Northern Sierra Air Quality Management District

Gretchen Bennitt, Executive Director

DISTRICT HEADQUARTERS
200 Litton Drive, Suite 320
Grass Valley, CA 95945
(530) 274-9360 / FAX: (530) 274-7546
www.myairdistrict.com

NORTHERN FIELD OFFICE
257 E. Sierra, Unit E
Mailing Address: P.O. Box 2227
Portola, CA 96122
(530) 832-0102 / FAX: (530) 832-0101

Why Do We Have No Burn Days?

Burn day decisions for the Mountain Counties Air Basin (MCAB) are driven by air quality, estimates of air quality for the next day (the decisions are made the afternoon before they are effective) and by weather conditions. In the MCAB the specified value to be considered is a meteorological value called the 500-millibar (mb) height. The entire weight or mass of a column of air over a small area at the surface of the earth is defined as a bar. One thousandth of that mass is a millibar. Half of the mass of the column of air is 500 mb. Typically 500 mb heights are about 18,300 feet above sea level.

If you recall that cold air is denser than warm air, you will understand that the more warm air there is in a column, the greater volume will be needed to attain a given mass, such as half a bar or the 500 mb level. Because there is a lot of variation of the amounts of cold or warm air in a particular column, lines or contours can be drawn through points representing 500 mb heights over a given area. For more than thirty years computers have been used to predict maps of these atmospheric contours at different levels especially 300, 500, 700, 850 and more recently 200 and 150 mb for specific time steps (usually at 12 hour steps). For sixty years now, twice a day, balloons carrying a small package equipped to measure temperature, moisture and pressure have been launched from certain cities or airports. These instruments provide specific data at the millibar levels noted and at other levels when significant changes occur. Sites in this part of the world for gathering these data (as well as wind speeds and directions) include Medford, Oregon, Oakland, San Diego and Vandenberg AFB in California, and Reno, Elko and Desert Rock in Nevada.

When 500 mb contours are higher than normal for a given time of year they usually form a pattern somewhat like an upside down v that is called a ridge of high pressure. These ridges form and move rather slowly from west to east at our latitude. They are usually preceded and followed by a trough of lower pressure shaped similar to the letter v.

The ridges, especially east from a centrally located north to south axis and into the western part of the next trough are generally associated with downward pushing air called subsidence. A strong ridge with a large amount of warm air causes the 500 mb contours to be significantly higher than average values for the time of the year. These "strong" ridges are also characterized by a strong temperature inversion or inversions. That is, the air warms as height increases. Sometimes the warmest level is at only a few hundred feet above the surface, other times it may be between 1500 feet and 3000 feet or higher. Since the cooler air below this level is denser, it cannot rise unless it is heated. Often we describe this lower level of air as trapped. If burning occurs below a significant inversion, the smoke is trapped.

When burning occurs below an inversion west of Nevada County, the smoke plume will not rise very high. If westerly winds blow the smoke from the Central Valley into the foothills, the plume may be pushed against the hills and up the smaller valleys and canyons causing smoke problems in that region. If the inversion traps valley smoke below 2500 feet the effect on western Nevada County can be unpleasant and breathing difficulties may affect some people.

Over →

Each day in the Sacramento Valley morning minimum temperatures are compared with temperatures aloft reported by aircraft under contract to the California Air Resources Board. Morning stability over the valley is determined by subtracting the average of temperatures at 3000 feet from the minimum surface temperatures. When the morning stability is 17 or more and when the early morning average of particulates measurements by Coefficient of Haze (COH) monitors around the valley is more than three, a no burn day is declared for the Sacramento Valley. For the Sacramento Valley, that decision is made each morning. For the rest of the air basins in the state, the decision is made in the afternoon before the day in question.

In the areas of the state with mountainous, rough terrain, smaller valleys, peaks, ridges and some small basins, statistical studies of 500 mb heights and visibility were done for the months of the year. The relationship of the higher than normal contours, stronger inversions and trapping of pollutants was used to determine guidance contours for determining no burn days. This work was done about 30 years ago and has been quite effective.

Specifically, several occurrences of widespread air quality impacts were studied in 1998 (late April- early May and mid-October). Also four smoky days in the Lake Tahoe air basin were reviewed in 1999. In all of these cases with smoke problems, on the day of the burning, the 500 mb heights were increasing to values above the guidance contour for no burning for that particular month. These guidance contours are available in Title 17 of the California Code of Regulations.

According to proposed changes to Title 17, local air districts will be allowed to do some burning on marginal days if they choose to do so. Some of those marginal days would occur when the 500 mb heights are a small amount above the guidance (burn limiting) contour. Districts would have to be very attentive to air quality if they exercise that option. It may be effective to allow some burning at locations with especially favorable conditions on those marginal burn days. Careful placement of the burns will be important to avoid smoke impacts. If not too much burning is done this use of marginal burn days may be especially effective at higher elevations.

Of course when fuel is wet more smoke is produced than when fuel is dry. For this reason Foresters often cover piles of wood for burning during the winter on days when dispersion is good.

Why are many rainy days permissive burn days? Usually rain is associated with troughs of lower pressure. In the middle and upper atmosphere, such as at 500 mb, heights lower than normal generally enhance upward motion. Not only does this provide fine dispersion, but also moisture in the air is lifted, cooled to condensation and clouds form. There is also a "spin" term, called positive vorticity, which follows the right hand rule in the northern hemisphere that can tell us to expect upward motions in the atmosphere when the spin is cyclonic. Especially in areas of orographic lift, precipitation is often the result. There are, however, weather patterns with significant warm air advection (largely horizontal motion) than can cause clouds and even precipitation without assuring good conditions for dispersion. Often you will notice fog before and with the precipitation in these cases.

If you experience poor air quality, ESPECIALLY IF IT IS SEVERE ENOUGH TO CAUSE CHOKING OR COUGHING, please contact the staff of the Northern Sierra Air Quality Management District at (530) 274-9360.