

# **SACRAMENTO VALLEY AIR BASIN 2016 SMOKE MANAGEMENT PROGRAM**

Prepared by

**The Sacramento Valley Basinwide Air Pollution Control Council  
and Technical Advisory Committee**

**Sacramento Valley Basinwide Air Pollution Control Council**

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**California Air Resources Board**

Approved: \_\_\_\_\_

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## **1. AUTHORITY AND APPLICABILITY**

The Sacramento Valley Air Basin (SVAB) Smoke Management Program (Program) was prepared by the Technical Advisory Committee and the Basin Control Council of the SVAB pursuant to Section 41863 of the California Health and Safety Code (HSC) and Section 80140(a) of Subchapter 2, Smoke Management Guidelines for Agricultural and Prescribed Burning of Title 17 of the California Code of Regulations (CCR). The Program officially took effect on October 30, 2001. Air district staff coordinated with the Air Resources Board, fire protection agencies, land managers with jurisdiction in the SVAB, other affected parties, and the public in its development. In accordance with the CCR, Title 17, Section 80140(c), the smoke management program of the SVAB is designated as a regional smoke management program. The Air Resources Board has the sole authority to approve the Program (80140(e-i)); pursuant to Section 80140 (k and l), any amendments to the program must be submitted to the Air Resources Board for approval within 30 days after adoption by the Basin Control Council and may require modifications as necessary.

The Program applies to all agricultural burning that is conducted at all elevations in the SVAB, as defined by Section 80101(a) of Title 17 of the CCR. Policies and procedures apply throughout the year unless otherwise specified in the Program. Some requirements apply only during the fall burning season.

## **2. PROGRAM GOALS**

The Program goals are the following:

- Protection of air quality in the Sacramento Valley;
- Protection of public health and safety; and,
- Effective management of daily agricultural burning operations.

## **3. PROGRAM PARTICIPANTS**

Program participants include:

- The Sacramento Valley Basinwide Air Pollution Control Council (BCC);
- The SVAB Technical Advisory Committee (TAC);
- The SVAB air districts (districts), agricultural departments and fire agencies;
- Air Resources Board Meteorology Section and other responsible sections;
- Smoke Management Program Coordinator (SMPC), under contract with the BCC; and,
- Meteorological services consultant under contract with the BCC.

## **4. PROGRAM EQUATIONS**

### **4A. Air Resources Board Allocation Equation**

#### **Standard Allocation Equation**

The standard ARB acreage allocation equation is used throughout the year. The equation calculates a “theoretical maximum acreage allocation” for the day.

The following “theoretical maximum acreage allocation” equation may be altered in the future as recommended by the TAC and the ARB.

$$\text{Allocation} = (-1/0.006) * (-170 + (1 * \text{Amstab}) + (0.2049159 * 500mb12) - (0.3579679 * \text{WS}) + (1 * \text{PM}_{2.5} \text{ 0-6}))$$

*Amstab* = morning temperature difference between 3,000 feet above mean sea level (msl) and the surface

*500mb12* = 500 millibar heights at 4:00 a.m. from National Weather Service models

*WS* = average wind speed forecasted by the ARB through the mixing layer

*PM<sub>2.5</sub> 0- 6* = Particulate Matter (PM<sub>2.5</sub>) basinwide average from 12:00 a.m. to 6:00 a.m.

#### **Spring increase to standard allocation equation**

During the months of March, April and if needed, May, the acreage allocations may be increased due to improved atmospheric dispersion by a factor of 1.5.

#### Determining burn day status above 3,000 feet

The burn day status for above 3,000 feet msl is determined by 500 millibar (mb) pressure elevations as outlined in Title 17 Section 80250 – SVAB. The 500 mb charts show large scale regional features (atmospheric pressure at 18,300 feet msl) that can be used to identify subsidence and stagnation which causes poor dispersion. The SVAB uses one decameter higher (other values may be selected) than the decision point for burning above 3,000 feet msl. In place of the standard 3,000 feet msl, the elevation may be specified in increments of 500 feet on a day-by-day basis as determined from vertical temperature soundings.

#### 4B. Fall Burn Season Acreage Distribution Equation

During the intensive fall burn season (September 15<sup>th</sup> – November 30<sup>th</sup>), the SMPC distributes acreage to the districts using the distribution equation described below. The distribution equation does not apply to Shasta and Tehama counties. Those counties will receive 200 acres per day unless they request additional acres from the SMPC. If there are elevated morning PM<sub>2.5</sub> values those counties will receive fewer acres or no acres if a no-burn day is declared.

The distribution equation is: County Acreage Allocation = CP \* BA

The equation variables are:

VARIABLE	VALUE OF VARIABLE
Basin Allocation (BA)	BA from initial ARB allocation
County Proportion (CP)	CW / sum of all CW
County Weighting Factor (CW)	AQ * VR *(CF/BF+CR/BR+BS/CS)
Air Quality Factor (AQ)	0-1
Ventilation Rating Factor (VR)	1-5
County Fall Total Acres (CF)	Total burned to date
Basin Fall Total Acres (BF)	Sum of all CF
County Ready Acres (CR)	As reported by each county
Basin Ready Acres (BR)	Sum of all CR
County Success Ratio (CS)	0-1
Basin Success Ratio (BS)	0-1

#### 4C. Spring, Summer and Winter Acreage Distribution System

During those times outside of the intensive fall burn season, the ARB will distribute the allocated acreage directly to the counties based upon the distribution system detailed in the following table. The percentages or minimums in the following table represent each county's total acreage distribution for burning acreage during the winter, spring, and summer seasons. The primary crop residues burned during these seasons are from rice, wheat, corn, safflower, and orchards.

Notwithstanding these percentages, the ARB may adjust the distribution based upon current burning, meteorological, and air quality factors.

<b>SPRING, SUMMER AND WINTER ACREAGE DISTRIBUTION SYSTEM</b>	
<b>COUNTY</b>	<b>ACREAGE DISTRIBUTION</b>
Butte	17 %
Colusa	17 %
Glenn	13 %
Placer	5 %
Sacramento	9 %
Shasta	200 acres
Sutter	17 %
Tehama	200 acres
Yolo/Solano	15 %
Yuba	7 %

## 5. EQUATION FACTORS

### 5A. Air Quality Reduction Factors

Local air quality problems are determined on the basis of the average midnight to 6:00 a.m. PM<sub>2.5</sub> readings for one or more stations in or near each district. The air quality (AQ) reduction factors (0-1) are used in the ARB allocation page.

The following table lists the PM<sub>2.5</sub> air monitoring station(s) associated with each county or district for the purpose of calculating the air quality reduction factor.

<b>Corresponding PM<sub>2.5</sub> Monitoring Station(s) for Air Quality Reduction Factors</b>	
<b>COUNTY</b>	<b>MONITORING STATIONS</b>
Butte	Average of Chico and Gridley
Colusa	Colusa
Glenn	Willows
Placer	Roseville
Sacramento	Higher of T Street or Del Paso Manor
Shasta	Anderson
Sutter	Yuba City
Tehama	Red Bluff
Yolo-Solano	Average of Davis and Woodland
Yuba	Yuba City

When any district's midnight to 6:00 a.m. average PM<sub>2.5</sub> is equal to or is greater than 27 micrograms per cubic meter (ug/m<sup>3</sup>) there is a decrease in the acres allocated to that county. Higher concentrations will result in greater reductions in allocated acres (e.g., 27-28 ug/m<sup>3</sup> is reduced 20%, 29-30 ug/m<sup>3</sup> is 40%, 31-32 ug/m<sup>3</sup> is 60% and 33-34

$\text{ug/m}^3$  is 80%). When any district's 12:00 a.m. to 6:00 a.m. average  $\text{PM}_{2.5}$  is equal to or greater than 35  $\text{ug/m}^3$ , a no burn day will be declared in that district.

## 5B. Ventilation Rating Factor

The ventilation rating factor is provided by the meteorological services consultant and is the average of the total of the ventilation factor for each burning management zone in each district (e.g. Glenn has five zones and thus five ventilation zone factors). The factors are a composite number based upon available meteorological data and have been assigned values, from one to five, and the corresponding qualitative judgments by the meteorological services consultant:

1. Considerable impact in the region regardless of the placement of fires;
2. Considerable impact in the region if caution is not used in the placement of fires;
3. Some impact in the region but the impact is acceptable;
4. Minor localized impact within the region; and,
5. Minimal or no impact in the region.

The ventilation rating is a subjective number produced by professional meteorologists trained specifically in smoke management practices. The meteorologist takes into account surface and upper level wind strength and direction, atmospheric stability, field moisture, major roadways, urban areas, and approaching frontal systems. Prior to assigning the rating for specific regions, the duty meteorologist reviews all relevant weather information that may have an impact on the movement and dispersion of smoke from burning agricultural field waste. The meteorologist reviews satellite and radar images and surface and upper air prognostic charts to gain a complete understanding of the current and future weather pattern within the SVAB during the burning period (generally 11:00 a.m. to 3:00 p.m.). After reviewing all relevant documents and preparing the forecast, the final task prior to disseminating the information is to assign the rating for each designated region.

## 5C. Success Ratio Factor

The Success Ratio for each county is derived from basin totals divided by county totals for ready acres and the historical planted acreage of rice, corn, wheat and safflower recorded in the year 2000.

Acreage Information, Year 2000					
District/County	100% rice	50% corn	100% wheat	100% safflower	County Totals
Butte	98,000	7,106	2,500	600	108,206
Colusa	147,270	3,660	18,900	11,600	181,430
Glenn	87,383	16,285	17,127	1,195	121,990
Placer	15,799	653	441	32	16,925
Sacramento	7,606	37,225	15,018	7,349	67,198
Sutter	118,157	6,992	9,500	16,078	150,727
Yolo/Sol	36,229	50,839	79,195	31,845	198,108
Yuba	36,620	1,053	538	210	38,421
Shasta	2,677	0	500	0	3,177
Tehama	1,000	1,300	2,000	250	4,550
Basin Totals	550,741	125,113	145,719	69,159	890,732

Success Ratio =

IF ((Basin ready/Basin 00 subtotal) / (county ready/county total)) > 2 , 2 ((Basin ready/Basin 00 subtotal) / (county ready/county total)))

## **6. DEFINITIONS OF BASINWIDE METEOROLOGICAL AND AIR QUALITY FACTORS**

The basinwide meteorological factor (BMF) is determined using Tables 4 and 5 of Section 80320, of the CCR. These tables reflect average basinwide morning ("AM") stability, and wind speed respectively. The average AM stability number comes from morning aircraft flights and temperature reports in the north (Red Bluff or Chico) and south (Sacramento) portion of the SVAB along with surface temperature observations. The north and south numbers are averaged together to determine the basinwide AM stability or the temperature difference from 3,000 feet msl to ground surface. The basinwide average wind speed is an average of the north (Chico) and the south (Sacramento) wind measurements. The observed winds, profiler data, pressure gradient nomograms, and computer model forecasts (ETA and AVN prognostic models) are also used. ARB meteorologists consult with the meteorological services consultant meteorologists.

The surface stations used to determine the AM stability number are the Automatic Meteorological Observing Stations (AMOS) and towered controlled airports. To assure an accurate determination of morning stability, the emphasis is placed on choosing the coolest of these locations which is representative of rice growing locations. The coolest of the morning temperatures in the north and south of the SVAB would be selected from the early morning hours of 12Z to 15Z. The ARB duty forecaster could choose not to use the coolest site if it was considered to be unusually cold and possibly in error. The temperature at 3,000 feet msl from the morning aircraft flight may be modified if a dry adiabat followed from the warmest temperature of the sounding below 3,000 feet intersected at the 3,000 feet msl level at a temperature warmer than the temperature reported from the flight. The duty meteorologist could choose to use the temperature at the intersection of the dry adiabat and the line representing 3,000 feet.

The basinwide air quality factor (BAQF) equals the average of one hour readings of PM<sub>2.5</sub> from midnight to 6:00 a.m. The ARB generates the BAQF from data collected from the basinwide network of beta attenuating monitor (BAM) samplers.

## **7. FACTORS AFFECTING ACREAGE ALLOCATIONS**

### **7A. Rainfall Effects**

The ARB allocations will be reduced to 2,000 acres after a daily rainfall amount that exceeds an average of 0.05 inches in the lower elevations of the SVAB (as noted on the 12Z station reports or other available information). The policy is to reduce large ARB acreage allocations whenever wet conditions exist in the SVAB and then increase acreage allocations on subsequent days as the fields dry out. The wet day calculation is as follows:

Rainfall today	Highest Rainfall Previous 3 days	Day is
0.00 - 0.00 inches	1.51 inches or greater	Wet
0.01 - 0.05 inches	0.81 inches or greater	Wet
0.06 - 0.11 inches	0.51 inches or greater	Wet
0.12 - 0.17 inches	0.25 inches or greater	Wet
0.18 inches or greater	none required	Wet

District staff or their agents shall perform crackle tests (as described in Section 14A), as appropriate, on rice straw following an average of 0.15 inches (or more) rainfall. Districts, or their agents, shall also advise growers of their responsibility to conduct a crackle test before burning.

### **7B. North Wind Days**

The ARB will reduce basinwide allocations on north wind days, if necessary, to a maximum of 8,000 acres to avoid air quality impacts on urban areas in the southern part of the SVAB. On north wind days when the basinwide average wind speed exceeds ten miles per hour (mph), the BMF is set to zero (0). In the allocation file, the ARB provides notification language such as, "Due to anticipated extensive air flow from north to south, the Air Resources Board has curtailed the basinwide allocation to 2,500 acres". The criteria for determining "extensive airflow from north to south" are widespread measured or forecast north winds along with a north to south pressure gradient.

### **7C. Special Circumstances - Adverse Air Quality Conditions**

A no burn day may be declared or the calculated acreage allocation may be reduced by the ARB if the burning of

that acreage may cause or contribute to a smoke episode. For this purpose, a smoke episode may be defined as an area characterized by either citizen complaints, restricted airport visibilities due to smoke, wildfires, or high PM<sub>2.5</sub> levels. In making these decisions, the complaints must be verifiable and the visibility reductions must be evaluated for the effects of relative humidity above 70%. When this occurs, ARB will include the reason for the decrease in allocation on their daily allocation page.

#### **7D. Special circumstances - Superior Ventilation Conditions**

The ARB may, after consultation and concurrence with the SMPC, increase the acreage allocation amount and recommend an extension of the burning hours if the meteorological conditions are favorable and current air quality readings indicate no air quality problems. The updated allocation information will be available to all districts and may be selectively distributed by the ARB or SMPC around the air basin to avoid potential problems or to satisfy a request for more acres. The ARB duty meteorologist has the authority to issue more than the minimum acres and extend burn hours prior to the regular ARB acreage allocation time. ARB meteorologists will be available during the burn hours to provide updates and districts must have staff available to discuss updates. During the fall program, the ARB meteorologists must re-evaluate the allocation numbers and contact the SMPC or districts to discuss the re-evaluation prior to their lunch hour, as appropriate.

For this purpose, an exceptionally favorable meteorological condition may be defined as vigorous southerly air circulation and an originally calculated BMF greater than 0.50. In this event, the meteorological factor may be set to a higher number (i.e., 0.6 to 1.0) based on an updated forecast and/or hourly PM<sub>2.5</sub> levels or favorable field observation reports which may be used to calculate a new allocation. On many days, air quality improves during the middle of the day as heat increases the volume of the mixing layer into which emissions are dispersed. Later in the day, as cooling occurs, the volume of air in the mixing layer decreases and particulate concentrations increase.

Air quality data is available throughout the day online. The SMPC may initiate a request that the ARB review the program data for a possible acreage increase. The update or updates may be issued at 9:30 a.m., 10:30 a.m. and 11:30a.m. or later as needed. The ARB will provide acreage updates directly to the districts outside of the fall burning period as meteorological and air quality conditions warrant. During the fall burn program, updates can be found on the 11AM file.

### **8. FACTORS AFFECTING DISTRIBUTION OF ACRES**

#### **8A. North/South Acreage Shifts**

The north/south acreage shift will occur only on those days with the following meteorological conditions described below or when the ARB declares a north wind day. The decision to shift must be based upon current meteorological conditions and a prediction that the conditions will persist during the burn hours. Data from all AMOS and airport stations basinwide must meet the criteria for a shift. The range of shifting can vary from 10% to 50% of the basinwide allocation.

Wind direction (WD): consistent basinwide northerly/southerly flow surface and aloft (WD 0 or 1)  
Duration time (DT): more than two hours measured/predicted to continue several hours (DT 0 or 1)

Wind speed (WS): greater than or equal to 5, 8 or 11 mph (WS 10-30%)

Mixing depth (MD): greater than or equal to 2,000 or 3,000 feet msl (MD 10-20%)

- The North shift goes to: Glenn, Butte, and Sacramento and Yolo/Solano's south zones and Colusa's north zones.
- The South shift goes to: Colusa, Sutter, Yuba, Placer, and Sacramento's and Yolo/Solano's north zones.

The meteorological differences north and south of the Sutter Buttes will be taken into account.

#### **8B. Sacramento Federal Ozone Non-Attainment Area No Burn Days**

Automobile emissions constitute the majority of ozone precursors emitted in the SVAB. However, if open burning can be postponed on days predicted to exceed ambient air quality standards for ozone, this could help reduce the need for additional costly regulations on industry in the SVAB. Therefore, a program will be conducted in the SVAB on days with predicted ozone violations. As part of the program, a no burn day may be declared by a district on a day when the ARB and/or the district predict(s) an exceedance of ambient air quality standards for ozone in that district.

The Sacramento Federal Ozone Non-Attainment Area (SFONA) consists of all of Sacramento and Yolo Counties and portions of Solano, El Dorado, Sutter and Placer counties. The SFONA districts rely on ozone forecasting to predict exceedances of the federal standards. On days where an ozone exceedance is predicted for the SFONA burning shall not be allowed in the following zones:

SACRAMENTO FEDERAL OZONE NON-ATTAINMENT AREA ZONES	
AIR DISTRICT	NO-BURN ZONES
Sacramento Metropolitan AQMD	All <u>Zones 1,2 and 3</u>
Yolo-Solano AQMD	Zones 2,4,5 and 6
Feather River AQMD (Sutter County only)	Zone 6 Sutter County (caution recommended in zones 4 and 5)
Placer County APCD	Zones 2 and 3 (caution recommended in zone 1)

**Procedure:**

The Sacramento Metropolitan Air Quality Management District (SMAQMD) provides a daily forecast for the SFONA region. When the next day ozone forecast exceeds 100 on the Air Quality Index (AQI), the following day shall be declared a no burn day in the zones in the above table. ARB will include the ozone forecast in its morning burn decision as a required no burn day for the affected districts or zones thereof. This information will be made available to districts in the burn allocation webpage.

The ARB may modify the forecast burn decision for burn zones surrounding the SMAQMD if meteorological conditions have either improved or worsened since the time that the Sacramento Regional forecast was made. The ARB has access to real-time ozone data, which can be used in making this decision. The forecast decision for the SMAQMD would remain the same, unless conditions have worsened.

If any districts are predicting a violation of the federal 8-hour ambient standard for ozone, they will notify the burn program staff at all other districts in the SVAB, the ARB, and the SMPC by telephone or email. It is highly recommended that the districts voluntarily cooperate in not allowing burning on that day. During the fall intensive burn season, the SFONA no burn decision(s) will be included in the daily computer files.

Notwithstanding the burn day status results of the acreage allocation equation in the Program, each district's APCO or his/her designee should declare a no burn day for all or part of their jurisdiction on any day when local or regional conditions result in a forecast of an exceedance of a federal or state air quality standard, such as ozone or particulate matter or any other standard where agricultural burning could cause or contribute to that exceedance.

PM<sub>2.5</sub> forecasting began in the SMAQMD in the winter of 2003-2004. The SMAQMD will advise the local Agricultural Commissioner and ARB Meteorology staff when the pollutant level forecast triggers a no burn day for its jurisdiction. While such forecasts would be expected at times during the winter months, some forecasts may occur during the summer ozone season on the July 4<sup>th</sup> holiday and/or during the smoke impacts from wildfires.

## 9. ALLOCATION TYPES AND UPDATES

### 9A. Initial Basinwide Allocation

During the fall burning season, ARB and the SMPC will consult on daily meteorological air quality conditions, prior to the ARB allocation decision to determine the appropriate initial basinwide acreage allocation for the day. During the other time of year, ARB determines the initial basinwide acreage allocation, and distributes the allocation.

### 9B. Interim Basinwide Allocation

In the fall, after the initial basinwide acreage allocation is determined for regular burn days, the SMPC may issue acreage updates to districts, at their request, up to the next, interim basinwide allocation limit of 4,000, 7,500, or 10,000 acres. Coordination is required between the ARB and SMPC to exceed the interim limits. At the 4,000 and 7,500 acre thresholds, the ARB Meteorology Section makes the decisions so that a prompt response is given to the SMPC.

## **9C. Maximum Theoretical Allocation**

The maximum theoretical allocation is the acreage allocation calculated by the equation that can only be exceeded if an updated allocation is provided by the ARB.

## **9D. Updated ARB Acreage Allocation**

The ARB and the SMPC may jointly decide to update the initial, interim, or maximum theoretical allocation after receiving air quality and meteorological data and district field observations that represent current conditions after morning burning. Allocation updates shall be available only when air quality and meteorological data indicate.

## **9E. Updated Acreage Distribution**

The SMPC may update the distribution of acres to districts, if warranted, between the initial and interim allocations and up to the maximum allocation limit. Districts must provide sufficient information including field observations, the latest meteorological data, and air quality levels (remember data polling times) in order to justify their request for an acreage update from the SMPC.

Districts will provide information on the total acres burned and designated to be burned up to the hour of the request for updates from the ARB. The information will include reports of district observations of burning conditions and local meteorology and air quality. This information will be used to evaluate the air quality impacts of burning already underway or completed.

# **10. TYPES OF DAYS**

In accordance with State regulation, either a district or ARB may use their judgment in determining the type and/or amount of burning allowed on any given day, provided that the decision is more stringent. This includes ARB reducing the allocation to the SVAB below 2,000 acres and/or less than 200 acres per county. The ARB will identify those days when an overriding judgment decision is made as well as the justification for the decision. This will aid the program participants in tracking and evaluating the effectiveness of the burn day criteria.

The ARB's decision of a no-burn day above 3,000 feet msl will be taken into consideration in making a decision regarding the type of burning allowed below 3,000 feet msl.

## **10A. No Burn Days**

No burn days are days with a zero acreage allocation to the SVAB resulting from the equations or from the following no burn day criteria. A no burn day will be declared when:

1. AM stability is equal to or greater than 17 degrees Fahrenheit and the 12:00 a.m. to 6:00 a.m. average basinwide PM<sub>2.5</sub> is equal to or greater than 30 ug/m<sup>3</sup>, or;
2. Average basinwide north wind speed is forecast to be equal to or greater than 20 miles per hour (applies from September 1<sup>st</sup> through December 31<sup>st</sup>), or;
3. AM stability is equal to or greater than 17 degrees Fahrenheit and the 12:00 a.m. to 6:00 a.m. average PM<sub>2.5</sub> is equal to or greater than 32 ug/m<sup>3</sup> at three or more monitoring sites.
4. In addition, for the period from December 1<sup>st</sup> through January 31<sup>st</sup>, a no burn day will be declared for the portion of the SVAB south of Tehama County if the average of the three sites with the highest 12:00 a.m. to 6:00 a.m. average PM<sub>2.5</sub> concentration in the portion SVAB south of Tehama County is:
  - a. Greater than or equal to 35 ug/m<sup>3</sup>, and
  - b. The forecasted maximum afternoon mixing depths are 1,500 feet above ground level or less, and
  - c. The forecasted ARB wind speed factor for the Sacramento Valley is either less than 5 mph with any wind direction or greater than 10 mph with predominantly north winds.

During the intensive fall burn season, the SMPC will notify districts of a possible ARB decision to declare a no burn day in the 8AM file comments with the final no burn decision from the ARB in the 9AM file.

No burning will be declared in certain burning management zones on Federal Ozone Exceedance days. Districts also have the authority to declare a no burn day within their jurisdiction.

## **10B. Prunings Only Days**

A prunings only day will be declared when:

- 1) AM stability is equal to or greater than 17 degrees Fahrenheit and the 12:00 a.m. to 6:00 a.m. average basinwide PM<sub>2.5</sub> is 28 ug/m<sup>3</sup> to 29 ug/m<sup>3</sup>, or;
- 2) Average basinwide north wind speed is forecast to be equal to or greater than 20 miles per hour (applies from January 1<sup>st</sup> through August 31<sup>st</sup>).

During the intensive fall burn season, the SMPC will announce any prunings only burning decisions in the 9AM file. The burning of tree stumps is not permitted on a prunings only burn day.

#### **10C. Restricted Field Days**

A restricted field day will be declared when:

- a. AM stability is equal to or greater than 17 degrees Fahrenheit and the 12:00 a.m. to 6:00 a.m. average basinwide PM<sub>2.5</sub> is 25 ug/m<sup>3</sup> to 27 ug/m<sup>3</sup> and the wind speed is forecast to be less than or equal to 5 mph, or;
- b. Average basinwide north wind speed is forecast to be equal to or greater than 15 mph.

The ARB may declare a restricted field day if the AM stability is greater than or equal to 25 degrees Fahrenheit.

Districts may allocate acreage for the burning of small amounts of ditches, field stubble or spot burning if such burning will not adversely affect downwind air quality. Only 50 total acres of field crop residue burning is allowed per county.

#### **10D. Regular Burn Days**

Regular burn days are declared when the theoretical acreage allocation is equal to or greater than 2,000 acres and ARB has not designated a prunings only or restricted field day. Allocation per district or county will be a minimum of 200 acres. An air quality reduction factor may result in no burning in a district due to high PM<sub>2.5</sub> values. Certain zones of a district may be restricted because of high ozone levels.

On days when the burning conditions are superior, efforts to provide the highest reasonable acreage allocation to districts shall be made in order to allow for maximum burning on days when there is the lowest potential of smoke impacts to populated areas.

### **11. BURN HOURS**

The ignition hours for agricultural burning of field crops are as follows. Burn hours are 10:00 a.m. to 5:00 p.m. from March 1<sup>st</sup> to August 31<sup>st</sup>. Between September 1<sup>st</sup> and the end of February ignition hours are from 10:00 a.m. to 3:00 p.m. During the intensive fall burn season, all field crop fires must be out (no flames) by 4:00 p.m. to minimize high afternoon PM<sub>2.5</sub> unless the SVAB receives a late update or burn hours are extended. Districts will consider the adverse smoke dispersion effects due to the change from daylight savings time back to standard time.

Ignition hours for orchard crops are from 8:30 a.m. to 5:00 p.m., or one hour before sunset whichever is earlier, year-round. Districts may, after consideration of air quality impacts, allow additional orchard prunings to be added as fuel to an existing hot base fire after the ignition hours.

The 8AM file is used to communicate all decisions regarding early burning with acreage allocation distributions during the intensive fall burn season. Files will be uploaded on the website and may be retrieved as early as 7:30 a.m. depending on conditions.

The SMPC, after concurrence by the ARB, may extend burning hours before and/or after the standard burn hours basinwide with favorable south winds or impending rainfall. If the ARB provides an update after 2:00 p.m., the ARB will extend the burn hours to a specific time determined by them. Extending afternoon burn hours presupposes improving dispersion or maintaining good dispersion.

### **12. COMMUNICATION PROCEDURES ON EARLY PRE-STORM DAYS**

During the intensive fall burn season, the meteorological services consultant will initiate the discussion on pre-storm forecasts and messages to districts. An early pre-storm advisory will be in the Pre-Storm Status section of the Program Files.

The SMPC and the meteorological services consultant will provide an initial message on the 11AM file to advise of later messages:

Message at 4 p.m. on the meteorological services consultant website  
Message at 9:30 p.m. on the meteorological services consultant website  
Message at 5 a.m. on the meteorological services consultant website

Outside of the intensive fall burn season, the districts obtain the acreage allocation directly from ARB. An early burn can be noted on the acreage allocation webpage if warranted.

## **13. PROCEDURES FOR MANAGING AGRICULTURAL BURNING**

### **13A. Conference Call**

During the fall season, at 9:30 a.m., a conference call facilitated by the meteorological services consultant shall commence. The meteorological conditions for the day and any pertinent concerns and questions may be discussed in this forum in detail.

### **13B. Web-Based Burn Map**

A map of the SVAB can be used by districts to plot their burn allocations. The map can show the location of fields, the acreage and the timing of ignition. The SMPC and districts are then able to view allocated acreage throughout the SVAB, which can help with spatial management of field crop burning.

### **13C. Daily Acreage Allocation and Distribution Considerations**

The allocation and distribution methods will use the following information:

1. Atmospheric stability, inversion heights, and depth of the mixing layer;
2. Wind speeds and directions (upper level and surface);
3. Relative humidity, fuel moisture and cloud cover;
4. Baseline air quality fine particulate matter ( $PM_{2.5}$ ) data and airport visibilities;
5. Quantity and location of agricultural residue to be burned;
6. Consideration of downwind populated areas; and,
7. Presence of prescribed burning and nearby wildfires.

Emphasis is placed on the expected mixing depths during the burn hours in making burning management decisions. During the intensive fall burn season, the meteorological services consultant along with the ARB will comment on the atmospheric mixing in their computer files. Additionally, information will be discussed each morning between the ARB duty meteorologist and the SMPC to determine the initial acreage allocation. The SMPC may, if conditions warrant, reduce the acres allocated by ARB to the SVAB. Outside of the fall season, the ARB provides the daily allocation and if needed meteorological resources. Districts coordinate burns with neighboring counties to try to minimize smoke impacts.

### **13D. Operating Dates of the Fall Program and Management Responsibilities**

During the intensive fall burn season, the SMPC distributes acreage to the districts using the distribution equation described below. If significant rainfall shortens the intensive fall burn season, the SMPC will stop operations before November 30<sup>th</sup> with prior notification to the TAC.

The allocation of acreage to the growers is managed by either by the district or the county Agricultural Department whichever has the assigned responsibility. The responsible agency must have access to the air quality and meteorological files and is using the best, current data available in making allocation decisions. If fire agencies issue burn authorizations, they shall report in a timely manner and on a daily basis to the district all allocations made to growers in order to ensure that inspectors are aware of permissive burns as they occur.

### **13E. Spatial Management of Burning**

As shown in Appendix A, there are 37 distinct burning management zones in the SVAB used to manage the burning geographically to avoid impacting populated areas. When meteorology and/or air quality is more favorable in one or more zones, additional acreage can be placed in those areas but such distribution should never over-concentrate the acreage. The updating and distribution of acreage by the SMPC will take into account weather and air quality differences between the north and south sections of the SVAB. Prescribed burning will be incorporated into the spatial management of the burning by the district in order to minimize air quality impacts. Project size, elevation and location will be factors considered in the smoke management.

## **13F. Data Management for the Intensive Fall Burn Season**

Districts shall keep track of ready and burned acreage. A file containing ready and burned acreage information is sent to the SMPC each day during the fall season and entered into the basinwide data tracking system. In reporting “ready acres”, each district or county may add up to 25% of their total planted rice acres with the fields added after the field has been harvested and met the drying time. Districts or counties may also augment the “ready acres” number with any other crop burning acreage that is ready to burn.

## **13G. Daily Acreage Distribution and Burn Authorization**

Districts may not authorize field burning on any day before obtaining a burn decision and acreage distribution for that day pursuant to this Program. The burning of prunings, may be authorized, according to the established burn hours, after confirming it is a burn day.

## **13H. Personnel on Duty and Holiday and Weekend Staffing**

To prevent potential smoke impacts to urban areas and airports within their respective district or an adjacent county, districts shall not allow field stubble burning unless the district has staff who are administering the agricultural burning program. District staff shall observe smoke dispersion and downwind impacts or review up-to-the hour airport and air quality readings prior to requesting additional acres for field burning in their district. This includes holidays and weekends.

Districts may allow prunings only burning, without staff on duty via a recorded announcement after confirming the burn day status and acreage allocation. During the intensive fall burn season, all districts must access the 8AM file to confirm the burn day decision prior to allowing agricultural burning. Districts may contact ARB prior to 3:00 p.m. on the day before a holiday or weekend to request ARB's extended outlook.

## **13I. Conservative Burn Management**

Districts shall use air quality and meteorological data to assist in making decisions on placement of burns in their district's burning management zones. The SVAB Agricultural Burning Map, on the PFIRS website, is used for plotting allocated burn acres and for coordinating burn decisions with other districts.

Districts shall employ extra caution when allowing burning when smoke may impact urban areas, airports, and major roadways, and shall advise growers that the grower will be held responsible for any adverse downwind impacts.

Successful burn program management relies upon consideration of the following information and procedures when allocating burning:

### **1. Field conditions**

There is no substitute for field observations in understanding burn conditions. The following factors should be considered:

- a) Fuel moisture: Higher fuel moisture creates more smoke and reduces plume rise, increasing the probability of impacts on downwind receptors. As necessary, the use of the crackle test (as described in Section 14A) as well as early test fires of small acreage assists in making burn allocation decisions.
- b) Fuel density and arrangement: The increased density of vegetative waste increases the amount of smoke created when burned. A rice field which has been chopped, leaves straw on the ground, preventing airflow and trapping moisture. The potential of weeds, such as tule, on adjacent levees to burn should be considered when a field is burned since the emissions from the additional vegetation must be taken into account.
- c) Burning techniques: The method used by the grower to ignite the field and the speed in which the field is burned can affect smoke production and plume rise.

### **2. Meteorological conditions**

Winds and convection currents can vary greatly throughout the region and can shift throughout the day. Districts shall evaluate data as it becomes available throughout the day to ensure the success of the program.

- a) Surface wind speed, low inversion heights, cold ambient surface temperatures, the rapidly declining mixed layer, and high relative humidity can increase the potential for fumigation and should be evaluated throughout the burn day.
- b) Wind direction and speed, both surface and aloft (transport) are critical. The latest wind data should be used to verify wind direction before making placement decisions. The potential for smoke transport downwind

- significantly increases when wind speeds exceed 8 mph and an inversion is present.
- c) Authorize only small fires in remote areas if dispersion conditions are poor. When conditions are expected to restrict smoke dispersion, very limited field crop burning should take place only in locations which would not impact populated areas. Caution should be used on days when the daily criteria are close to requiring restricted field day status.
  - d) Airport data are collected at the beginning of each hour from Federal Aviation Administration tower controlled airports. Airport data are available at 15 minutes past each hour. The AMOS data are collected each hour and are reported at 15 minutes past each hour. Complete AMOS data may not be available until 30 minutes past the hour.

### **3. Air quality considerations**

Districts must consider the short-term and long-term impacts from burn allocations by carefully analyzing air quality trends and forecasts along with meteorological information.

- a) ARB provides current air quality conditions as measured at BAM monitoring sites which can be monitored throughout the burn day in order to make informed decisions.
- b) Airport visibility observations should be checked hourly in the district and surrounding areas.
- c) Smoke complaints received by the district should be investigated and burning closely monitored.
- d) Care must be taken to ensure that burn day activities will not contribute to a build-up of pollutants over time that may contribute to elevated PM<sub>2.5</sub> and/or exceedances of air quality standards.
- e) Areas with elevated concentrations should be considered a poor location when allocating burn acres; in considering if a district will allow any burning that may cause a worsening of current or forecast conditions.
- f) Areas/burn zones with elevated concentrations may be specified by ARB or the SMPC as "no burn".

### **4. Spatial and temporal considerations**

Districts shall distribute their allocated acreage spatially and temporally within each district's burning management zones to minimize emission densities and protect downwind urban areas.

- a) Field lighting times must be specified to the grower so that burning times are staggered.
- b) Flexibility should be employed in shifting acreage among zones and to the north and south.
- c) If the field is adjacent to and/or upwind of populated areas, the burning of a small field versus a large field is a more protective approach.

In order to avoid overwhelming an area with co-mingled smoke, districts may enter their scheduled allocations on the agricultural burning map that is available for daily use. Districts should notify adjacent district(s) whenever a considerable number of acres are allocated in a zone contiguous to another district or air basin or if there is reason to believe that smoke may cause impacts to another district or air basin.

### **13J. District Communications with Growers**

Effective burning management requires better and timelier communication with the growers so that the logistics of conducting the burning can be accomplished. Districts should use voice mail, answering machines and reference burn lists to advise growers near the top of the burn list to be ready to burn to make the system more efficient.

### **13K. Adjustments for Burned Acreage**

When a field is baled, grazed, flooded, or straw is substantially reduced due to other factors and there is a request to burn the remaining straw, the district will review the conditions in the field and may decide the percentage reduction in acres up to a maximum of 95% of the total acreage.

### **13L. Acreage Updates**

Acreage updates requested from either the ARB or SMPC will be accompanied by the following information provided by the requesting district:

- District name;
- Burn contact person and phone number;
- Total acres allocated to growers and number of acres burned;
- Spatial distribution of the fires by burning management zones;
- Description of field conditions (e.g., fuel moisture/wind speed/wind direction);
- Characteristics of smoke plumes;
- Complaints received by the district;

- Smoke problems or high PM<sub>2.5</sub> monitoring readings;
- Current local and Sutter Buttes' winds;
- Current local airport observations; and,
- Downwind air quality and communication with adjacent district(s).

## **14. GENERAL BURNING REQUIREMENTS FOR GROWERS**

### **14A. Drying Times**

It is imperative that agricultural wastes be sufficiently dry to ensure proper burning by observing the required drying times. No spread rice straw shall be burned prior to a three-day drying period and no rowed rice straw shall be burned prior to a ten-day drying period, unless the rice straw passes the "crackle test". For rice straw, after 0.15 inches or more of rainfall, a representative sample of the straw must pass the crackle test to be legally burned (Section 80150(c3)). The increase in fuel moisture due to rainfall and high humidity in the lower elevations of the SVAB results in poor combustion.

Drying times for rice fields harvested with the "stripper header" method shall be three days after the first frost found on the field and if the straw passes the crackle test; or three days after mowing and spreading or chopping straw; or if the district verifies that the straw is sufficiently dry and passes the crackle test the field will be considered ready to burn.

The crackle test is performed as follows: When checking the field for moisture, a composite sample of straw from under the mat, in the center of the mat, and from different areas of the field shall be taken to ensure a representative sample. A handful of straw from each area will give a good indication. Rice straw is dry enough to burn if a handful of straw selected, as described, crackles when it is bent sharply (Section 80150(c2)).

### **14B. Ready to Burn List**

All persons wanting to burn must notify their local district office to get on the ready to burn list (list). Only fields that have been completely harvested can be placed on the list. All pertinent burn information requested by the district must be provided. Most (not all) burning is allocated on the basis of the list in the order it was reported.

Prior to allocating acreage, the geographical distribution of acres shall be considered including any burning near roadways, airports, and populated areas when wind directions and other factors are favorable.

Ready Acres are defined as follows: A maximum of 25 percent of a district's or county's planted rice acres. Rice fields must have been harvested, passed the drying time and be on a conditional rice burn permit. All other crop residues, in any amount, may be included on the list but only when they are actually ready to be burned.

### **14C. Burning Authorization and Acreage Allocation**

No person may conduct agricultural burning unless their district or the responsible designee has authorized the burning and allocated the acres for a specific field. The switching of fields without prior approval from the district's APCO is prohibited. If burn acres are allocated and the burning is not completed, the grower must contact their district at the earliest possible time to return the unused acres. The field will remain in the same position on the list.

### **14D. Ignition Patterns**

Rice, barley, oat and wheat straw are to be ignited only by strip firing into the wind or by backfiring, except under a special permit of the district when and where extreme fire hazards are declared by a public fire protection agency to exist, where crops are determined by the district not to lend themselves to these techniques. (80150(a)(1))). The approved burning techniques (e.g. backfiring, strip firing, and X-firing at low wind speeds) improve burning and minimize emissions of pollutants. Districts may authorize other lighting methods for safety reasons or if the crop does not lend itself to the approved techniques or if there are pressing time constraints to conduct the burning.

### **14E. Harvest Date**

No field crop acreage that was harvested prior to September 10<sup>th</sup> shall be burned during the period from October 1<sup>st</sup> through November 15<sup>th</sup>, unless justified by the grower and approval is granted by the local district APCO.

#### **14F. Return Unused Burn Acreage**

Growers who are authorized to burn and do not burn their allocated acres must return unused acres to the district in a timely fashion. If a grower does not return unused acres (when no burning was attempted) to the district for re-allocation to other growers the field that was not burned may be dropped to the bottom of the list.

#### **14G. Chopped Rice Fields**

Growers must report to the district any rice field(s) that they want to burn that have been chopped. Districts should take this information into consideration for possible higher fuel moisture content of the straw and poor combustion characteristics due to reduced air/fuel mixing.

### **15. COMPUTER FILE DATA AND COMMUNICATION TIMETABLE**

#### **15A. Computer Files**

The burn management program relies on timely transmission, review, and analysis of pertinent air quality, meteorological, and burn information. These data are critical in burning management decisions. Computers are used to transmit the data. The information generated during the fall burn season includes:

1. District files of ready acres and yesterday's burned acreage and complaints;
2. The meteorological services consultant zone ventilation ratings for the distribution equation;
3. The meteorological services consultant daily weather discussion and AMOS and airport data;
4. The SPMC's daily comments preceding the acreage distribution table;
5. The basin acreage distribution to districts and the "Season to Date" summary;
6. The ready file checklist and comments;
7. ARB acreage allocation, meteorological factors, air quality data, and comments;
8. ARB BAM tables for yesterday and from midnight to 6:00 a.m. today;
9. Verified complaints which were reported to the SPMC by district and complaints reported directly to ARB;
10. The AMOS and airport data for the latest hour or last identified hour; and,
11. The zone file with yesterday's specific zone and crop burned and season summary.

#### **15B. Computer File Transmission and Access Timetable**

Districts must send their ready file information to the SPMC before 8:15 a.m. each day.

<b>Filename</b>	<b>Access Time</b>	<b>Contents</b>
8AM	8:15 a.m.	SPMC preliminary comments and reminders specific to the conditions for that day SPMC ready file checklist and comments Meteorological services consultant preliminary weather discussion Current airport and AMOS data ARB BAM tables for yesterday along with the 12:00 a.m.to6:00 a.m. average
9AM	9:15 a.m.	SPMC basin acreage distribution table SPMC file retrieval checklist and comments specific to the conditions for that day Meteorological services consultant final weather discussion Current airport and AMOS data ARB equation factors and basinwide acreage allocation and complaints table SPMC zone and crop burning file
11AM	11:15 a.m.	SPMC information, if necessary, for allocation update or pre-storm advisory Meteorological services consultant latest weather information

### **16. COMPLAINT HANDLING AND ENFORCEMENT**

A standard Complaint Report Form has been created for the purpose of uniform reviewing and completeness in data gathering. Districts shall record all agricultural burn complaints on the complaint report form or a reasonable facsimile in

order to report and review complaints uniformly.

Consistent and proportional enforcement actions must be applied to all types of violations. Financial settlements that are a result of a district notice of violation (or notice of noncompliance) is often an effective deterrent to further violations and can mitigate competitive business advantages gained through illegal burning. Enforcement should follow each district's enforcement policy and be consistent with federal, state, and local law.

It is each participating district's responsibility to ensure that their district's regulations cover the enforcement portions of Title 17 of the CCR Subchapter 2 Smoke Management Guidelines for Agricultural and Prescribed Burning sections 80145 (k)-(o). It is noted that, specific codes related to the burning of rice straw in the SVAB are also found in the California Health and Safety Code Section 41865, Connelly-Areias-Chandler Rice Straw Burning Reduction Act of 1991.

Examples of violations relevant to the Program may include:

1. Burning field acres on a no burn day;
2. Burning rice acreage committed for phase down reduction;
3. Burning without authorization;
4. Burning more acres than the allocated acreage;
5. Burning outside the established burn hours;
6. Not meeting the drying criteria or crackle test;
7. Using unauthorized lighting techniques;
8. Burning acres enrolled in an Emission Reduction Credit (ERC) program; and,
9. Not showing due diligence in safely extinguishing accidental ignitions.

#### SACRAMENTO VALLEY AIR BASIN BURNING COMPLAINT INVESTIGATION REPORT

Complaint received by:

Complaint filed on:

Complainant      Name:  
                       Address:  
                       Phone:

Date and time of problem:

ARB referral:

Repeat complaint:

Exact location of smoke problem:

Burning management zone:

Duration of smoke problem in hours or minutes:

Nature of smoke problem: (visible plume, smoke in area, odor of burning, breathing problem):

Wind speed and wind direction at time of problem:

Wind shift during day and directions:

Weather conditions at time of problem (clear, cloudy, raining, cold day, warm day, etc.):

Burn day above 3,000 ft.:      Below 3,000 ft.:      Basin allocated acres:      District acres

Allocation update:      Acres burned:      Agriculture:      Other:

Air quality levels:      Ozone:      location:      PM2.5:      location:

Contacted other fire control agencies (USFS, CAL FIRE, FD) regarding other possible fires:

Type of burning problem (circle): rice    other field    orchard    wildland    levee    forestry    refuge    residential    structural    wildfire    disease    illegal  
unknown

Source of burning within county or outside county:

Complaint verified as related to agricultural burning and reported:

Investigated by:

Date of investigation:

Date and time complainant notified of disposition:

If a complaint from smoke impacts due to agricultural burning, has been verified, it is considered valid. Only during the intensive fall burn season, districts will report complaints to the SMPC in the daily ready file. The affected district regardless of the source of the smoke must count a valid complaint. Smoke complaints from the public which are received by ARB are forwarded to the district(s) involved for investigation. Complaints received by ARB during the intensive fall burn season are counted by the SMPC.

Districts shall investigate each complaint within a reasonable time and report the results of the investigation to the

complainant. Districts shall maintain complaint documents for a minimum of three years. These are considered public information through a public information request.

## **17. PRESCRIBED BURNING**

The Smoke Management Guidelines for Agricultural and Prescribed Burning, outlined in Title 17, Subchapter 2 of the California Code of Regulations, are to provide for the continuation of agricultural burning, including prescribed burning and agricultural burning, while minimizing smoke impacts on the public. Prescribed burning is the planned application of fire to vegetation to achieve any specific objective on lands selected in advance of that application. The planned application of fire may also include natural or accidental ignition. "Prescribed fire" means any fire ignited by management actions to meet specific objectives and includes naturally-ignited wildland fires managed for resource benefits.

### **17A. Policies and Procedures**

The following outlines the necessary steps required for persons or entities proposing to conduct a prescribed burn.

1. Submit a smoke management plan (SMP) either in paper form, utilizing either the SMP form from ARB, the SMP from the Program, submitting through the Prescribed Fire Information Reporting System (PFIRS) website or by submitting a SMP as per the district of jurisdiction's burn rules;
2. Receive final approval of the SMP from the district of jurisdiction;
3. Receive a district permit to burn;
4. Request authorization to burn no later than the afternoon prior to the requested burn day; and
5. Maintain communication with the district and report the burn status along with the acres burned upon its conclusion.

The district of jurisdiction must approve the proposed burn through the PFIRS website so that the burn information can be displayed on the PFIRS maps.

The ARB provides a 48 hour forecast, 72 hour outlook, and a 96 hour trend through PFIRS. The district may request ARB's help in deciding on a burn authorization up to 24 hours in advance of the ignition. Prioritizing burns for disease control, economic concerns, safety etc. is an individual district's decision. However, districts may, in the daily burn authorization system give preference to agricultural burning including prescribed burns that are employing fuel reduction measures along with efforts to reduce smoke emissions.

If indicated, PFIRS can provide for secondary and tertiary districts to be notified that a SMP has been submitted to a neighboring district. Coordination can be worked out between the districts in conducting the burn. Anyone can view approved burns on the PFIRS website.

During the intensive fall burn season, all proposed prescribed burning shall be reported by the districts to the SMPC at least one day prior to ignition. This information should also be available on PFIRS, however it may not be available one day prior to ignition. This broadcasting of burn information can promote coordination and enhance the monitoring of agricultural and prescribed burning. For SMPs, districts can use the SVAB SMP, approved equivalent plans of the Northeast Air Alliance or ARB, or a SMP through PFIRS.

If the burning is conducted during the intensive fall burn season at or below the daily variable elevation level and not higher than 2,000 feet elevation, then the proposed acreage will be considered part of the local acreage distribution. The ARB may adjust the elevation threshold for burn decisions in the lower elevations versus higher elevations, pursuant to Section 80250(a). The ARB will consider revising a no burn decision above 2,000 feet elevation when the local district makes a request based upon review of local meteorological and air quality conditions. When there is an authorization request to burn at or below 2,000 feet, the districts must provide notification to the SMPC what is the scheduled day of burning to allow planning for allocation and distribution of acreage. For prescribed burns below 2,000 feet, the SMPC will, if possible, take the acreage needed for those burns out of any excess acreage available over the initial allocation but below the interim allocation limit.

## **18. EMISSION FACTORS AND FUEL LOADING**

The emissions factors and fuel loading for biomass are shown in the following table.

EMISSIONS FACTORS AND FUEL LOADING							
CROP RESIDUE	PM <sub>10</sub>	PM <sub>2.5</sub>	NOx	SOx	VOC	CO	FUEL LOADING TONS PER ACRE
	POUNDS PER TON						
Alfalfa	28.5	27.2	4.5	0.6	21.7	119.0	0.8
Barley	14.3	13.8	5.1	0.1	15.0	183.7	1.7
Corn	11.4	10.9	3.3	0.4	6.6	70.9	4.2
Oats	20.7	19.7	4.5	0.6	10.3	136.0	1.6
Rice	6.3	5.9	5.2	1.1	4.7	57.4	3.0
Safflower	17.7	16.9	4.5	0.6	14.8	144.0	1.3
Sorghum	17.7	16.9	4.5	0.6	5.1	77.0	2.9
Wheat	10.6	10.1	4.3	0.9	7.6	123.6	1.9
Almond	7.0	6.7	5.9	0.1	5.2	52.2	1.0
Apple	3.9	3.7	5.2	0.1	2.3	42.0	2.3
Apricot	5.9	5.6	5.2	0.1	4.6	49.0	1.8
Avocado	20.6	19.4	5.2	0.1	18.5	116.0	1.5
Bean/Pea	13.7	13.0	5.2	0.1	14.2	148.0	2.5
Cherry	7.9	7.4	5.2	0.1	6.0	44.0	1.0
Citrus	5.9	5.6	5.2	0.1	6.8	81.0	1.0
Date Palm	9.8	9.3	5.2	0.1	3.8	56.0	1.0
Fig	6.9	6.5	5.2	0.1	6.0	57.0	2.2
Grape	4.9	4.6	5.2	0.1	3.8	51.0	2.5
Nectarine	3.9	3.7	5.2	0.1	2.3	33.0	2.0
Olive	11.8	11.1	5.2	0.1	10.3	114.0	1.2
Orchard	7.8	7.3	5.2	0.1	6.3	66.0	1.8
Peach	5.9	5.6	5.2	0.1	3.0	42.0	2.5
Pear	8.8	8.3	5.2	0.1	5.1	57.0	2.6
Prune	2.9	2.8	5.2	0.1	4.6	47.0	1.2
Walnut	4.2	4.0	4.5	0.2	4.8	67.0	1.2
Grassland	15.9	15.2	4.5	0.6	10.7	114.0	2-3.2
Chaparral	20.1	17.3	3.5	0.1	14.4	153.7	7-23
Forest	19-30	17-27	3.5	0.1	8-21	154-312	7-23+

Sources: Jenkins, Darley, Hardy, Ward, AP42

## **19. APPENDIX**

# *Sacramento Valley Agriculture Burn Zone Map*

