Section 7.17
Agricultural Burning Methodology
(June 2005, updated August 2020)

EMISSION INVENTORY SOURCE CATEGORY

Miscellaneous Processes - Managed Burning and Disposal – Agricultural Burning

EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION

670-660-0262-0000 (47241) Agricultural Burning – Pruning

670-662-0262-0000 (47258) Agricultural Burning – Field Crops

670-668-0200-0000 (47266) Agricultural Burning – Weed Abatement

670-995-0240-0000 (82131) Waste Burning (unspecified)

Background

This document describes the methods used to estimate emissions from waste burning. Emissions in this source category come from the open burning of agricultural residues (such as crop stubble and orchard pruning), weed abatement (such as ditch and canal bank burning), and other materials. See Table 1 below for the emission inventory categories (EIC) updated.

Waste burning is a district reported emissions inventory category. While several districts have updated this category in the recent past, others have not. This update provides default emission estimates for those districts that have not submitted updates in recent years or that have made requests for an update. Emission estimates for those districts for the 2017 inventory update are presented in Appendix A.

Table 1: Updated Emissions Inventory Categories

EIC category	EIC Code
Agricultural Burning – Pruning	670-660-0262-0000
Agricultural Burning – Field Crops	670-662-0262-0000
Agricultural Burning – Weed Abatement	670-668-0200-0000
Waste Burning (unspecified)	670-995-0240-0000

Activity Data

The burning activity data are from the agricultural burn reports submitted by the air districts. The annual reports provide information on the amount of materials burned or the size of areas burned by crops. The raw data on the report needs to be pre-processed for the inventory update. A template designed by CARB staff was used for the data processing, including assigning each of the crops to a

proper EIC category, developing the monthly profiles, and aggregating the data into regions (county, air basin and district) if needed. In addition, data on the reports were quality-checked (QC/QA) and errors in the data were identified and corrected. Districts were contacted for more information as needed. The activity data was compiled and processed by the CARB staff that manage the agricultural burn reports.

Emission Factors

Emission factors by crops are available for PM10, PM2.5, NOx, SO2, VOC, CO, and NH3. The main sources of the emission factors are the U.S. EPA's "Compilation of Air Pollutant Emission Factors" (AP-42), UC Davis studies, and CARB sponsored tests. The emission factors and fuel loading factors are presented in Appendix B. The background information for those factors is given in Appendix C.

Emissions Estimation

The equation for emission estimation is given by

Emissions in tons =
*Crop acres * FL * EF * 1//2000 (ton/lbs)*

where:
FL = fuel loading (tons fuel/crop acres)
EF = emission factor (lbs pollutant/tons)

The amount of material burned (fuel loading) was reported in either acres or tons of fuel burned, though acres were the most common. Emissions were calculated by multiplying the acres reported by the crop specific fuel loading factors and then by the crop specific emission factors. Or, if data on tons of crops burned were available, emissions were calculated by multiplying the tons reported by the crop specific emission factors. The emissions were then converted from pounds to tons and summed by source category, county, air basin and district.

Example Calculation for PM10 Emissions

Assume ABC County burned 250 acres of Almond orchard:
Fuel Loading = 1.00 ton/acre
PM10 Emission Factor = 7.00 lbs PM10/ton

*250 acres * 1.00 ton/acre = 250 tons of Almond pruning*

*250 tons * 7.00 lbs/ton * (1/2000) ton/lbs = 0.875 tons PM10*

Temporal Profiles

Fractions of activities for each month was calculated by region and source category using the monthly activity data from the reports. The fractions were then used to update the monthly profiles. The data available however were not sufficient for updating the other temporal profiles. The assumptions that the burning activities occur 16 hours a day and 7 days a week were retained. There was no default value for operating weeks per year.

Speciation

There were no emission factors in the emission factor table (see Appendix B) for total PM and TOG. Thus emissions of those two pollutants were calculated using the speciation profiles for particulate maters and organic gases available in CEIDARS.

Changes

Several data sources were used in the 2005 update to obtain the activity data, including a contracted study, Ag burn permits and annual burning reports collected from the air districts. This update was using the latest activity data from the annual Ag burn reports submitted by the districts and processed by CARB staff in the Agricultural and Prescribed Burning Support Section. The activity data were not only up to date, consistent, well processed and quality-assured, but also based on actual burnings, thereby providing an improved emission inventory.

References

Scarborough, J.; Gong, P. "Creating a Statewide Spatially and Temporally Allocated Agricultural Burning Emissions Inventory Using Consistent Emission Factors", May 2002**.** Report. Center for the Assessment and Monitoring of Forest and Environmental Resources (CAMFER); College of Natural Resources, UC Berkeley. ARB Contract Number: 99-714.

Jenkins, B., "Atmospheric Pollutant Emission Factors from Open Burning of Agricultural and Forest Biomass by Wind Tunnel Simulation", April 1996. UC Davis. ARB Contract Number A932-126.

Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, Fifth Edition, AP-42, January 1995, U.S. EPA. Table 2.5-5. Fuel loadings and EFs. AP-42 values are used where Jenkins data are not available. Section 13.1 used for forest burning.

Notes

The prescribed burn emission inventory is developed separately with different methodologies. The reader is referred to “Section 7.15 Range Improvement” and “Section 7.16 Forest Management” (Klaus Scott, 2019).

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