

Louisiana **Smoke Management Guidelines for Sugarcane Harvesting**

Training Summary Report - Summer 2000



Louisiana Smoke Management Guidelines for Sugarcane Harvesting

Introduction

Prescribed burning as a harvest management tool in sugarcane is a widely used practice. There are numerous environmental and public issues associated with this practice, and the state is instituting a voluntary smoke and ash management program to assist growers in addressing these issues. Additionally a number of research projects are under way to address possible remedies to cane burning. Growers should have a responsible attitude toward environmental and public issues while attempting to be as efficient as possible in sugar production. There are several objectives which growers should always strive to achieve with regard to smoke and ash management:

- , Minimize the adverse effect caused by open field burning of sugarcane.
- , Prevent it from being blown across public highways and airports.
- , Prevent it from affecting public areas, especially public health facilities such as hospitals, clinics, nursing homes and doctors' offices, etc.
- , Prevent it from affecting schools during times when students and teachers are present.
- , Prevent it from affecting subdivisions, individual homes and other housing facilities.
- , Minimize ash fallout that may result from burning sugarcane.

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 sugarcane fields under weather conditions that allow the fire to be confined to a predetermined area, in a manner that will produce the desired result of reducing trash in the delivered cane supply. Smoke and ash management can be defined as conducting a prescribed burn under recommended weather conditions and with burning techniques to lessen the impact of smoke and ash generated from 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 the industry to manage smoke and ash from sugarcane burning more effectively. Although voluntary, growers are strongly encouraged to incorporate these guidelines as routine harvesting practices.

Objective

The guidelines are intended to manage smoke and ash from sugarcane prescribed burning operations to lessen their impact on public health and welfare. In sugarcane prescribed burning, it is recognized that numerous variables affect the fire behavior and resulting smoke and ash. These guidelines do not attempt to consider all the variables affecting smoke and ash behavior, but only offer basic guidance. 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 other governmental entity having jurisdiction or to relieve any person from the consequences of damages or injuries that may result from burning activities because of negligence.

Administration, Training and Communications

The Certified Prescribed Burn Manager (CPBM) program is administrated by the Louisiana Department of Agriculture and Forestry. The Louisiana Department of Agriculture and Forestry (LDAF), the American Sugar Cane League and the LSU AgCenter developed the *Louisiana Smoke Management Guidelines for Sugarcane Harvesting* and will provide training and program information for growers.

Growers should make every attempt to provide education and training to their employees who conduct burning operations. A thorough explanation of the goals and recommendations will help employees understand the importance of smoke and ash management. Additionally, it should be emphasized that prescribed burning burns should not go unattended. Proper equipment for controlling and confining fires, including a water tank, should be available at all burns.

The sugarcane industry's ability to burn sugarcane is a significant economic factor for the survival of the sugarcane industry. Until proven technology allows economically efficient harvesting without burning, it is critical that growers and processors do the best job possible with regard to smoke and ash management. Louisiana is not the only state, nor is sugar production the only industry, 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 the trash layer. In the meantime, many growers concerned about stand loss as a result of the trash mat will likely continue to burn the trash layer later in the year. The same smoke and ash management practices need to be followed, regardless of the time of the year the trash layers are burned.

Procedure

When prescribed burning of sugarcane is to be used, the recommended procedures are:

- Step 1. Identify Areas Sensitive to Smoke and Ash
- 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 Distance
- Step 6. Determine Trajectory of Smoke and Ash Plume
- Step 7. Evaluate the Prescribed Burn Results

Note: In sugarcane prescribed burning, it is recognized that numerous variables affect the fire behavior and resulting smoke and ash. These guidelines do not attempt to consider all the variables, but they offer only basic guidance.



Step 1. Identify Smoke Sensitive Areas

Obtain a map that shows each farm or field to be burned. Each map should show sensitive areas that are within a 20-mile radius from each field. Also identify all sensitive areas adjacent to or within the farm and mark them on your map. The map will then 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 communications between growers and the public. When burning cane heaps that are harvested by soldier machines, the smoke normally does not contain much ash. However, hotter fires from standing cane cause rising ash that later “falls out.” This can create a problem long distances from the burn. Determination of downwind sensitive areas that could be affected by burning cane is important to help reduce the impact of ash “fallout.” Smoke and ash sensitive areas include airports, highways, communities, recreation areas, schools, hospitals, utility substations, subdivisions, individual homes, factories and nursing homes, etc.

Knowledge of power lines, substations and gas lines. Open field burning, especially burning of uncut fields prior to chopper harvesting, should be carefully undertaken when power and gas lines or utility substations are present in the field or surrounding fields. 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 cane should not be grown immediately adjacent to the wooden poles. The area around the poles and under power lines should be cut green when practical or 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 cane fields, ash from burning cane as well as green trash blown from combine extractor fans can cause serious problems. Communication with the utility company personnel and back burning around the facility should be practiced. When combine harvesting, 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. Growers using combine harvesters can cut them green and growers using soldier harvesters should make arrangements with the mill to accept cane from these fields unburned.

Communication with Fire Districts should be practiced. Growers should notify their local Fire Districts 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 during harvest season from their sugar mills and 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, SILT and forecasted weather changes, will help the CPBM 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 transmitted on the Internet by the National Weather Service (NWS) from offices in Shreveport, Lake Charles and New Orleans. This information is available by 9:00 a.m. each day.

The National Weather Service will also broadcast the Category Day on the National Oceanic and Atmospheric Administration (NOAA) weather radio channel.

The Internet addresses are:

- Lake Charles area: <http://www.boi.noaa.gov/firewx/NEFWFLCH.html>
- New Orleans area: <http://www.boi.noaa.gov/firewx/NEFWFNEW.html>
- Shreveport area: <http://www.boi.noaa.gov/firewx/NEFWFSHV.html>
- Statewide: <http://forestry.ldaf.state.la.us/public/default.htm>

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 (ASA). This advisory requires a smoke management Category Day 1 be issued. When an ASA is issued, growers are asked not to ignite new fires and to complete any fires burning at the time the Air Stagnation Advisory is declared.

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Step 3. Develop a Prescribed Burn Plan

A Prescribed Burn Plan should be completed by each grower prior to the harvest season. One plan can be completed for an entire farm or for an individual field. All information needed to plan and conduct a burn and for comments concerning the burn is contained in this form.

Prescribed Burn Plan

1 Farm Operator _____
 Address _____ Farm Location _____
 City _____
 State & Zip _____ Parish _____
 Field Identification: _____

2 **Pre-Burn Considerations:**
 Personnel & 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 (SILT) _____

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 _____

What to include in a Prescribed Burn Plan:

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 as “see attached map” is acceptable, and an actual map or drawing is to be included with this plan if necessary.
2. **Pre-Burn Considerations:** In pre-burn considerations before the burn is started, the grower and/or the individual conducting the burn should think through the burn process and plan for possible problems. Some considerations to include:
 - a. Are any special people or equipment needed before, during or after the burn to make it safer?
 - b. Do any special precautions need to be taken before the field is ignited, such as, pre-cutting cane around utility poles and utility substations?
 - c. Identify ALL sensitive areas, especially those that may have been built since the last burn.
 - d. Identify sensitive areas and notify individuals 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 forecasted 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 CPBM on the day of the burn and **at the actual field location at the time of ignition**.
6. **Surface Inversion Lifting Temperature:** 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 approximately at what temperature an inversion will start to rise.
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 that 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 CPBM 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

During harvest season, a grower can obtain the smoke category day from the fire weather forecast from each sugar mill and/or the Internet.

Burn only during acceptable times and weather conditions. Wind direction, wind velocity and air temperature inversion layers (SILT) drastically affect smoke and ash management. Since cane fields are seldom burned during the early morning hours because of dew and wet leaves, early morning weather is usually not of great concern. However, many growers burn cane later in the day when afternoon temperature inversions (normally after 4:00 p.m.) often can 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 impact highways, residences and public areas. To reduce risk to sensitive areas, growers should avoid burning in the late afternoon. The ideal time to burn is often between 10:00 a.m. and 4:00 p.m.

Table 1 - Smoke Category Day

Category Day	Recommendation
1	NO BURNING
2	No burning until after 11 a.m. and not before surface inversion has lifted. Fire should be substantially burned out by 4 p.m.
3	Daytime burning after surface inversion has lifted.
4	Burning anytime.
5	“Unstable and Windy.” Excellent smoke dispersal. Burn with caution.

NOTES: _____



Step 5. Determine Smoke and Ash Screening Distance

The type of burn, together with the category day, will determine the distance downwind that may be adversely impacted by smoke and ash. The grower must identify where people, buildings, utility structures and highways are located within the impact 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, (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 impact 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, etc.

Table 2 - Potential Impact Area 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 cane**, the ash produced potentially becomes the most important factor to consider. Unlike smoke, ash will travel further on a category 5 day than on a category 2 day. When considering the distance that ash will travel, the CPBM must understand that the screening distances for ash are somewhat the **reverse** of the distances predicted for smoke.

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

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



Step 6. Determine Direction of Smoke and Ash Plume

By using a template like the one shown in figure A, a CPBM 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:

1. Locate the burn site on a map.
2. 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 impact (see Table 2). Every map will have a scale showing miles per inch. Use only the scale as shown on your map.
3. 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 smoke and ash impact areas.

Figure A, Smoke and Ash Impact Area



Step 7. Evaluate the 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 is initially 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 sugarcane burns successfully and (4) is certified by the Louisiana Department of Agriculture and Forestry (LDAF).

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/meter, 3.28 feet/meter, 1.1 yards/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. Same as 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: Staking of cut cane. This is generally the slowest type of burn. The material is usually 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 in a confined predetermined area to accomplish the harvest of sugarcane under specified smoke and ash management guidelines. It is used in sugarcane production to reduce vegetative trash during harvest.

Screening Distance: The area to examine for potential 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, factories, etc.

Smoke Management: Conducting a prescribed burn under specific field and meteorological conditions, and with burning techniques that keep the smoke and ash impact 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 mps (8.8 mph).

Ventilation Rate: The mixing height times 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 mps) provide the minimum recommended ventilation rate of 2000 ($500 \times 4 = 2,000$).

Warm Front: The leading edge of a relatively warm air mass which moves in such a way that warm air displaces colder air. Winds associated with warm frontal activity are usually 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.

LOUISIANA SUGAR FACTORIES

Alma Plantation (225) 627-6666	Evan Hall Factory (225) 473-8241	Lula Sugar Factory (225) 473-9293
Cajun Sugar Cooperative, Inc (337) 365-3401	Glenwood Cooperative, Inc. (504) 369-2941	Westfield Sugar Factory (504) 369-6450
Caire & Graugnard (504)-497-3351/497-8500	Iberia Sugar Co-op., Inc. (337) 364-1913	Raceland Raw Sugar Corp. (504) 537-3533
Caldwell Sugars Co-op, Inc. (504) 447-4023	Jeanerette Sugar Co., Inc. (337) 276-4238	St. James Factory (225) 265-4057
Cinclare Central Factory (225) 749-2861	Lafourche Sugar Corp. (504) 447-3210	St. Mary Sugar Co-op, Inc. (337) 276-6761
Cora-Texas Mfg. Co., Inc. (225) 545-3679	Louisiana Sugarcane Co-op (337) 394-3255	Sterling Factory (337) 828-0620
Enterprise Factory (337) 276-4592		

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