Louisiana SMOKE MANAGEMENT Guidelines for Agriculture

Introduction

Prescribed burning as a harvest management tool in Louisiana agriculture is a common practice. There are numerous environmental and public issues associated with this practice; however, the state has instituted a voluntary smoke and ash management program to assist growers in addressing these issues. In addition, a number of research projects are under way to address possible ways to reduce the need for prescribed agricultural burning.

Growers should have a responsible attitude toward environmental and public issues while attempting to be as efficient as possible. There are several objectives growers always should strive to achieve regarding smoke and ash management:

• Minimize the adverse effects caused by open-field controlled agricultural burning. Prevent smoke and ash from being blown across public highways and airports.

• Prevent smoke and ash from affecting public areas, such as hospitals, schools and doctor's offices.

• Prevent smoke and ash from affecting subdivisions and other housing facilities.

• Prevent smoke and ash from affecting electrical substations and power lines.

Growers should practice smoke and ash management by using recommended prescribed burning practices. Prescribed burning can be defined as the controlled application of fire to any agriculturally related fields under weather conditions that allow the fire to be confined to a predetermined area while minimizing the effects of associated smoke and ash. Smoke and ash management involves conducting a prescribed burn under recommended weather conditions and with burning techniques to reduce the effects of smoke and ash generated by prescribed burning on the environment, public health and welfare.

Application of these guidelines will minimize concentrations of smoke and ash in sensitive areas and assist in maintaining air quality standards. The use of these voluntary guidelines will allow agricultural industries to manage smoke and ash from agricultural burning more effectively. Although voluntary, growers are strongly encouraged to incorporate these guidelines as routine management practices.

Objective

These guidelines should assist with managing smoke and ash from agricultural prescribed burning operations to reduce their effects on public health and welfare. In agricultural prescribed burning, it is recognized that numerous factors affect the fire's behavior and the resulting smoke and ash. These principles offer basic guidance to consider when prescribed burning is done.

Nothing in these guidelines shall be construed as allowing any person to be in violation of any regulations, laws, ordinances or orders of the state of Louisiana (or any other governmental entity having jurisdiction) or to relieve any person from the consequences of damage or injuries that may result from burning activities because of negligence.

Administration, Training and Communications

The Certified Prescribed Burn Manager program is administrated by the Louisiana Department of Agriculture and Forestry. The Louisiana Department of Agriculture and Forestry and the LSU AgCenter developed the Louisiana Smoke Management Guidelines for Agriculture and will provide training and program information for agricultural producers.

Growers should make every attempt to provide education and training to their employees who conduct prescribed burning operations. A thorough explanation of the goals and recommendations will help employees understand the importance of smoke and ash management. In addition, prescribed agricultural burns should always be attended by appropriate personnel. Proper equipment for controlling and confining fires, including a water tank, should be available at all burns.

The ability of growers to conduct controlled agricultural burning is a significant economic factor for many industries, especially the sugar industry. It is critical growers do the best job possible regarding smoke and ash management.

Louisiana is not the only state facing this challenge. Every industry that uses prescribed burning recognizes that reducing or eliminating open field burning is one of the most important research topics facing it. Researchers are working to identify the most effective techniques for handling agricultural plant material.

Procedure

When prescribed burning is to be used in agriculture, the recommended procedures are:

Step 1. Identify smoke-sensitive areas

Step 2. Obtain fire weather forecast

Step 3. Develop a prescribed burn plan

Step 4. Determine smoke category day

Step 5. Determine smoke and ash screening distances

Step 6. Determine direction of smoke and ash plume

Step 7. Evaluate prescribed burn results

Step 1. Identify smoke-sensitive areas

Obtain a map that shows each farm or field to be burned. Each map should show sensitive areas within a 20-mile radius of each field. Also, identify all sensitive areas adjacent to or within the farm and mark them on your map. The map then will show the fields to be burned and all potential sensitive areas within 20 miles in all directions from your farm or field.

The first step toward effective smoke and ash management is the awareness of where people, buildings, utility structures and highways are located that could be negatively affected by open field burning. People with health problems who live in areas potentially affected by open field burning should be identified before the harvest season begins. This requires effective communication between growers and the public. Determination of downwind sensitive areas that could be affected by burning is important to help reduce the effects of ash "fallout." Smoke and ash sensitive areas include airports, highways, communities, recreation areas, schools, hospitals, utility substations, subdivisions, individual homes, factories, nursing homes and so forth.

Knowledge of power lines, substations and gas lines. Open field burning should be carefully undertaken when power and gas lines or utility substations are present in the field or surrounding areas. Fire can destroy wood utility poles and cause disruption of electrical service when smoke and ash envelop utility lines. Areas around wooden poles should be kept free of weeds, and crops should not be grown immediately adjacent to the wooden poles. The area around the poles and under power lines should be back burned from the side. As with any sensitive area, a water tank should be in the immediate area, and the person responsible for the burn should remain on site until the burn is completed and declared safe.

When utility substations are adjacent to fields, ash from burning can cause serious problems. Communication with utility company personnel and back burning around the facility should be practiced. With sugarcane harvesting operations, the combine's extractor fan hoods should be turned in the opposite direction to avoid cane trash (burnt or green) from being blown into the station.

Classification of "no-burn" fields. Certain fields, because of their proximity to extremely sensitive areas, should never be burned. For sugarcane growers, these fields can be cut green with combine harvesters, and growers using whole-stalk harvesters should arrange with the mill to accept unburned cane from these fields.

Communication with fire districts should be practiced. Growers should notify their local fire district(s) of daily burn plans and locations. Many motorists will call 911 to report a field on fire, and by law, the fire company must respond unless they have been notified prior to the prescribed burn.

Step 2. Obtain fire weather forecast

Growers can obtain the fire weather forecast and smoke category day from the Internet. There are three weather variables that a burn plan must have: (1) surface winds, (2) transport winds and (3) category day. Two other variables, the surface inversion lifting temperature — known as SILT or Mix HGHT 500 (degrees Fahrenheit) — and forecast weather changes, will help the certified prescribed burn manager understand the weather for that particular day. These factors are used to determine the potential for fire, smoke and/or ash problems resulting from a prescribed burn.

The forecasts are provided on the Internet by the National Weather Service from offices in Shreveport, Lake Charles, New Orleans, and Jackson, Mississippi (for northeast Louisiana). This information is available each morning. The National Weather Service also will broadcast the category day on the National Oceanic and Atmospheric Administration weather radio channel. The Internet addresses are:

Lake Charles area: https://forecast.weather.gov/product.php?site=NWS&product=FWF&issuedby=LCH

New Orleans area: https://forecast.weather.gov/product.php?site=NWS&product=FWF&issuedby=LIX

Northwest Louisiana: https://forecast.weather.gov/product.php?site=NWS&product=FWF&issuedby=SHV

Northeast Louisiana: https://forecast.weather.gov/product.php?site=NWS&product=FWF&issuedby=JAN

Important Note: Occasionally, during periods of relatively stagnant air, the National Weather Service, at the request of the Louisiana Department of Environmental Quality, will issue an air stagnation advisory. This advisory requires a smoke management Category Day 1 be issued. When an air stagnation advisory is issued, growers are asked not to ignite new fires and to complete any fires burning at the time the advisory is declared.

Step 3. Develop a prescribed burn plan

A prescribed burn plan should be completed by each grower. One plan can be completed for an entire farm or for an individual field. You can print this page for your use.

1 Prescribed Burn Plan

Farm Operator _____

Address _____

Farm Location _____ City _____

State and ZIP _____ Parish _____

Field Identification _____

2 Things to Consider Before the Burn:

Personnel and Equipment Needed _____

Special Precautions _____

Smoke and Ash Sensitive Areas

Notification List

Weather Information	**3 Acceptable Range**	**4 Forecast**	**5 Actual**
Surface Winds			
Speed			
Direction			
Transport Winds			
Speed			
Direction			

Category Day _____

6 Surface Inversion Lifting Temperature _____

7 Possible Weather Changes _____

8 Fire Problems _____

Smoke or Ash Problems _____

9 Ignition Time _____ Completion Time _____

Plan Completed By _____ Signature _____ Date _____

10 Burn Completed By _____ Signature _____ Date _____

1. **Farm information:** Space is provided for identifying the farm operator. Field identification asks you to identify what fields will be covered by this plan. A simple statement such as "see attached map" is acceptable, and an actual map or drawing is to be included with this plan, if necessary.

2. **Things to consider before the burn:** Before the burn is started, the grower or the individual conducting the burn should think through the burn process and plan for possible problems. Some considerations to include:

   - Are any special people or equipment needed before, during or after the burn to make it safer?
   - Do any special precautions need to be taken before the field is ignited, such as clearing around utility poles and utility substations?
   - Identify ALL sensitive areas, such as homes, subdivisions, hospitals, schools, etc.
   - Notify individuals in any sensitive areas of the upcoming burn.

3. **Acceptable ranges in weather:** Enter an acceptable range for surface winds, transport winds and category day. These values are determined by the grower prior to harvest season. Using the burn plan map, a grower can determine the best surface wind directions, as well as the acceptable category days for that farm.

4. **Weather forecast:** Enter the forecast values for surface winds, transport winds and category day as given by the fire weather forecast on the day of the burn.

5. **Actual weather:** Enter the actual values for surface winds as determined by the certified prescribed burn manager on the day of the burn and at the actual field location at the time of ignition.

6. **Surface inversion lifting temperature (SILT):** Enter the SILT (surface inversion lifting temperature) as given by the fire weather forecast on the day of the burn. Knowing this temperature, a grower can determine at approximately what temperature an inversion will start to rise. Some fire weather forecasts use "MIX HGT 500 Temperature (Fahrenheit)" in place of SILT.

7. **Possible weather changes:** Evaluate and record any predicted changes in the weather for the day of the burn, especially in wind direction. For instance, a fast-moving cold front will cause the wind to change direction and speed drastically.

8. **Fire problems and smoke or ash problems:** This area gives you a place to note any problems with fire, smoke or ash for future reference. Even the smallest event noted could prove to be important at some time in the future.

9. **Ignition time and completion time:** Enter the time of day that the burn was started (ignition time) and the time of day the burn was completed and declared safe (completion time).

10. **Plan completed by and burn completed by:** Enter name of person who prepared the burn plan and the certified prescribed burn manager who actually conducted the burn. This requires a signature and date. Use the back of this form to record comments that can provide guidance for future burning or other beneficial information.

Step 4. Determine smoke category day

A grower can obtain the smoke category day from the official fire weather forecast on the internet.

Burn only during acceptable times and weather conditions. Wind direction, wind velocity and air temperature inversion layers (surface inversion lifting temperature) drastically affect smoke and ash management. Fields are seldom burned during the early morning hours because of dew, so early morning weather usually is not of great concern. Accordingly, many growers will burn later in the day; however, afternoon temperature inversions (normally after 4 p.m.) often occur. When a temperature inversion occurs, upper air temperatures prevent smoke and ash from rising, causing the smoke and ash to drift laterally. This can affect highways, residences, and public areas. To reduce risk to sensitive areas, growers should avoid burning in the late afternoon or evening. The ideal time to burn often is between 10 a.m. and 4 p.m. There should be no burning at night.

Table 1. Smoke Category Day

Category Day	Recommendation
1	No burning
2	No burning until after 11 a.m. and not before the surface inversion has lifted. Fires should be burned out by 4 p.m.
3	Burning after the surface inversion has lifted. Fires should be burned out by 4 p.m.
4	Burning anytime during the day. Fires should be burned out by 4 p.m.
5	Unstable and windy. Excellent smoke dispersal. Burn with caution. Fires should be burned out by 4 p.m.

Step 5. Determine smoke and ash screening distances

The type of burn, together with the category day, will determine the distance downwind that may be adversely affected by smoke and ash. The grower must identify where people, buildings, utility structures and highways are located within the area that could be negatively affected by smoke and ash. The most important weather condition to consider for ash screening distance is the surface and transport wind direction.

Identify a planned burn as one of the three following categories: (1) backing fire, (2) head fire or (3) piles/windrows. (See glossary for descriptions.)

Using the following table, find the block that represents your type of burn and the forecast category day. The number in that block is the minimum number of miles downwind from the burn that smoke and ash may have an effect on sensitive areas. It is this distance downwind that the grower needs to examine for possible smoke- and ash-sensitive areas, such as airports, highways, communities, recreation areas, schools, hospitals, utilities, subdivisions, residences, factories and nursing homes.

Table 2. Potentially affected areas — distances from burn site

Type of Burn	Category Day				
	1	2	3	4	5
Backing fire	No burn	10 miles	5 miles	3 miles	1 mile
Head fire	No burn	20 miles	10 miles	5 miles	1 mile
Piles/ windrows	No burn	30 miles	15 miles	8 miles	1 mile

Important: When burning standing sugarcane, the ash produced potentially becomes the most important factor to consider. Unlike smoke, ash will travel farther on a Category 5 day than on a Category 2 day. When considering the distance ash will travel, the certified prescribed burn manager must understand the screening distances for ash are somewhat the reverse of the distances predicted for smoke.

The best available information shows the majority of ash will "fall out" within 3 to 5 miles from the burn site on a Category 3 or Category 4 day with winds of 10 to 15 mph, and a lesser amount of ash will continue to "fall out" for the next 15 to 20 miles.

Note: *The most important weather condition to consider for ash screening distance is the surface and transport wind direction.*

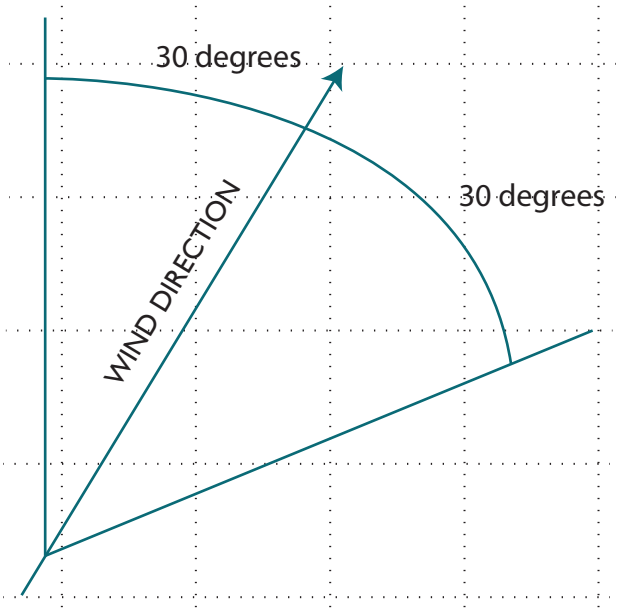
6. Determine direction of smoke and ash plume

By using a template like the one shown in Figure A, a certified prescribed burn manager can determine the direction smoke and ash will travel from a particular field based on the wind direction at ground level and the transport wind direction and speed. The distance smoke and ash will travel is determined in Step 5. Use the template shown (Figure A), or you can draw the template directly on a map. The following are the steps used in determining the trajectory of a smoke and ash plume:

- Locate the burn site on a map.
- Draw a line indicating the wind direction from the burn site. This centerline will represent the path of the smoke plume. Mark this centerline in miles from the burn site for the potential distance of smoke and ash travel/effects. (See Table 2.) Every map will have a scale showing miles per inch. Use only the scale shown on your map.

• To allow for normal smoke and ash movement, as well as shifts in wind direction, draw two other lines from the burn site at an angle of 30 degrees from the centerline. (See Figure A.) The area contained within this 60-degree arc and the mileage indicated by the centerline are the potential areas to be affected by smoke and ash.

Figure A. Smoke- and Ash-Affected Area Step



Step 7. Evaluated prescribed burn results

Evaluate the results and success of the burn. Make any necessary notations on your prescribed burn plan for that particular farm or field. Keep your completed burn plan for future reference.

Glossary

Air Stagnation Advisory (ASA): A statement issued by a National Weather Service forecast office when atmospheric conditions are stable enough that the potential exists for air pollutants to accumulate in a given area. The statement initially is issued when conditions are expected to last for at least 36 hours.

Backing Fire: The fire spreading against the wind. Flames tilt away from direction of spread. Less smoke results from a backing fire.

Category Day: A scale from 1 to 5 based on ventilation rates. For smoke dispersal, 1 is poor and 5 is good.

Certified Prescribed Burn Manager (CPBM): An individual who successfully completes (1) an approved certification-training program, (2) passes a written test, (3) has performed five agricultural burns successfully and (4) is certified by the Louisiana Department of Agriculture and Forestry.

Head Fire: A fire spreading with the wind. Flames tilt in the direction of the spread.

Inversion: An increase of temperature with an increase of height in the atmosphere. Vertical motion in the atmosphere is inhibited, allowing for pollution buildup. A "normal" atmosphere has temperature decreasing with height.

Meter (m): Basic unit of length in the metric system. There are 39.37 inches per meter, 3.28 feet per meter or 1.1 yards per meter.

Meters Per Second (mps): Expression of meters traveled each second. One meter per second is equal to 2.2 miles per hour.

Mixing Height: Measured from the sea level upward, the height to which relatively vigorous mixing occurs because of convection, which is the same as the mixing depth. Use of the term normally implies presence of an inversion, and the base of the inversion is the top of the mixed layer and defines the mixing height. Minimum recommended mixing height is 500 meters (1,640 feet).

Particulate Matter: Any liquid or solid particles. "Total suspended particulates," as used in air quality, are those particulates suspended in or falling through the atmosphere. They generally range in size from 0.1 to 100 microns.

Piles/Windrows: Stacking of cut sugarcane or other agricultural debris. This generally is the slowest type of burn. For sugarcane, this material usually is wetter and results in greater smoke emission and less ash.

Plume: The segment of the atmosphere occupied by the emission from a single source or a grouping of sources close together. A convection column, if one exists, forms a specific part of the plume.

Prescribed Burn: A prescribed burn means the controlled application of fire to any agriculturally related fields under weather conditions that allow the fire to be confined to a predetermined area while minimizing the effects of associated smoke and ash. It is used, for example, in sugarcane production to reduce vegetative trash during harvest.

Screening Distance: The area to examine for potentially sensitive targets.

Sensitive Targets: Areas that can be adversely affected by smoke and ash. Examples: Airports, major highways, communities, recreation areas, schools, hospitals, nursing homes, subdivisions, residences and factories.

Smoke Management: Conducting a prescribed burn under specific field and meteorological conditions – and with burning techniques that keep the effects of smoke and ash on the environment within acceptable limits.

Surface Inversion Lifting Temperature (SILT): The ambient air temperature in which the surface inversion should lift.

Transport Wind Speed: A measure of the average rate of the horizontal transport of air within the mixing layer. May also be the wind speed at the final height of plume rise. Generally refers to the rate at which emissions will be transported from one area to another. Minimum recommended transport wind speed is 4 meters per second (8.8 mph).

Ventilation Rate: The mixing height multiplied by the transport wind speed gives a rate indicating the capability of the lower atmosphere to diffuse and disperse smoke. Ventilation rate is calculated by multiplying the afternoon mixing height in meters by the transport wind speed in meters per second. The minimum recommended mixing height (500 meters) and the minimum recommended transport wind speed (4 meters per second) provide the minimum recommended ventilation rate of 2,000 (500 times 4 = 2,000).

Warm Front: The leading edge of a relatively warm air mass that moves in such a way that warm air displaces colder air. Winds associated with activity of a warm front usually are light, and mixing is limited. The atmosphere is relatively stable compared to cold-front activity.

Wind Shear: A variation in wind speed and/or direction in a layer of the atmosphere or between layers. The variation may be in the horizontal or vertical and may result in significant turbulence, depending on the magnitude of the wind speed/direction difference. A strong wind shear may act like an inversion and inhibit plume rise. It also may fracture the smoke plume, not allowing smoke and ash to rise much above terrain levels. A strong horizontal anticyclonic shear results in a downward motion and may bring smoke and ash aloft back to the surface.

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