE	None	
864999	NURSERY PLANTS BEDDING	None	
866209	FLOWERS MUMS POTTED	None	
866559	NURSERY PLANTS ORCHID	None	
866605	FLOWERS POINSETTIA POTTED	None	
866999	NURSERY PLANTS POT'D UNSP	None	
867055	FLOWERS ASTERS CUT	None	
867170	FLOWERS CARNATION CUT STD.	None	
867171	FLOWERS CARNATION CUT MIN.	None	
867179	FLOWERS CARNATION UNSPEC.	None	
867205	FLOWERS CHRYSNTH. CUT STD.	None	
867206	FLOWERS CHRYSNTH. CUT POM.	None	
867209	FLOWERS CHRYSNTH. UNSPEC.	None	
867360	FLOWERS GARDENIAS CUT	None	
867435	FLOWERS IRISES CUT	None	
867559	FLOWERS ORCHIDS CUT ALL	None	
867663	FLOWERS ROSES CUT STANDARD	None	
867664	FLOWERS ROSES CUT MIN.	None	
867669	FLOWERS ROSES UNSPECIFIED	None	
867899	FLOWERS DECORATIVE DRIED	None	
867999	FLOWERS CUT UNSPECIFIED	None	
868999	FLOWERS FOLIAGE CUT ALL	None	
876130	FLOWERS CACTI SUCCULENTS	None	
879999	FLOWERS FOLIAGE PLANTS	None	
892999	NURSERY TURF	No Land Prep.	0.00
894999	NURSERY HERBAC. PRRNLS	None	
895999	NURSERY WOODY ORNAMNTALS	None	
898999	NURSERY HORT. SPECMN. MISC.	None	
899999	NURSERY PRODUCTS MISC.	None	
933179	FOREST PRODUCTS FIREWOOD	None	

Adjustments for Rice in the Sacramento Valley Air Basin. Over 97% of California's rice is grown in the Sacramento Valley Air Basin [NASS]. Based on wetter average soil conditions documented for the Sacramento Valley Air Basin compared to the average soil moisture measured in the San Joaquin Valley, the operations specific emission factor for land planing (12.5 lbs PM_{10}/acre-pass) was reduced to 1.1 lbs PM_{10}/acre-pass [Spencer, 2012]. This change resulted in a reduced rice land preparation emission factor of 6.32 lbs PM_{10}/acre/year, compared to the previous statewide value (20.0 lbs PM_{10}/acre/year).

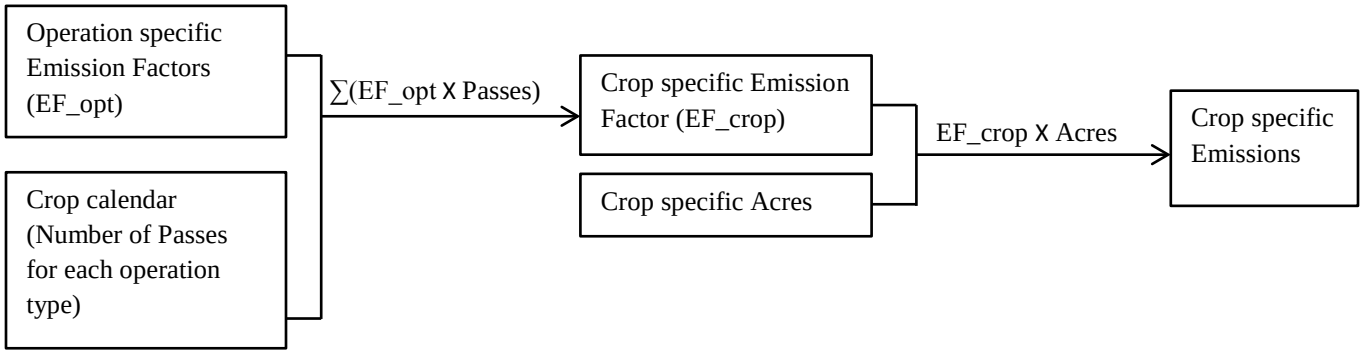
Estimating PM_{10} Emissions. For each crop, land preparation emissions (lbs PM_{10}/year) are calculated by multiplying the crop specific emission factor by the associated harvested acreage:

PM_{10} $Emissions_{crop}$ = PM_{10} Emission $Factor_{crop}$ X Acres

Total PM_{10} emissions for each COABDIS unit are calculated as the sum of all crop PM_{10} emissions within the COABDIS unit.

Figure 1 provides a summary of ARB's PM_{10} emissions estimates process.

Figure 1
Estimating PM_{10} emissions from agricultural land preparation operations



Estimating Total PM and $PM_{2.5}$ Emissions. Total PM and $PM_{2.5}$ are derived from calculated PM_{10} 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) to the coarse PM (>2.5 microns) category. Compared to the previous profile, the updated particle size profile reduces the $PM_{2.5}/PM_{10}$ 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 PM_{10} emissions by their size fraction: Total PM = PM_{10}/0.4543

$PM_{2.5}$ emissions are calculated by multiplying total PM emissions by the $PM_{2.5}$ particle size fraction: $PM_{2.5}$ = (PM_{10}/0.4543) x 0.0681

Table 1 presents PM_{10}, $PM_{2.5}$ and total PM emissions from agricultural land preparation 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 unit, along with associated harvested crop acreage and the number of annual acre-passes.

TEMPORAL ACTIVITY

Monthly temporal activity profiles allocate emissions based on crop specific profiles that reflect the percentage of land preparation activities occurring each month. Temporal activity for each county is derived by summing the monthly 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.

Activity by Crop. Each crop profile indicates the percentage of annual land preparation operations that take place each month. Table 3 provides activity profiles for all statewide crop profiles and for the rice crop profile developed for the Sacramento Valley Air Basin to reflect the timing of rice land preparations in the region.

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

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 by COABDIS 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. For all regions, growth is projected through 2020.

ASSUMPTIONS AND LIMITATIONS

1. The land preparation emission factors for each operation (discing, land planing, etc.) are assumed to produce the same level of emissions statewide, regardless of crop or soil type.
2. Except where more specific information is available, the land preparation emission factors do not change geographically for counties. For this update, more specific information was available for rice land planing activities in the Sacramento Valley Air Basin and the emission factor was adjusted accordingly.
3. A limited number of emission factors are assigned to all land preparation activities.
4. Crop calendar data collected for San Joaquin Valley crops and practices were used to develop crop profiles, which were then 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. The crop profile for rice was adjusted for the Sacramento Valley Air Basin to reflect the timing of land preparation activities.
5. In addition to the activities provided in the crop calendars, it is also assumed that field and row crop acreage receives a land planing pass once every five years.
6. Testing of agricultural soils and ambient air in the San Joaquin Valley is assumed to accurately represent the particle size distribution of PM statewide.
7. UCD directly measured PM_{10} emissions. 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 to the land preparation 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). Statewide, acreage for this update decreased by 1% from 2000.
- An updated particle size fraction is used for ARB speciation profile #417. The updated profile reduces the fraction that $PM_{2.5}$ contributes to PM10 from 22.2% to 15% and reduces the contribution of $PM_{2.5}$ to total PM from 1.0% to 0.068%.
- $PM_{2.5}$ emissions are reported for the first time.

- The statewide rice land preparation emission factor was adjusted for the Sacramento Valley Air Basin to reflect the reduced emissions associated with wetter soil conditions during land planing operations compared to San Joaquin Valley conditions.
- New county specific temporal profiles were developed based on 2005 (non- SJV Air Basin) and 2007 (SJV Air Basin) land preparation emissions and crop specific activity profiles.
- New growth surrogates were adopted based on linear regressions of harvested acreage for 2000-2009.

These changes produced emissions reductions of about 16% compared to the 2000 inventory, with reductions primarily related to changes in the statewide crop mix [Gaffney, 2003].

COMMENTS AND RECOMMENDATIONS

Emissions Testing. As available and appropriate, new emissions testing data for land preparation operations can be incorporated into future updates.

Crop Calendars. As feasible, future updates could include county specific crop calendars and acre-pass information rather than basing statewide emissions estimates solely on San Joaquin Valley practices.

Speciation Profiles. Currently, ARB uses San Joaquin Valley test data as a statewide default. As available and appropriate, future updates could include regional or county-specific particle size speciation profiles.

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

GIS-Based Data. As more refined GIS-based data are available, gridded estimates of crop specific acreage may be developed. These data could supplement California County Agricultural Commissioner harvested acreage data by indicating how the spatial distribution of crops, and thus associated emissions, changes over time.

SAMPLE CALCULATIONS

The following steps, along with information in Table E, below, summarize the data computations necessary to estimate 2007 PM_{10} emissions from agricultural land preparation in Fresno County:

Step 1: Insert Crop Acreage. The acres harvested for 2007 for selected crops in Fresno County are shown in the 'Acres' column of the table.

Step 2: Insert PM_{10} Emission Factor for Crop. Enter the appropriate emission factor from Table 4. (The emission factors are based on the crop profiles in Table C.)

Step 3: Compute Crop Specific PM_{10} Emissions. Multiply the annual harvested acreage for each crop by the associated PM_{10} emission factor and divide by 2000 lbs/ton to calculate PM_{10} emissions (tons/year).

tons/year PM_{10} emissions = (Acres x PM_{10} Emission Factor)/2000

Step 4: Compute Total COABDIS unit PM_{10} Emissions (tons/year). Sum all crop PM_{10} emissions for each COABDIS unit to compute total agricultural tilling PM_{10} emissions.

Step 5: Compute TSP emissions. Divide PM_{10} emissions by the particle size fraction for <PM_{10} given in ARB speciation profile #417.[5]

tons/year TSP emissions = PM_{10}/0.4543

Step 6 Compute $PM_{2.5}$. Multiply TSP emissions by the particle size fraction for < $PM_{2.5}$ given in ARB speciation profile #417.[5,8]

tons/year $PM_{2.5}$ emissions = (PM_{10}/0.4543) x 0.0681

Table E
Estimating 2007 agricultural land preparation PM emissions
for selected crops in Fresno County

Crop	Crop Profile	Acres[1]	Emission Factor[2] (lbs PM_{10}/acre)	Tons/year PM_{10}	Tons/year TSP	Tons/year $PM_{2.5}$
Cherries, Sweet	Citrus	3,452.47	0.07	0.12	0.27	0.02
Cotton Lint, Pima	Cotton	126,256.52	8.90	561.84	1236.72	84.22
Lettuce, Head	Lettuce	21,834.80	12.75	139.20	306.40	20.87
Tomatoes, Processing	Tomatoes	160,550.00	10.10	810.78	1784.67	121.54
Wheat, All	Wheat	102,373.74	3.70	189.39	416.89	28.39
Etc. (for each crop)						
Fresno County Totals		1,380,839		3,732.15	8,215.17	559.45

1 Fresno County 2007 acreage provided in https://www.arb.ca.gov/ei/areasrc/fullpdf/2007sjv_acreage.pdf

2 Crop emission factors provided in Table 4

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Table 1
2005 Agricultural Land Preparation Emissions

Year	Air Basin	County	Air District	2005 Harvested Acres	Annual Acre-Passes	Emissions, tons/year		
						PM10	PM2.5	Total PM
2005	GBV	Alpine	GBU	7.00	10.15	0.01	0.00	0.03
2005	GBV	Inyo	GBU	4,830.00	6,961.80	9.60	1.44	21.13
2005	GBV	Mono	GBU	11,956.00	17,765.20	24.11	3.61	53.06
2005	LC	Lake	LAK	16,426.00	23,803.64	22.54	3.38	49.62
2005	LT	El Dorado	ED	322.47	221.50	0.22	0.03	0.47
2005	LT	Placer	PLA	1,073.05	4,592.89	7.74	1.16	17.03
2005	MC	Amador	AMA	6,038.00	6,801.99	7.14	1.07	15.72
2005	MC	Calaveras	CAL	1,750.00	1,524.10	2.32	0.35	5.12
2005	MC	El Dorado	ED	3,260.53	2,239.62	2.17	0.33	4.79
2005	MC	Mariposa	MPA	981.00	3,268.78	2.68	0.40	5.89
2005	MC	Nevada	NSI	350.00	355.95	0.26	0.04	0.58
2005	MC	Placer	PLA	13,949.65	59,707.57	100.58	15.08	221.39
2005	MC	Plumas	NSI	10,000.00	14,500.00	20.00	3.00	44.02
2005	MC	Sierra	NSI	3,500.00	5,075.00	7.00	1.05	15.41
2005	MC	Tuolumne	TUO	600.00	870.00	1.20	0.18	2.64
2005	MD	Kern	KER	17,406.02	38,145.45	43.48	6.52	95.70
2005	MD	Los Angeles	AV	9,535.36	28,777.07	26.64	3.99	58.63
2005	MD	Riverside	MOJ	31,823.83	69,402.80	76.92	11.53	169.31
2005	MD	Riverside	SC	46,799.75	102,062.95	113.12	16.96	248.99
2005	MD	San Bernardino	MOJ	27,628.48	62,635.86	69.25	10.38	152.43
2005	NC	Del Norte	NCU	1,950.00	2,827.50	3.90	0.58	8.58
2005	NC	Humboldt	NCU	3,000.00	4,087.50	5.84	0.88	12.86
2005	NC	Mendocino	MEN	18,743.00	16,516.97	12.18	1.83	26.81
2005	NC	Sonoma	NS	48,291.56	50,898.76	44.42	6.66	97.79
2005	NC	Trinity	NCU	564.00	768.44	0.99	0.15	2.17
2005	NCC	Monterey	MBU	331,025.00	1,363,742.13	1,544.87	231.58	3,400.55
2005	NCC	San Benito	MBU	56,414.00	186,511.37	215.25	32.27	473.80
2005	NCC	Santa Cruz	MBU	20,146.00	62,021.76	66.90	10.03	147.25
2005	NEP	Lassen	LAS	67,605.00	98,014.75	135.20	20.27	297.61
2005	NEP	Modoc	MOD	89,248.00	163,788.35	229.34	34.38	504.81
2005	NEP	Siskiyou	SIS	97,644.00	146,184.55	210.01	31.48	462.28
2005	SC	Los Angeles	SC	10,752.64	32,450.74	30.04	4.50	66.12
2005	SC	Orange	SC	6,817.00	20,846.06	16.35	2.45	35.99
2005	SC	Riverside	SC	52,415.72	114,310.50	126.69	18.99	278.87
2005	SC	San Bernardino	SC	1,763.52	3,998.03	4.42	0.66	9.73
2005	SCC	San Luis Obispo	SLO	111,623.00	273,329.95	274.16	41.10	603.49
2005	SCC	Santa Barbara	SB	123,654.00	449,700.43	427.51	64.08	941.04
2005	SCC	Ventura	VEN	90,861.00	200,117.57	212.87	31.91	468.56
2005	SD	San Diego	SD	53,458.00	49,792.87	46.96	7.04	103.37

Table 1

2005 Agricultural Land Preparation Emissions

Year	Air Basin	County	Air District	2005 Harvested Acres	Annual Acre-Passes	Emissions, tons/year		
						PM10	PM2.5	Total PM
2005	SF	Alameda	BA	7,742.00	10,286.72	12.78	1.92	28.12
2005	SF	Contra Costa	BA	25,940.00	79,242.25	70.31	10.54	154.77
2005	SF	Marin	BA	5,827.00	8,667.39	11.68	1.75	25.71
2005	SF	Napa	BA	42,385.00	42,924.15	32.01	4.80	70.47
2005	SF	San Francisco	BA	0	0	0	0	0
2005	SF	San Mateo	BA	3,447.00	11,743.85	10.31	1.55	22.69
2005	SF	Santa Clara	BA	21,522.00	81,799.98	79.40	11.90	174.78
2005	SF	Solano	BA	53,404.82	121,503.75	127.45	19.10	280.54
2005	SF	Sonoma	BA	22,725.44	23,952.36	20.91	3.13	46.02
2005	SS	Imperial	IMP	524,679.00	1,337,711.06	1,768.14	265.05	3,892.02
2005	SS	Riverside	SC	56,159.70	122,475.54	135.74	20.35	298.79
2005	SV	Butte	BUT	194,893.00	633,414.98	575.97	86.34	1,267.82
2005	SV	Colusa	COL	256,544.00	1,164,691.30	941.02	141.06	2,071.36
2005	SV	Glenn	GLE	212,733.00	759,080.02	661.39	99.14	1,455.84
2005	SV	Placer	PLA	6,438.30	27,557.34	21.63	3.24	47.60
2005	SV	Sacramento	SAC	131,189.00	343,405.01	304.80	45.69	670.91
2005	SV	Shasta	SHA	29,305.00	60,519.16	67.97	10.19	149.61
2005	SV	Solano	YS	87,134.18	198,242.97	207.94	31.17	457.72
2005	SV	Sutter	FR	224,428.00	819,370.89	682.38	102.29	1,502.04
2005	SV	Tehama	TEH	52,936.00	38,577.98	72.92	10.93	160.50
2005	SV	Yolo	YS	301,242.00	1,047,638.97	918.37	137.66	2,021.50
2005	SV	Yuba	FR	72,694.00	225,972.14	187.74	28.14	413.24

Table 2

2007 Agricultural Land Preparation Emissions

Year	Air Basin	County	Air District	2005 Harvested Acres	Annual Acre-Passes	Emissions, tons/year		
						PM10	PM2.5	Total PM
2007	SJV	Fresno	SJU	1,380,839.17	4,257,973.54	3,732.15	559.45	8,215.17
2007	SJV	Kern	SJU	950,705.13	1,592,135.92	2,015.83	302.18	4,437.23
2007	SJV	Kings	SJU	579,771.60	1,884,406.08	1,680.55	251.92	3,699.21
2007	SJV	Madera	SJU	364,080.25	524,913.35	616.30	92.38	1,356.60
2007	SJV	Merced	SJU	591,529.49	1,554,267.94	1,683.18	252.31	3,705.00
2007	SJV	San Joaquin	SJU	617,864.25	1,608,777.44	1,556.51	233.32	3,426.17
2007	SJV	Stanislaus	SJU	397,908.34	750,441.18	908.33	136.16	1,999.40
2007	SJV	Tulare	SJU	866,209.89	1,522,154.57	1,566.45	234.81	3,448.05

Table 3

Agricultural Land Preparation PM Emissions Seasonal Profile 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	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.302	0.302	0.302
Almonds	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.500
Citrus	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.333	0.333	0.333
Corn	0.174	0.000	0.290	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.268	0.268
Cotton	0.000	0.090	0.090	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.410	0.410
DryBeans	0.000	0.338	0.338	0.000	0.000	0.000	0.000	0.000	0.000	0.162	0.162	0.000
Garbanzo	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.333	0.333	0.333	0.000
Garlic	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.250	0.250	0.250	0.000
Grapes-Raisin	0.000	0.000	0.000	0.020	0.111	0.111	0.090	0.398	0.090	0.179	0.000	0.000
Grapes-Table	0.000	0.000	0.000	0.361	0.000	0.000	0.000	0.000	0.000	0.277	0.361	0.000
Grapes-Wine	0.000	0.000	0.000	0.035	0.159	0.159	0.123	0.123	0.123	0.276	0.000	0.000
Lettuce	0.000	0.000	0.000	0.000	0.000	0.000	0.467	0.000	0.000	0.467	0.065	0.000
Melon	0.000	0.140	0.140	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.360	0.360
Onions	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.200	0.200	0.200	0.200	0.200
Rice, Statewide	0.000	0.000	0.082	0.444	0.444	0.000	0.000	0.000	0.000	0.010	0.010	0.010
Rice, Sacramento Valley Air Basin	0.000	0.000	0.030	0.100	0.800	0.040	0.000	0.000	0.000	0.010	0.010	0.010
Safflower	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.500
Sugar Beets	0.074	0.074	0.074	0.074	0.074	0.074	0.092	0.092	0.092	0.092	0.092	0.092
Tomatoes	0.079	0.079	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.281	0.281	0.281
Vegetables	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.157	0.157	0.157
Wheat	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.500

Table 4

Agricultural Land Preparation PM_{10} Emissions Temporal Profile by COABDIS

(% of annual emissions by month, 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	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.302	0.302	0.302
2005	GBV	Inyo	GBU	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.302	0.302	0.302
2005	GBV	Mono	GBU	0.092	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.005	0.301	0.301	0.296
2005	LC	Lake	LAK	0.097	0.000	0.161	0.009	0.040	0.040	0.031	0.031	0.031	0.071	0.244	0.244
2005	LT	El Dorado	ED	0.021	0.000	0.000	0.021	0.095	0.095	0.074	0.074	0.074	0.240	0.153	0.153
2005	LT	Placer	PLA	0.007	0.000	0.084	0.416	0.416	0.000	0.000	0.000	0.000	0.019	0.028	0.028
2005	MC	Amador	AMA	0.051	0.000	0.011	0.014	0.065	0.065	0.050	0.050	0.050	0.254	0.195	0.195
2005	MC	Calaveras	CAL	0.049	0.000	0.043	0.006	0.026	0.026	0.020	0.020	0.020	0.121	0.335	0.335
2005	MC	El Dorado	ED	0.021	0.000	0.000	0.021	0.095	0.095	0.074	0.074	0.074	0.240	0.153	0.153
2005	MC	Mariposa	MPA	0.169	0.000	0.282	0.001	0.004	0.004	0.003	0.003	0.003	0.007	0.262	0.262
2005	MC	Nevada	NSI	0.000	0.000	0.000	0.035	0.159	0.159	0.123	0.123	0.123	0.276	0.000	0.000
2005	MC	Placer	PLA	0.007	0.000	0.084	0.416	0.416	0.000	0.000	0.000	0.000	0.019	0.028	0.028
2005	MC	Plumas	NSI	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.302	0.302	0.302
2005	MC	Sierra	NSI	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.302	0.302	0.302
2005	MC	Tuolumne	TUO	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.302	0.302	0.302
2005	MD	Kern	KER	0.035	0.044	0.045	0.019	0.019	0.019	0.022	0.024	0.023	0.095	0.330	0.326
2005	MD	Los Angeles	AV	0.068	0.027	0.051	0.026	0.027	0.027	0.035	0.057	0.057	0.198	0.214	0.213
2005	MD	Riverside	MOJ	0.051	0.040	0.045	0.018	0.016	0.016	0.066	0.019	0.019	0.180	0.271	0.261
2005	MD	Riverside	SC	0.051	0.040	0.045	0.018	0.016	0.016	0.066	0.019	0.019	0.180	0.271	0.261
2005	MD	San Bernardino	MOJ	0.086	0.007	0.081	0.006	0.006	0.006	0.111	0.006	0.006	0.237	0.232	0.217
2005	NC	Del Norte	NCU	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.302	0.302	0.302
2005	NC	Humboldt	NCU	0.063	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.202	0.368	0.368
2005	NC	Mendocino	MEN	0.000	0.000	0.000	0.035	0.158	0.158	0.122	0.122	0.122	0.277	0.003	0.003
2005	NC	Sonoma	NS	0.020	0.001	0.007	0.024	0.105	0.105	0.082	0.082	0.082	0.234	0.128	0.128
2005	NC	Trinity	NCU	0.086	0.000	0.000	0.003	0.014	0.014	0.011	0.011	0.011	0.300	0.276	0.276
2005	NCC	Monterey	MBU	0.021	0.028	0.031	0.019	0.021	0.021	0.300	0.023	0.023	0.333	0.112	0.070
2005	NCC	San Benito	MBU	0.031	0.015	0.017	0.008	0.010	0.010	0.271	0.015	0.015	0.349	0.148	0.112
2005	NCC	Santa Cruz	MBU	0.013	0.039	0.039	0.019	0.013	0.013	0.279	0.013	0.013	0.307	0.148	0.104
2005	NEP	Lassen	LAS	0.090	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.289	0.309	0.309
2005	NEP	Modoc	MOD	0.075	0.020	0.020	0.020	0.020	0.020	0.024	0.030	0.030	0.214	0.262	0.262
2005	NEP	Siskiyou	SIS	0.067	0.007	0.007	0.007	0.007	0.007	0.009	0.014	0.014	0.206	0.327	0.327
2005	SC	Los Angeles	SC	0.068	0.027	0.051	0.026	0.027	0.027	0.035	0.057	0.057	0.198	0.214	0.213
2005	SC	Orange	SC	0.015	0.220	0.212	0.006	0.006	0.006	0.013	0.006	0.006	0.135	0.227	0.146
2005	SC	Riverside	SC	0.051	0.040	0.045	0.018	0.016	0.016	0.066	0.019	0.019	0.180	0.271	0.261
2005	SC	San Bernardino	SC	0.086	0.007	0.081	0.006	0.006	0.006	0.111	0.006	0.006	0.237	0.232	0.217
2005	SCC	San Luis Obispo	SLO	0.040	0.026	0.040	0.024	0.035	0.035	0.154	0.032	0.032	0.237	0.182	0.163
2005	SCC	Santa Barbara	SB	0.032	0.053	0.055	0.030	0.034	0.034	0.191	0.033	0.033	0.262	0.137	0.106
2005	SCC	Ventura	VEN	0.019	0.049	0.050	0.008	0.007	0.007	0.269	0.010	0.010	0.313	0.151	0.107
2005	SD	San Diego	SD	0.050	0.067	0.051	0.020	0.020	0.020	0.069	0.022	0.022	0.201	0.236	0.222

Table 4

Agricultural Land Preparation PM_{10} Emissions Temporal Profile by COABDIS

(% of annual emissions by month, 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	0.082	0.000	0.000	0.005	0.020	0.020	0.016	0.016	0.016	0.299	0.264	0.264
2005	SF	Contra Costa	BA	0.123	0.018	0.174	0.006	0.009	0.009	0.008	0.008	0.008	0.089	0.275	0.272
2005	SF	Marin	BA	0.061	0.004	0.004	0.005	0.005	0.005	0.005	0.005	0.005	0.195	0.352	0.352
2005	SF	Napa	BA	0.001	0.000	0.000	0.035	0.156	0.156	0.121	0.121	0.121	0.275	0.006	0.006
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	0.031	0.115	0.115	0.021	0.021	0.021	0.021	0.030	0.030	0.127	0.247	0.220
2005	SF	Santa Clara	BA	0.044	0.044	0.048	0.012	0.014	0.014	0.190	0.018	0.018	0.299	0.167	0.133
2005	SF	Solano	BA	0.077	0.029	0.068	0.002	0.004	0.004	0.003	0.003	0.003	0.159	0.327	0.320
2005	SF	Sonoma	BA	0.020	0.001	0.007	0.024	0.105	0.105	0.082	0.082	0.082	0.234	0.128	0.128
2007	SJV	Fresno	SJU	0.043	0.049	0.053	0.010	0.017	0.013	0.040	0.039	0.022	0.149	0.287	0.276
2007	SJV	Kern	SJU	0.032	0.033	0.034	0.011	0.011	0.011	0.015	0.018	0.016	0.099	0.363	0.357
2007	SJV	Kings	SJU	0.055	0.043	0.093	0.001	0.002	0.002	0.001	0.003	0.002	0.069	0.365	0.364
2007	SJV	Madera	SJU	0.057	0.010	0.069	0.006	0.020	0.020	0.016	0.034	0.016	0.098	0.329	0.327
2007	SJV	Merced	SJU	0.072	0.035	0.097	0.017	0.018	0.009	0.011	0.011	0.011	0.092	0.314	0.312
2007	SJV	San Joaquin	SJU	0.098	0.026	0.137	0.019	0.024	0.009	0.008	0.009	0.009	0.100	0.282	0.278
2007	SJV	Stanislaus	SJU	0.067	0.031	0.095	0.010	0.011	0.004	0.017	0.004	0.004	0.105	0.332	0.320
2007	SJV	Tulare	SJU	0.088	0.013	0.135	0.004	0.003	0.003	0.002	0.005	0.002	0.060	0.346	0.339
2005	SS	Imperial	IMP	0.067	0.031	0.049	0.023	0.023	0.023	0.092	0.032	0.032	0.206	0.215	0.206
2005	SS	Riverside	SC	0.051	0.040	0.045	0.018	0.016	0.016	0.066	0.019	0.019	0.180	0.271	0.261
2005	SV	Butte	BUT	0.008	0.005	0.039	0.075	0.597	0.030	0.000	0.000	0.000	0.013	0.118	0.116
2005	SV	Colusa	COL	0.017	0.023	0.036	0.069	0.528	0.029	0.003	0.003	0.003	0.062	0.115	0.111
2005	SV	Glenn	GLE	0.037	0.009	0.079	0.060	0.477	0.025	0.001	0.001	0.001	0.026	0.144	0.141
2005	SV	Placer	PLA	0.016	0.000	0.042	0.087	0.692	0.035	0.000	0.000	0.000	0.029	0.049	0.049
2005	SV	Sacramento	SAC	0.091	0.010	0.130	0.018	0.119	0.019	0.011	0.011	0.011	0.084	0.248	0.248
2005	SV	Shasta	SHA	0.065	0.000	0.010	0.029	0.233	0.012	0.000	0.000	0.000	0.209	0.221	0.221
2005	SV	Solano	YS	0.077	0.029	0.068	0.002	0.004	0.004	0.003	0.003	0.003	0.159	0.327	0.320
2005	SV	Sutter	FR	0.017	0.022	0.055	0.068	0.535	0.028	0.001	0.001	0.001	0.039	0.122	0.114
2005	SV	Tehama	TEH	0.044	0.000	0.032	0.005	0.038	0.002	0.000	0.000	0.000	0.087	0.395	0.395
2005	SV	Yolo	YS	0.084	0.022	0.093	0.019	0.133	0.010	0.003	0.003	0.003	0.113	0.259	0.259
2005	SV	Yuba	FR	0.017	0.000	0.049	0.080	0.641	0.032	0.000	0.000	0.000	0.015	0.082	0.082