# Crop Residue Burning Program Operating Guide

**State of Idaho**
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# Crop Residue Burning Program Operating Guide

**June 2014**

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# Acronym List

| | |
|---|---|
| CRB | crop residue burning |
| CMAQ | Community Multiscale Air Quality |
| CRP | Conservation Reserve Program |
| CREP | Conservation Reserve Enhancement Program |
| DEQ | Department of Environmental Quality |
| GPS | Global Positioning System |
| ISP | institution with sensitive populations |
| MM5 | mesoscale meteorological model |
| mph | miles per hour |
| NAAQS | National Ambient Air Quality Standards |
| NRCS | Natural Resources Conservation Service |
| NWS | National Weather Service |
| $O_3$ | ozone |
| $PM_{2.5}$ | particulate matter less than 2.5 microns in diameter |
| $PM_{10}$ | particulate matter less than 10 microns in diameter |
| ppb | parts per billion |
| RH | relative humidity |
| SIP | State Implementation Plan |
| SMA | smoke management area |
| TRIM | records management database used by DEQ |
| $\mu g/m^3$ | micrograms per cubic meter |
| USDA | US Department of Agriculture |

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# 1 Purpose

The purpose of this operating guide is to serve as the main crop residue burning (CRB) smoke management program implementation guide. It describes in detail the overall and day-to-day operation of the program, including grower and Idaho Department of Environmental Quality (DEQ) requirements, roles and responsibilities of DEQ staff, CRB program policies and procedures, and program evaluation and annual review requirements. The appendices contain useful reference tools such as weather forecasting websites and burn decision procedures. Since the CRB program is dynamic and still evolving to incorporate identified program improvements, this operating guide will be reviewed on an annual basis and revised as necessary.

DEQ's CRB program and this operating guide do not apply to crop residue burning on tribal lands within reservation boundaries. Interested parties should contact individual tribes for information on crop residue burning on reservations in Idaho.

For ease of reading, this operating guide refers to all persons who conduct crop residue burning as "growers." However, this does not mean that only growers may conduct crop residue burning. Any person may conduct crop residue burning so long as the burning is conducted in accordance with the requirements of the CRB program, CRB rule (IDAPA 58.01.01.617–624), and State Implementation Plan (SIP).

# 2 Program Requirements

The following is a summary of the commitments made during the crop residue disposal negotiation process and memorialized in the statute (House Bill 557), CRB rule, and SIP. More detailed descriptions of the policies and procedures are in following sections and the appendices.

## 2.1 Burning Subject to DEQ's Crop Residue Burning Program

The following burning is regulated under DEQ's CRB program and must comply with the rules and regulations of the program:

- Residue from traditional crops—Includes, but is not limited to, cereal grain, row crops, alfalfa, hay, and Kentucky blue grass
- Conservation Reserve Program (CRP) and Conservation Reserve Enhancement Program (CREP) lands—Includes the burning of CRP and CREP land while the land remains in the programs and when the land is being taken out of the program to return to agricultural production
- Pasture—Grazing lands comprised of introduced or domesticated native forage species that are used primarily for livestock production. Lands receive periodic renovation and/or cultural treatments such as tillage, fertilization, mowing, and weed control and may be irrigated (US Department of Agriculture, Natural Resources Conservation Service [USDA, NRCS] "National Range and Pasture Handbook," December 2003).
- Wildlife habitat areas or habitat improvement areas that include nonnative vegetation or food crops that provide forage

- Weed patches within a crop field
- Spot and bale burning
- Propane flaming

The following burning is **not regulated** under DEQ's CRB program but is regulated under other open burning rules:

- Orchard clippings—Regulated under IDAPA 58.01.01.613, "Orchard Fires."
- Rangeland—Land on which the historic climax plant community is predominantly grasses, grass-like plants, forbs, or shrubs. Includes lands revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing (USDA, NRCS "National Range and Pasture Handbook," December 2003). Regulated under IDAPA 58.01.01.614, "Prescribed Burning."
- Wildlife habitat areas or habitat improvement areas that include only native vegetation and not food crops. Regulated under IDAPA 58.01.01.614, "Prescribed Burning."
- Ditch banks, fence lines, and canal banks (includes rock piles in a field but does not include weed patches in a field that are not within rock piles). Regulated under IDAPA 58.01.01.608, "Weed Control Fires."
- Residential yard waste—Includes tree leaves, yard trimmings, and gardening waste. Regulated under IDAPA 58.01.01.611, "Residential Solid Waste Disposal Fires."

## 2.2 Grower Requirements

Growers must complete the following activities for crop residue burning. Spot and bale burning and propane flaming requirements are discussed in Appendix A.

- Register for a permit at least 30 days prior to the proposed burn date and provide the following information:
  - Location of the field
  - Plot plan showing the field location and property lines in relation to the nearest residential, public, and commercial properties and public roads
  - Type of crop residue, acreage, and fuel characteristics
  - Fire prevention measures that will be available
  - Requested burn date
- Pay a registration fee of $2 per acre, which must be submitted at least 7 days prior to the requested burn date.
- Obtain all necessary local or State fire safety permits. These may include permits from the Idaho Department of Lands (IDL) or local fire district offices. As a convenience to the grower, DEQ's CRB online application communicates with IDL's burn permit system to assist in issuing IDL burn permits. If you have questions about fire safety permits please contact IDL at 866-581-6498.
- Successfully complete the CRB training prior to burning and renew the training every 5 years.
- Notify DEQ 2–3 days before a specific field is ready to burn so it can be placed on the ready-to-burn list.
- Contact appropriate agency to determine any requirements for public roadway safety.
- Obtain approval from DEQ prior to burning.

- Carry a portable form of communication during the burn.
- Burn crop residue only in the field where it was generated.
- Report postburn results to DEQ within 24 hours. If the grower fails to submit a postburn report, he risks losing priority for his next burn. The postburn report must be submitted using either the online tool (preferred) or by communication with the DEQ staff (Seasonal Smoke Coordinator or Regional Office Analyst). Grower name, permit number, field name, and burn date are automatically generated in the online postburn report. The following additional information must be entered for the postburn report:
    - Number of acres burned
    - Any comments about the burn or feedback on how the program was effective or ineffective

## 2.3 DEQ Requirements per Rules and Statute

The following is a list of requirements that DEQ must follow when approving crop residue burns:

- Approve or deny requests to burn:
    - To approve a request to burn, DEQ must determine that ambient air quality levels meet both of the following criteria:
        1) Do not exceed 75% of the level of any National Ambient Air Quality Standard (NAAQS) on any day and are not projected to exceed such level over the next 24 hours
        2) Have not reached, and are not forecasted to reach and persist at, 80% of the 1-hour action criteria for particulate matter under IDAPA 58.01.01.556
    - May not approve crop residue burning on weekends, federal or state holidays, after sunset or before sunrise, or during an episode of air stagnation or degraded air quality.
    - May not approve crop residue burning within 3 miles of institutions with sensitive populations (ISPs) when surface wind speeds exceed 12 miles per hour (mph) at the field.
- Assemble an advisory committee consisting of representatives from environmental organizations, grower organizations, tribal organizations, health organizations, the Idaho State Department of Agriculture, DEQ, and others to discuss the CRB program.
- Consider the following parameters when making a burn decision (please see section 4.3.1 for a full discussion of burn parameters and criteria):
    - Expected emissions from all burns proposed for the same date
    - Proximity and emissions from other burns within the area
    - Moisture content of the crop residue
    - Acreage, crop type, and fuel characteristics
    - Meteorological conditions
    - Proximity to ISPs
    - Proximity to public roadways and airports
    - Any other factors relevant to preventing exceedances of the program concentration limits or action levels defined by the statute, CRB rule, or SIP

- Designate burn or no-burn days, post the burn decision daily on the website, and offer an e-mail update service with the following information:
    - Burn or no-burn determination
    - Locations of proposed burns and number of acres permitted to be burned in each county
    - Meteorological conditions and real-time ambient air quality monitoring data
    - Toll-free number to receive requests for information
- Provide near real-time information on whether a given day is a burn or no-burn day, location of approved burns and number of acres permitted to be burned, meteorological conditions, and real-time air quality monitoring data.
- Implement an enhanced documentation process for instances when air quality monitoring levels reach trigger limits prior to the burn approval process or when air quality monitoring levels reach trigger limits following an approved crop residue burn.
- Prepare an annual report that includes, at a minimum, an analysis of exceedances of the program concentration limits that were reasonably suspected to have been caused or contributed to by approved crop residue burning and an assessment of the circumstances around any reported endangerment to human health associated with approved crop residue burning. The report shall also include recommended revisions to the CRB rule or this operating guide deemed necessary to prevent future exceedances of the program concentration limits.

# 3 Roles and Responsibilities of DEQ Staff

The following descriptions of roles and responsibilities explain what occurs during the fall burn season. During the fall burn season, DEQ uses a meteorologist to assist with fire weather forecasting, make preliminary burn decisions the day before a requested burn, and conduct conference calls during the preliminary and final burn decision process. During the spring burn season, the Smoke Management Analyst usually develops the forecast and works individually with the regional office staff to make the final burn decision; however DEQ's meteorologist is available to assist with forecasting throughout the year as needed.

Please note, DEQ has no responsibility for fire safety or prevention. The person conducting the burn is responsible for obtaining all required permits, taking all appropriate fire safety measures, having appropriate fire safety equipment, and overseeing the burn until the fire is out. If the fire escapes, the person conducting the burn can be held liable for property damage and fire suppression costs. If a burn escapes, DEQ staff shall move themselves and their vehicles to a safe area. DEQ staff shall not assist in controlling the fire. Failure to control a fire is a violation of General Permit Condition #2. A notice to comply or notice of violation should be issued when there is sufficient evidence to document such a violation. The applicable rule citation for this violation is IDAPA 58.01.01.621.02.

## 3.1 Smoke Management Program Coordinator

DEQ employs one Smoke Management Program Coordinator who works out of the State Office in Boise. The Smoke Management Program Coordinator is responsible for smoke management

for all types of allowable forms of open burning statewide on lands outside the five Indian reservations.

The Smoke Management Program Coordinator's roles and responsibilities for the crop residue program are as follows:

- Serve as the main point of contact for DEQ with the CRB Advisory Committee.
- Develop training for growers and DEQ staff.
- Ensure program implementation complies with the statute, CRB rules, and the SIP.
- Serve as the main point of contact for the CRB program with the air quality enforcement program.
- Provide back-up for the Smoke Management Analysts as needed.

## 3.2 Smoke Management Analyst

DEQ employs two Smoke Management Analysts: one for northern Idaho and one for southern Idaho. The Smoke Management Analyst for northern Idaho works out of the Lewiston Regional Office and also fulfills the role of Regional Office Analyst (section 3.4) for the Lewiston Office. The Smoke Management Analyst for southern Idaho works out of the State Office in Boise.

The Smoke Management Analysts' roles and responsibilities are as follows:

- Serve as primary contact for their respective area of the state.
    - Internal to DEQ—year-round
    - External to DEQ—during non-burn season
- Review and process registration forms.
    - Determine completeness and contact grower if additional information is needed
    - Identify ISPs, public roadways, airports, and populated areas
    - Identify initial permit requirements
    - Approve the registration and issue the "Registration Receipt and Initial Permit Requirements" document and cover letter
- Review the meteorological forecast and air quality monitoring data.
- Participate in daily conference calls with Seasonal Smoke Coordinators (section 3.3), regional office staff, and the meteorologist.
- Issue daily burn decisions by county, including the number of acres per county—see section 4.3.2.1 for full discussion of burn decision responsibilities.
- Review Seasonal Smoke Coordinators' or Regional Office Analysts' requests for increases in approvable acres during the burn day and approve or deny.
- Review air quality and meteorological data throughout a designated burn day and make decision to stop burning as needed.
- Provide support to regional offices.
- Keep the Smoke Management Program Coordinator informed of issues as necessary.
- Support CRB program enforcement activities.
- Assist with outreach activities.

## 3.3 Seasonal Smoke Coordinators

DEQ employs approximately nine Seasonal Smoke Coordinators who work out of the regional offices. The Seasonal Smoke Coordinators are responsible for the following activities:

- Serve as primary point of contact for growers during the burn season.
- Assist with grower registration.
- Review the meteorologist's forecast (fall burn season only) to understand the potential for burning each day.
- Participate in daily conference calls.
    - Comment on current day's events.
    - Be prepared with a list of growers and fields that are ready to burn.
- Approve individual growers and fields in accordance with the burn decision.
- Issue notification of final burn approval (permit posted online) by 11:00 a.m. using the CRB website.
- Notify growers by phone of final burn approval—ask if grower understands all permit requirements and remind him to notify the appropriate fire department and/or sheriff's department.
- Observe and document burns (using weather checklist, Kestrel weather meters, and taking photos).
- Stay in contact with growers throughout the day.
- Stop burns when necessary due to deteriorating conditions.
- Request increases in approved acres from the Smoke Management Analyst if conditions justify and the final burn decision included this option.
- Save weather checklists (field notes and weather data) to the network drive or TRIM at least once per week.
- Conduct enhanced documentation as needed.
- Assist with grower registrations.
- Assist the Regional Office Analyst with responses to complaints, enforcement activities, investigation of apparent violations, and development of enforcement referral packages.
- Assist with outreach efforts and grower training.

## 3.4 Regional Office Analyst

DEQ has assigned one Regional Office Analyst for each of DEQ's six regions to support the CRB program. The Regional Office Analysts' responsibilities are described below:

- Serve as additional point of contact for growers and public (year-round).
- Train, supervise, and deploy Seasonal Smoke Coordinators.
- Assist the Seasonal Smoke Coordinators with the ready-to-burn list, acres per county, and final burn approvals.
- Assist with grower registrations.
- Observe burns when needed.
- Conduct enhanced documentation as needed.
- Respond to complaints.
- Investigate apparent violations.

- Develop enforcement referral packages for potential violations.
- Conduct outreach and grower training.

# 4 Policies and Procedures

## 4.1 Grower Training

Growers must successfully complete an in-person CRB training session provided by DEQ or complete the online CRB training prior to being approved to burn crop residue, burn spots and bales, or conduct propane flaming. Refresher training must be completed at least every 5 years. Training covers the following topics:

- Air quality protection and smoke management
- Open burning rules and CRB rules
- Grower responsibilities and requirements
- DEQ responsibilities and requirements
- Ignition and burning techniques for good smoke management

The training is offered periodically in the regional offices based upon demand and is also available online at DEQ's CRB website. Training provided by the Idaho State Department of Agriculture that was conducted within 5 years of the actual burn date satisfies this requirement.

## 4.2 Registrations and Fees

### 4.2.1 Grower Submittal of Registrations and Fees

Growers must register their fields at least 30 days prior to the requested burn date and pay fees at least 7 days prior to the requested burn date. Registrations are accepted online and in paper form. Growers who register online must also submit a signed copy of the registration form as soon as possible. The regional office staff and Smoke Management Analysts are available to provide assistance to growers who do not have internet access or are having trouble navigating the online registration process. The following information is required for registration:

- Location of the field(s), in the form of latitude and longitude and county
- Applicant information (and person conducting the burn, if not the same)—name, mailing address, e-mail address, and phone number
- Mobile phone number
- Plot plan showing the location of the field(s), property lines, and relative locations of residential, public, and commercial properties and public roads
- Type of crop residue, acreage, and fuel characteristics
- Fire prevention measures
- Proposed date of the burn

Any additional information that would be helpful to DEQ when making a burn decision should also be included on the registration form. This information may include special topographical features (e.g., canyon rims), special conditions (e.g., specific wind direction needed), and ISPs.

Growers may pay CRB fees online, by mail to the State Office, or in-person at the regional offices. Registrations and fees submitted by mail should be sent to:

Idaho Department of Environmental Quality
CRB Program
1410 N. Hilton
Boise, ID 83706-1255

### 4.2.2 DEQ Processing of Registrations and Fees

The Smoke Management Analysts will process the registration forms. Registrations should be date stamped and entered into the CRB database upon receipt. The Smoke Management Analysts will review the information submitted to determine whether it is accurate and complete. If additional information is needed, the Smoke Management Analysts or regional office staff should contact the grower to obtain the necessary information.

The Smoke Management Analysts will review the registrations to develop the initial permit requirements in accordance with DEQ's registration review standard operating procedure. The Smoke Management Analysts will identify ISPs located within 3 miles of each field as well as other special features, such as populated areas, public roads, and airfields. DEQ may also choose to include ISPs or other features that are further than 3 miles from the field if the analyst, with consultation from the Regional Office Analyst, deems appropriate. This decision may be made for large fields, types of crop residue that generate heavy smoke, growers that have not demonstrated good burning practices in the past, or areas with specific terrain or microclimates that may require a higher level of protection for ISPs. DEQ will add permit requirements that are based on the field location. These requirements are not expected to change from year to year. These field-specific permit requirements will remain attached to the field and will be applied every time the field is burned. If the permit conditions need to be revised, this can be done by the Smoke Management Analyst.

One-time burn approval conditions may be added to the permit by the Smoke Management Analyst, Seasonal Smoke Coordinator, or Regional Office Analyst during the burn approval process. The one-time burn approval conditions are not attached to the field and will not automatically be applied to the field every time it is burned. These one-time conditions are in addition to the field-specific permit conditions developed by the Smoke Management Analyst.

Once the Smoke Management Analyst has reviewed the registration, he or she will send the "Registration Receipt and Initial Permit Requirements" document and cover letter to the grower. The purpose of this document is to verify with the grower that the information submitted is complete, the registration has been accepted by DEQ, and the registration requirements have been met. This document will also include the general permit conditions that are applicable to all crop residue burning, the field-specific requirements added by the Smoke Management Analyst, and a map of the field in relation to nearby ISPs. The Regional Office Analyst and Seasonal Smoke Coordinator for the appropriate region should be notified that the registration has been approved.

**The "Registration Receipt and Initial Permit Requirements" document is NOT a final approval to burn.** It is a document that includes the initial permit requirements DEQ deems necessary to ensure compliance with the air quality and safety requirements of the rules.

Growers can submit fees using three methods: online, through the mail to the State Office, or hand delivered to the regional offices. All fees mailed to the State Office will be date stamped, entered into the database, and hand-delivered to the fiscal department in the State Office. Fees hand-delivered to the regional offices will be processed according to that office's procedures and entered into the database. Fees submitted online are automatically entered into the database so no action is required by DEQ.

Growers must submit payments at least 7 days prior to the requested burn date. DEQ will process fees as quickly as possible, and in most cases, fees will be processed within 2 days of receipt. Fees are applied to the grower's balance and not to a specific field. The grower must have a sufficient balance to indicate a specific field as ready to burn. The CRB admin tool will not allow a field to be clicked as ready-to-burn unless funds are in the grower's account.

### 4.2.3 Grower Notification of "Ready to Burn"

When a grower is ready to burn a registered field, he must notify DEQ either online or by phone so the field can be listed as "ready to burn." The CRB online application will not allow a field to be placed on the ready to burn list if the grower or burn manager does not have a valid CRB training date. The ready-to-burn list should be managed by the regional office staff so that only growers who are truly ready to burn are on the list.

## 4.3 Burn Decisions

The following burn decision policies and procedures explain what occurs during the fall burn season. During the fall burn season, DEQ employs a contract meteorologist to assist with fire weather forecasting, makes preliminary burn decisions the day before requested burns, and conducts conference calls during the preliminary and final burn-decision process. During the spring burn season, DEQ utilizes an in-house meteorologist and typically issues a preliminary burn decision but the other activities listed above are usually not conducted.

The Smoke Management Analysts are responsible for making the preliminary and final burn decisions for each county according to DEQ's burn decision standard operating procedure. Burn decisions are based on a review of current weather observations and forecasted meteorology, air quality conditions, fuel and soil moisture levels, other sources of smoke emissions, and the weather forecasts and burn recommendations provided by the meteorologist. The burn-decision process includes two daily conference calls for both northern and southern Idaho—the first at 8:30 a.m. and the second at 3:30 p.m. local time. During the daily conference calls, the Seasonal Smoke Coordinators and Regional Office Analysts should assist the Smoke Management Analysts by providing input based upon local knowledge and experience and their interactions with growers. Seasonal Smoke Coordinators should remain in touch with growers to best understand which growers are truly ready to burn and to relay burn approvals to the growers in a timely manner. Figure 1 shows this burn-decision process in a flowchart. Appendix B describes the burn decision procedures for DEQ staff. Appendix C includes the burn decision criteria as they appear in the SIP.

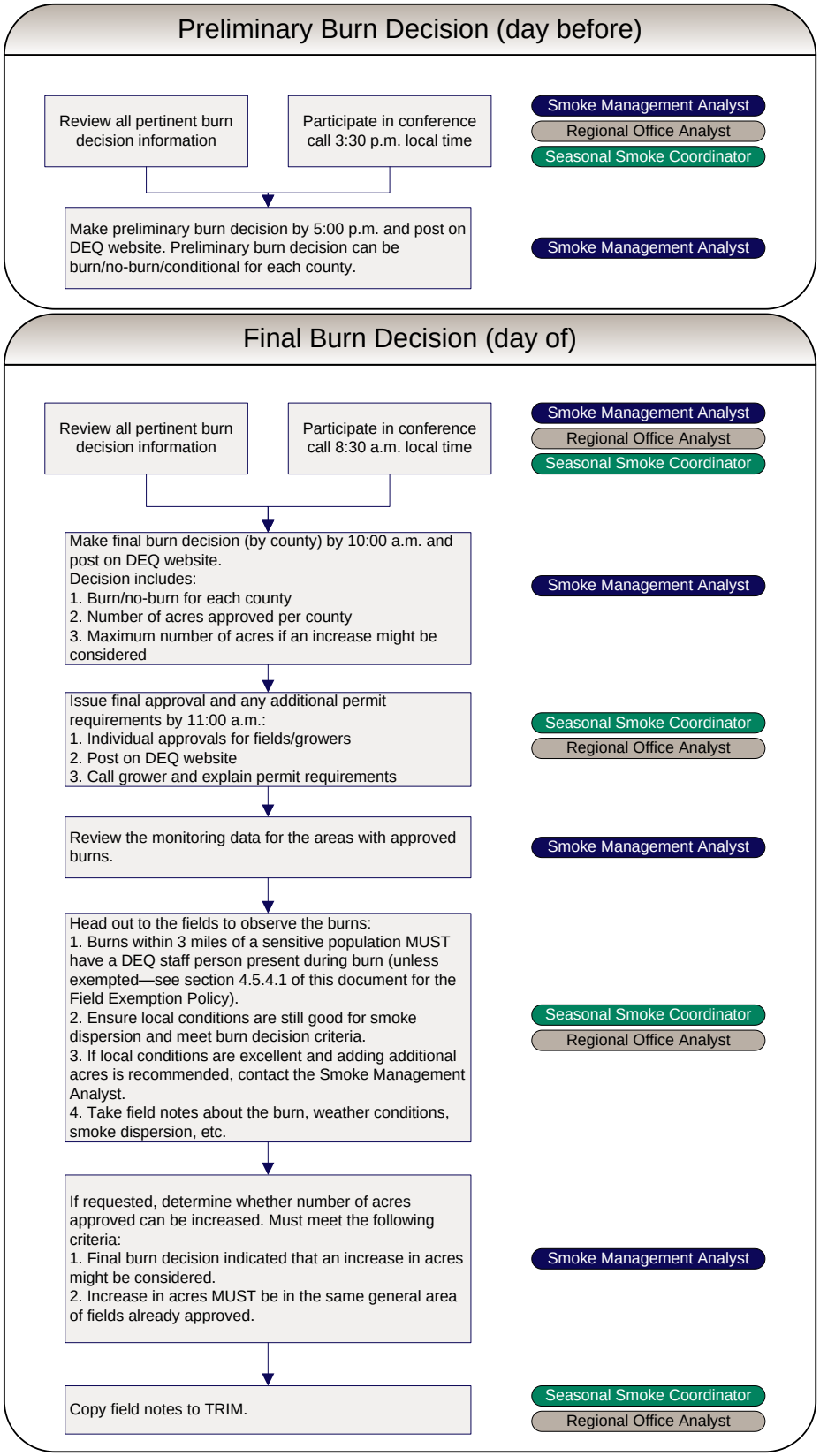


**Figure 1. Flowchart for burn decision for DEQ staff.**

The preliminary burn decision should be issued by 5:00 p.m. the day before the burn. For a Monday burn day, the preliminary burn decision should be made by 5:00 p.m. on the prior Friday. Preliminary burn decisions may consist of a burn, no-burn, or conditional burn decision. A conditional burn decision may be issued when the forecast does not clearly indicate either a burn or no-burn determination. A preliminary burn decision of no-burn may not be reevaluated during the final burn decision—the final burn decision must remain as no-burn. Therefore, a preliminary no-burn decision should only be issued when the analyst is very confident that the following day will be unsuitable for allowing burning.

The final burn decision should be issued by 10:00 a.m. on the burn day whenever possible. There may be instances when the final burn decision cannot be made by 10:00 a.m., and in these cases, the decision should be made by 11:00 a.m. at the latest. Final burn decisions may consist of a determination of burn or no-burn and shall include the number of approvable acres for each county. Final burn decisions should also include other pertinent information such as the approved burn window, whether test-burns are to be conducted, and if additional acreage may be approved pending satisfactory results from the initial acreage or test burns.

Test burns can be a useful method of assessing the dispersion conditions, especially near difficult areas such as canyon rims or towns or during periods of limited or uncertain dispersion. **Test burns should not normally be conducted at fields located within 3 miles of ISPs. Use caution with any test burns that are within 3 miles of an ISP.** Test burns should be large enough to obtain a good assessment of the dispersion conditions but not so large that adverse impacts become likely if conditions are worse than expected. Test burns should generally be approximately 40–80 acres. Test burns must be observed by DEQ staff.

### 4.3.1 Burn Decision Criteria and Parameters

DEQ considers a number of parameters and associated factors to make a sound decision about whether to allow the burning of each individual field. Generally, no single parameter should be the basis for the burn decision. Rather, some combination of parameters should allow DEQ to ensure the best possible conditions for smoke management. Even when air quality monitoring data remain in the good range, meteorological forecasts or observed weather conditions may be such that burning cannot be allowed due to poor dispersion characteristics. Conversely, air quality may be in the moderate range and meteorological forecasts or observed weather conditions may be such that limited burning can be allowed.

As a means to address the diverse topography, climate, soils, and crops throughout the state, DEQ has developed smoke management areas (SMAs) that divide the state into more manageable units. Figure 2 shows the SMAs and county boundaries.

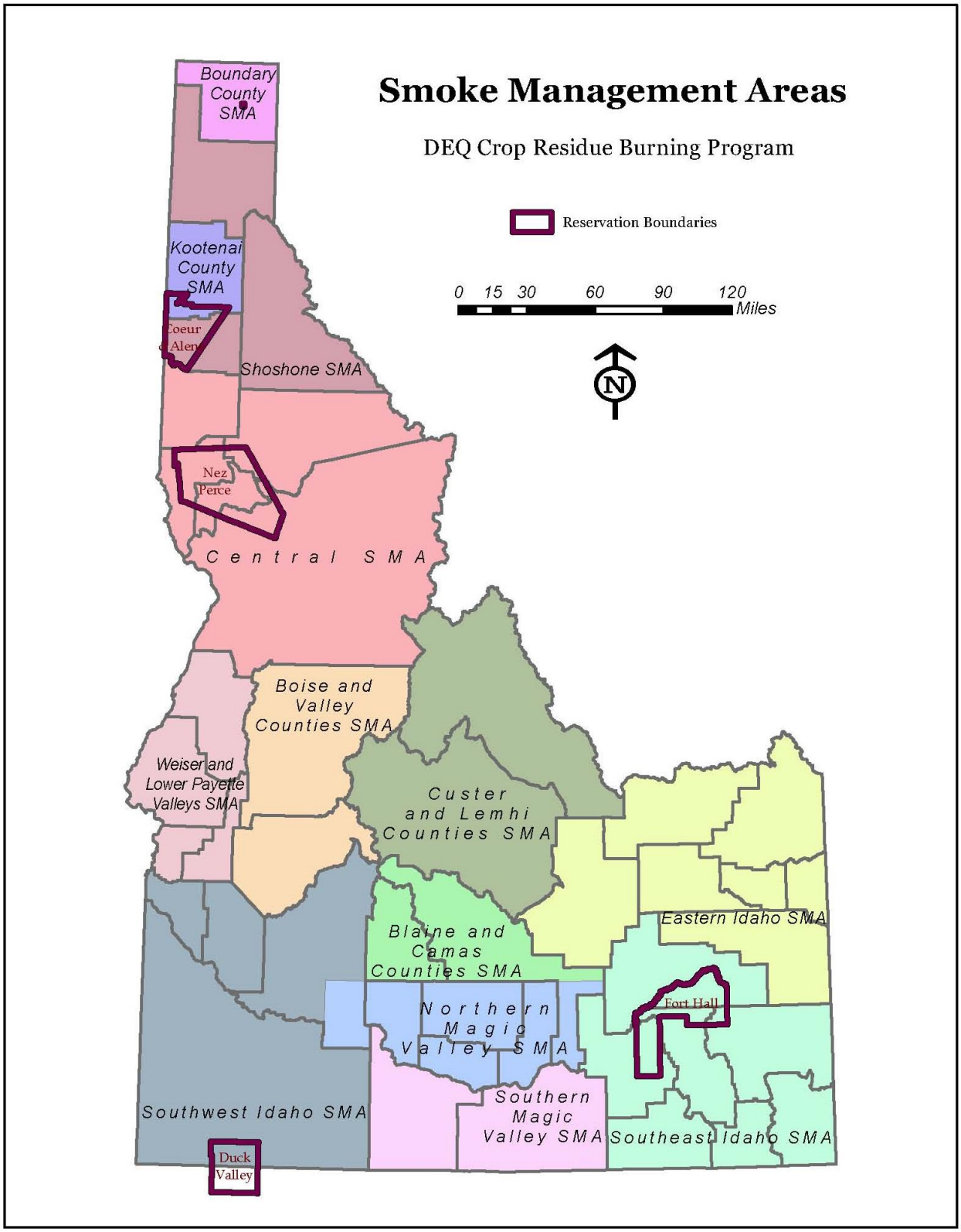


**Figure 2. Smoke management areas.**

In accordance with the CRB rule (IDAPA 58.01.01.621), DEQ will consider the following criteria when making a burn decision:

- Expected emissions from all burns proposed on the same day
- The proximity of other burns and other potential emission sources in the same area
- Moisture content of the crop residue to be burned
- Acreage, crop type, and fuel characteristics
- Meteorological conditions
- Proximity to ISPs, public roadways, and airports
- Any other factors relevant to preventing exceedances of the program concentration limits, such as burning/ignition methods and soil moisture

Burns will not be approved on weekends, federal or state holidays, after sunset or before sunrise, or during an episode or air stagnation or degraded air quality. However, spot and bale burning and propane flaming may occur on weekends and holidays (Appendix A).

#### *4.3.1.1 Air Quality*

To approve a request to burn, DEQ must determine that ambient air quality levels meet the following two criteria:

- Do not exceed 75% of the level of any NAAQS on any day and are not projected to exceed such level over the next 24 hours
- Have not reached, and are not forecasted to reach and persist at, 80% of the 1-hour action criteria for particulate matter

The pollutants of concern for crop residue burning are particulate matter less than 2.5 microns in diameter or less than 10 microns in diameter ($PM_{2.5}$ and $PM_{10}$, respectively) and ozone. The limits for these pollutants, given in micrograms per cubic meter ($\mu g/m^3$) of $PM_{2.5}$ and $PM_{10}$ or parts per billion (ppb) of ozone, are defined as follows:

- $PM_{2.5}$ 1-hour average—64 $\mu g/m^3$
- $PM_{2.5}$ 24-hour average—26 $\mu g/m^3$
- $PM_{10}$ 24-hour average—112 $\mu g/m^3$
- Ozone 8-hour average—56 ppb

If applicable monitoring data are not available, visibility may be considered as a component of the burn-decision process. If visibility is less than 10 miles and is expected to remain so throughout the day, a decision to burn should be made only after careful consideration of other parameters.

#### *4.3.1.2 Meteorological Conditions*

Table 1 lists the meteorological parameters that DEQ reviews and evaluates when making a burn decision. The goal is to ensure good smoke management (i.e., smoke that rises from the ground and remains aloft, disperses in the mixing layer, and drifts away from populated areas and ISPs with the transport winds). The information listed in Table 1 is for guidance only and is intended to be helpful in identifying no-burn days and conditional burn days (when a limited number of acres may be approved).

The information needed to evaluate these parameters may be obtained from a combination of several sources, including weather models, weather forecasts, and summaries of current conditions.

**Table 1. Burn decision meteorological parameters.**

| Parameter | Burn Day | Conditional Burn Day | No-Burn Day |
|---|---|---|---|
| **Ventilation** (a factor of 20-meter wind speed and mixing height) | "Good" to "Excellent" ventilation is preferred; however, if ventilation is "Good" or "Excellent," check to make sure surface wind speeds are <12 miles per hour (mph). | • "Good" to "Excellent" ventilation may be unacceptable if surface winds are >12 mph<br>• Burning under "Marginal" ventilation may be acceptable only if other criteria are met and burning proceeds with caution.<br>• "Poor" ventilation should be avoided unless there is good vertical convection with enough fuel and/or wind to carry the fire and good transport winds aloft. | "Very Poor" ventilation should be avoided. |
| **Cloud cover** | Mostly sunny to partly cloudy (10–40% cloud cover) is typically best. | • Clear bright skies may indicate a high pressure system with stagnant conditions. Make sure other criteria are met if this is the case.<br>• Cloudy conditions may be acceptable if clouds are high and all other criteria are met. | Mostly cloudy conditions with low clouds should be avoided. |
| **Surface wind speed (sustained)** | Moderate winds, 3 to 8 mph are preferred. | • Calm or near calm winds should be avoided. Light winds <3 mph generally are insufficient to carry the fire. However, sunshine and abundant/dry fuel, especially on a hill, may result in good rise for lighter winds <3 mph.<br>• Winds 8–12 mph may be ok if there is strong sunshine to maximize vertical convection, but proceed with caution. | • Burning is not allowed at fields located within 3 miles of an ISP when wind speeds exceed 12 mph.<br>• Winds >12 mph should be avoided even in remote areas for fire safety reasons. |
| **Surface wind direction** | • Avoid institutions with sensitive populations, populated areas, and nearby public roadways, etc.<br>• If possible, also avoid large bodies of water and large canyons/valleys.<br>• Be aware of typical wind shifting patterns in an area and atypical forecasted wind shifts. | N/A | It is critical to avoid cities and institutions with sensitive populations. |

| Parameter | Burn Day | Conditional Burn Day | No-Burn Day |
|---|---|---|---|
| **Transport wind speed** (at 850 millibar level or about 5,000 feet) | 7–20 mph is preferred. | Use caution with transport winds that are <7 mph or >20 mph. | Upwind of cities and institutions with sensitive populations, transport winds >20 mph should be avoided. |
| **Transport wind direction** | Avoid institutions with sensitive populations, populated areas, and nearby public roadways, airports, etc. | Avoid transport winds taking smoke towards cities and institutions with sensitive populations unless ventilation is “Good” to “Excellent.” | It is most critical to avoid cities and institutions with sensitive populations at all times. |
| **Mixing height** | Greater than 5,000 feet above ground level is desired. | With mixing heights of 2,000–5,000 feet, caution should be used. If transport winds will transport smoke over large bodies of water and large canyons/valleys, avoid burning if mixing height is less than 5,000 feet. | Avoid burning if the mixing height is <2,000 feet above ground level. |
| **Relative humidity** | 20–45% relative humidity is the ideal range. | • Relative humidity <20% is acceptable if fire control/safety concerns with surrounding fuels are low.<br>• Relative humidity between 45% and 60% may inhibit plume rise and smoke dispersion.<br>• For bluegrass, relative humidity >30% may inhibit plume rise and smoke dispersion. | Relative humidity >60% should be avoided as it may inhibit smoke dispersion and may leave unburned materials. |
| **Inversion conditions** There are two types of inversions (radiation and subsidence) and they should both generally be avoided. | Preferably, burns should occur after 10 a.m. and be extinguished before 5 p.m. to avoid trapping the smoke in mountain valleys by radiation inversions. | Radiation Inversion—This is a surface-based inversion that exists on most mornings and evenings, particularly when daytime heating is strong.<br>• Burning should not be permitted before the inversion has mixed out unless transport conditions after breakup would best protect population centers and burning during an inversion does not cause adverse impacts.<br>• A sufficient amount of time should be allowed at the end of the burn day for any residual smoke to disperse before a radiation inversion returns. | Subsidence Inversion—When a strong high-pressure system is present with clear skies, hot air subsides causing stable air and poor dispersion. This condition is easy to forecast and a no-burn day should be called when a strong high-pressure system is over the region. |

Burning when a subsidence inversion is present should only be approved after careful consideration. For radiation inversions, burning should generally not be permitted before an inversion has mixed out. However, there may be occasions when the Seasonal Smoke Coordinator, under the close guidance of the Smoke Management Analyst, may allow ignition prior to the inversion mixing out to promote optimum transport after mix-out and ensure protection of populated areas.

For example, north of Grangeville, afternoon transport winds typically carry smoke from burns on the Camas Prairie in a southerly direction, which poses a significant risk of adversely impacting Grangeville. However, the transport winds immediately following the morning inversion mix-out typically blow to the east. Because of this tendency, a burn may be approved to start in the morning so that smoke would rise to the inversion layer where it would remain until the inversion mixed out. The initial transport of the smoke would then be to the east, followed some time later by a shift to the south. Having already drifted some distance to the east, smoke movement to the south would not impact Grangeville.

Care must be taken when using this technique to determine that the mixing height prior to the inversion mix-out is adequate to hold the smoke generated from the burn without causing an adverse impact.

This practice should be used in other parts of the state only after conducting sufficient evaluation to adequately understand local wind patterns and temperature profiles to ensure that such a practice is expected to be successful. A Seasonal Smoke Coordinator wishing to use this practice must first work with the Smoke Management Analyst to conduct the necessary evaluation and documentation.

#### *4.3.1.3 Other Relevant Factors*

The following are additional factors that should be considered when making a burn decision:

- **Burning method**—Burning method includes both the ignition method (e.g., matches or lighters, propane torches, or diesel burners) and the pattern of lighting. Generally, hotter fires will result in less smoke production and better smoke lift.
- **Fuel type, size, and arrangement**—These characteristic also affect smoke emissions. Generally, denser fuel results in more smoke production. Fuel density can change by crop type and variety (e.g., generally wheat stubble is less dense than bluegrass residue and certain wheat or bluegrass varieties can be denser than others).
- **Fuel loading**—This is the amount of residue that is available to be burned per acre. Generally, greater fuel loading equates to more smoke.
- **Fuel moisture**—Fuel moisture content is dependent upon fuel type, recent precipitation, and relative humidity. To promote a hot burn and good plume rise, the fuel moisture should be as low as possible throughout the residue layer. Generally, higher fuel moisture levels will result in more smoke and reduced plume rise.
- **Soil moisture**—Moisture from the soil will cool the smoke and result in a reduced plume height.
- **Red Flag Warnings**—DEQ will not approve burns during a National Weather Service (NWS) issued Red Flag Warning. If burning is approved to take place before a warning

takes effect, caution must be used and all burns must be extinguished prior to the warning taking effect.

### 4.3.2 Making a Burn Decision

This section lists the general steps that Smoke Management Analysts and regional offices follow when making a burn decision.

#### *4.3.2.1 Smoke Management Analyst Responsibilities*

The Smoke Management Analyst makes preliminary and final burn decisions (i.e., burn/no-burn/conditional burn day) for each county. The number of approvable acres must also be included for final burn decisions. The Smoke Management Analyst's burn decision responsibilities include the following steps:

**Preliminary Burn Decision**

1. Review the air quality monitoring data and compare the current pollutant concentrations to the program concentration limits and the preburn trigger limits described in section 4.3.1.
2. Review the NWS forecast, forecast models, and meteorologist forecast; Table 1 includes guidelines for evaluating meteorological data and forecasts. The meteorological evaluation should be focused on those areas where requests to burn are expected.
3. Make a preliminary burn decision by county based on the weather forecast and forecasted air quality pollutant levels.
   - **No Burn**—Meteorological conditions or elevated air quality concentrations are forecasted to not allow burning; or there are no growers on the ready to burn list.
   - **Conditional**—There are growers currently on the ready-to-burn list; however, meteorological and air quality conditions for the next day are uncertain.
   - **Burn**—Growers are currently on the ready-to-burn list and meteorological and air quality conditions are forecasted to support burning.

**Final Burn Decision**

1. Review the air quality monitoring data and compare the current pollutant concentrations to the program concentration limits and the preburn trigger limits described in section 4.3.1.
2. Review the CRB website and consult with regional office staff to identify fields that are ready to burn, field locations, and other factors such as the requested acreage, locations of nearby ISPs, and initial permit conditions.
3. Review available current and forecast meteorological data sources. Table 1 includes guidelines for evaluating meteorological data and forecasts. The meteorological evaluation should be focused on those areas where requests to burn are expected.
4. Review information about other possible smoke sources, such as wildfires and prescribed fires, in the area of interest.
5. Review the meteorologist's daily burn recommendations for each SMA. These are qualitative assessments based on the smoke dispersion forecast. The meteorologist's burn recommendations will be provided as follows:

- **No Burn**—Smoke dispersion is forecasted to be poor. Burning is not recommended.
- **Conditional**—Smoke dispersion is forecasted to be marginal. Limited burning with caution may be possible. A "conditional" recommendation will only be made for the preliminary burn decision.
- **Burn**—Smoke dispersion is forecasted to be good to excellent. Other parameters such as air quality and fuel moisture level must still be suitable for burning.

6. Participate in the daily conference calls. Make a burn decision for each county based on the steps described above and input from the regional office staff and meteorologist.

   - **No Burn**—Either meteorological conditions or elevated air quality concentrations are forecasted to not allow burning or no growers have requested to burn.
   - **Burn**—Meteorological and air quality conditions are forecasted to support burning and growers have requested to burn.

#### *4.3.2.2 Regional Office Responsibilities*

The Seasonal Smoke Coordinators and Regional Office Analysts should review the following information for their SMAs in preparation for the CRB program conference calls:

- **Current and forecasted meteorological conditions—**Regional office staff should review the NWS forecast discussion and the meteorologist's forecast for their SMAs. Regional office staff should consider and be prepared to provide input on the burn-decision parameters that may be unique to their region, such as current and forecasted weather conditions, microclimates, terrain, and soil moisture levels.
- **Current and forecasted air quality conditions**—Regional office staff should review the current and forecasted air quality conditions in their SMAs and be prepared to make specific field approval recommendations during the burn-decision process.
- **Ready-to-burn list**—Regional office staff should review the ready-to-burn list and have a good idea of which growers are truly ready to burn and which fields are candidates for burning with the forecasted conditions.

## 4.4 Burn Day Activities—Growers

Because DEQ must operate the CRB program to protect public health and the environment, growers must remain as flexible as possible to have the greatest opportunity to burn their fields. DEQ will attempt to find appropriate burn days for all fields that growers desire to burn. However, there are bound to be instances when the requests to burn exceed the smoke carrying capacity of the atmosphere or instances where a specific field may require an uncommon wind direction to be safely burned.

DEQ will attempt to provide growers with as much notice of pending burn approval as possible. DEQ will normally make the final burn decision and specific burn approvals between 10:00 a.m. and 12:00 p.m. on the day of the burn. Growers can maximize their opportunities to receive burn approval by staying in close contact with the regional office staff.

When DEQ has given final burn approval for a field, the grower will be contacted by the Seasonal Smoke Coordinator, usually by 11:00 a.m. If the grower is ready to conduct the burn, the Seasonal Smoke Coordinator will issue the permit, which contains the field-specific permit

requirements and additional permit requirements (if any) added during the final burn approval. If the grower will not be able to conduct the burn that day, he should tell the Seasonal Smoke Coordinator as soon as possible so the field can be placed back on the ready-to-burn list, if desired.

The grower is required to abide by all permit requirements and may be subject to an enforcement action for failure to comply with any applicable statute, rule, or permit requirements. Appendix D provides information on how DEQ determines compliance with permit requirements. The grower **must** contact the Seasonal Smoke Coordinator if the conditions at the field fail to meet the conditions specified in the final notice of approval to burn and the grower still wants to burn. The grower may be required, as part of the burn approval, to conduct a test burn prior to having additional acres approved to be burned. **DEQ staff must be present at all test burns to evaluate smoke dispersion.**

During the burn, the grower must be reachable via cellular phone or another pre-determined form of portable communication. The grower is responsible for shutting down burns when required to do so by the Seasonal Smoke Coordinator. If DEQ determines that the burn is having, or will have, an adverse impact on ISPs, DEQ may require the grower to immediately extinguish the fire or withhold additional material so the fire burns down. Under no circumstances shall more fuel be added or ignited.

## 4.5 Burn Day Activities—DEQ

### 4.5.1 Field Approval Process

The Seasonal Smoke Coordinators, with assistance from the Smoke Management Analyst and the Regional Office Analyst, will determine which fields to approve for burning. The field approval process must be consistent with the burn decision.

The field approval process is based on which fields are appropriate to burn with the forecasted conditions. After all other factors have been evaluated, the length of time a field has been registered should be considered. Care should be taken to avoid overloading an airshed with smoke from too many approved burns in the same airshed.

The following factors should also be considered when determining which fields to approve for a given burn day:

- **Burning near canyon rims**—These burns should only be conducted when both surface and transport winds are blowing away from the canyon. The atmosphere over canyons can be cooler than the surrounding area, which can draw a smoke plume down to the ground. When winds are forecasted to carry smoke over a canyon, only those burns that are predicted to have excellent plume rise (i.e., the plume should be predicted to rise sufficiently to remain aloft even over the canyon) should be approved.
- **Burning near large bodies of water**—These burns should only be conducted when both the surface and transport winds are blowing away from the water. The atmosphere is typically cooler and more stable over large bodies of water such as lakes and major rivers. The cooling effect of the water can draw smoke downward. Even in the absence of a true lake-breeze, the interaction between lake-generated winds and prevailing winds is

complex and can cause variable conditions that can change quickly. Knowledge of the expected prevailing wind direction and strength is important. It is also important to know the direction of transport winds aloft, which may carry smoke over the lake. Surface and transport winds can be from vastly different directions. A good guide is to burn downwind of large bodies of water so that the plume does not blow over the water.

- **Favorable winds**—Some areas have fairly predictable wind patterns, including predominant wind directions, wind shifts, and diurnal patterns. In these areas, burns may be timed to take advantage of such patterns and priority for burn approval may be appropriate if these conditions are forecasted.
- **Burn location relative to ISPs**—Most burning should be conducted so that surface and transport winds carry smoke away from ISPs. This restriction will usually be included in the initial permit conditions. Consideration should also be given to the hours of operation at the ISP (e.g., a school that may be out of session on a particular day). In these cases, priority for burn approval may be given to those fields that can be burned with no risk to the sensitive population.
- **Elevation and field aspect**—Elevation should be considered in regard to the mixing height. An elevated field may be just below the top of the mixed layer, resulting in little room for the smoke plume to disperse within. Also, if a topographical feature such as a ridgeline is above the top of the mixed layer, a smoke plume may be trapped by the topography and may not be able to disperse. Field aspect (i.e., direction of the slope of the field) may help to identify fields that are warmer and dryer than other fields. This distinction can be particularly useful at the beginning or end of the season or following rain when the driest fields are the most appropriate to burn.
- **Infestation issues**—Fields that need to be burned due to infestations should be considered for approval priority to minimize the threat of the infestation worsening or spreading.

### 4.5.2 Public Notification of Burn Approvals

DEQ will notify the public of approved burns by posting the following burn decision information on the website:

- Whether a given day is a burn or no-burn day
- The location and number of acres permitted to be burned
- The location and amount of additional acres that may be added, if applicable, pending adequate results from test burns
- Meteorological conditions and any other real-time ambient air quality monitoring data

DEQ also has a toll-free phone number (800-345-1007) and website (*http://www.deq.idaho.gov/air-quality/burning/crop-residue-burning*) that the public can use to receive burn decision information, provide a comment, or submit a complaint. This toll-free number is shared with the Nez Perce Tribe and the Coeur d'Alene Tribe. DEQ also sends a listserv e-mail to announce that a burn decision has been made.

### 4.5.3 Permit by Rule

The permit by rule consists of three parts: registration, registration fee, and notification of final burn approval (posted online).

The grower will receive the following documents during the burn season:

- "Registration Receipt and Initial Permit Requirements" document, which acknowledges receipt of registration and provides the initial permit requirements for each field
- Final burn approval on DEQ website, which includes any additional permit requirements or conditions

Once the grower has notified DEQ that he is ready to burn (preferably 2–3 days prior to the field being ready), the field will be placed on the ready-to-burn list for burn approvals. The Seasonal Smoke Coordinator will notify the grower of the final approval the morning of the burn. The final notifications of burn approval will be posted on DEQ's website with any additional permit requirements under which the burn is approved.

All burns must be conducted in compliance with the listed permit conditions. The only time permit conditions might change is when an on-site Seasonal Smoke Coordinator or Regional Office Analyst identifies permit conditions that are inaccurate due to an error during the registration process or because they are not representative of conditions in the field. In such instances, the field staff **must** contact the appropriate Smoke Management Analyst to change the permit conditions. If the Smoke Management Analyst is unavailable, the burn must proceed according to the existing permit conditions or not take place at all.

**The notification of final burn approval posted online is the only document that authorizes the grower to burn the crop residue.**

### 4.5.4 Field Observation

Seasonal Smoke Coordinators should be in the field observing burns on all days when burning is approved in their SMAs, and all burns within 3 miles of an ISP shall be observed unless an exception has been made. Whenever a field located within 3 miles of an ISP is approved to be burned without DEQ observation, DEQ must contact the ISP(s) prior to ignition with the date, time, and location of the burn and contact information for the appropriate DEQ Regional Office Analyst and Smoke Management Analyst.

If grower noncompliance with program requirements is an ongoing problem in an SMA, it is recommended that Seasonal Smoke Coordinators or regional office staff tasked with smoke management duties be in the field 1–2 times during the fall burn season on days when no burn approvals are issued but conditions may seem conducive to potential unapproved crop residue burning. Establishing a DEQ presence during these occasions will provide an opportunity for grower outreach and education or enforcement actions and should improve program support and overall compliance.

#### *4.5.4.1 Field Observation Exceptions*

The following categories of burns have specific requirements for DEQ observation:

- **Test burns—**Field staff *must* observe all test burns.
- **Burns located within 1 mile of an ISP—**Field staff shall observe all crop residue burns within 1 mile of an ISP. Exceptions to this requirement must be preapproved by the Smoke Management Analyst. Exception requests must have documentation, such as e-mail communication, phone log notes, or other means to track the request and approval.

- **Burns located between 1 and 3 miles from an ISP—**For fields 20 acres or smaller, field staff shall observe these burns unless regional office staff have evaluated the proposed burn and have documented the justification that it is not necessary to observe the burn. Justification shall be based on the parameters described below and must be documented with e-mail, phone log notes, or field notes.

  For fields larger than 20 acres, field staff shall observe these burns. Exceptions to this requirement must be pre-approved by the Smoke Management Analyst. Exception requests must have documentation, such as e-mail communication, phone log notes, or other means to track the request and approval.
- **Burns located beyond 3 miles of an ISP—**Field staff are expected to be in the field observing burns when burning is approved in their SMA. Exceptions to this requirement must be preapproved by the Smoke Management Analyst. Exception requests must have documentation, such as e-mail communication, phone log notes, or other means to track the request and approval. The factors that will be used to justify the exceptions may include, but are not limited to, the following:
  - Fields that are considered to have a low risk of causing adverse impacts to an ISP
  - Fields located in remote areas where weather and terrain conditions are known to provide excellent dispersion conditions
  - Burning will be conducted by a highly proficient and adequately trained person with a history of complying with DEQ rules and implementing effective smoke management techniques
  - Total acreage approved for burning in the area is de-minimis per modeled impact analysis
  - The SMA does not have a history of grower noncompliance with program requirements

#### *4.5.4.2 Exception Parameters*

The following parameters should be evaluated to determine the risk of a particular burn and whether it needs to be observed by DEQ staff:

- **Person conducting the burn**—The experience and proficiency of the person conducting the burn should be considered. Growers who have a history of using good burning techniques and have demonstrated good judgment in conducting past burns may be considered for burning without DEQ observation. Growers who are new to the program or who have a history of using unreliable or ineffective burning techniques or have not demonstrated good judgment should not be considered for burning without DEQ observation.
- **Forecasted meteorological conditions**—Forecasted meteorological conditions that should be considered in determining the relative risk that a particular burn may pose to an ISP include the following:
  - Surface wind speed and direction
  - Transport wind speed and direction
  - Mixing height and ventilation
  - Air temperature
  - Relative humidity

    - Inversion strength and timing of the mix-out
- **Field conditions**—Field conditions that should be considered in determining how well a particular field may be expected to burn include the following:
    - Crop type
    - Fuel load
    - Fuel moisture
    - Soil moisture
    - Past successful or unsuccessful attempts to burn the particular field
- **Terrain, local conditions, and monitoring network**—Knowledge of terrain and other local conditions should be considered, including how terrain, predominant wind patterns, and local diurnal patterns may affect smoke behavior. Air quality monitors located at ISPs may be factored into the decision making process.

## 4.6 Enhanced Documentation

DEQ has established procedures to ensure that the provisions of IDAPA 58.01.01.621 and the SIP are met—specifically that ambient air quality levels of criteria air pollutants do not exceed 75% of any NAAQS; are not projected to exceed 75% of the NAAQS over the 24 hours following the burn decision; and have not reached, and are not forecasted to reach and persist at, 80% of the 1-hour action criteria for particulate matter under Section 556 of the "Rules for the Control of Air Pollution in Idaho" (IDAPA 58.01.01).

The purpose of enhanced documentation is threefold: (1) provide additional documentation of the burn approval decision making process when air pollution monitoring levels exceed trigger levels prior to the start of a burn (preburn enhanced documentation); (2) document events surrounding elevated air quality concentrations measured after the start of a burn (postburn enhanced documentation) if the approved burn was deemed to have potentially caused or contributed to the measured concentration or possible adverse impacts or public roadway safety hazards; and (3) evaluate the success of a burn that may help to enhance program implementation. The pollutant concentrations that trigger preburn and postburn enhanced documentation are shown in Table 2.

**Table 2. Enhanced documentation trigger levels for particulate matter less than 2.5 microns ($PM_{2.5}$) and ozone.**

| Averaging Period and Pollutant | Preburn Level | Postburn Level |
|---|---|---|
| 1-hour $PM_{2.5}$ | N/A | 64 µg/m$^3$ |
| 4-hour $PM_{2.5}$ | 22 µg/m$^3$ | 32 µg/m$^3$ |
| 24-hour $PM_{2.5}$ | 16 µg/m$^3$<br>(Air Quality Index = 59) | 26 µg/m$^3$<br>(Air Quality Index = 80) |
| 8-hour ozone | N/A | 56 ppb<br>(Air Quality Index = 47) |

*Note*: µg/m$^3$ = micrograms per cubic meter; ppb = parts per billion

Preburn enhanced documentation is **only required when burning will be approved or when burning has been approved but has not yet commenced** and either of the following two conditions occur:

- The rolling 4-hour average $PM_{2.5}$ concentration equals or exceeds 22 micrograms per cubic meter (µg/m$^3$) any time from 5:00 a.m. up to the start of the burn.
- The rolling 24-hour average $PM_{2.5}$ concentration equals or exceeds 16 µg/m$^3$ any time from 5:00 a.m. up to the start of the burn.

Postburn enhanced documentation is **only required when burning has been approved and has occurred** and any one of the following conditions occur:

- The 1-hour average $PM_{2.5}$ concentration equals or exceeds 64 µg/m$^3$ any time after the start of the burn through 10:00 p.m. on the day of the burn.
- The rolling 4-hour average $PM_{2.5}$ concentration equals or exceeds 32 µg/m$^3$ any time after the start of the burn through 10:00 p.m. on the day of the burn.
- The 24-hour average $PM_{2.5}$ concentration equals or exceeds 26 µg/m$^3$ during the burn day (midnight to midnight).
- The 8-hour average ozone concentration equals or exceeds 56 ppb any time after the start of the burn to midnight.

### 4.6.1 DEQ Staff Responsibilities

Smoke Management Analysts are responsible for the following tasks regarding enhanced documentation:

- Review the monitoring data prior to the morning burn decision to determine whether any preburn trigger levels have been exceeded.
- Notify the applicable regional office staff of instances when approved burns will require preburn enhanced documentation.
- Enter enhanced documentation trigger events on tracking log in TRIM
- Continue to track the monitoring data throughout the day and notify the applicable regional office staff of any enhanced documentation criteria that have been triggered during the burn day. This may consist of preburn triggers that have been exceeded prior to the start of the burn or postburn triggers that have been exceeded after the burn was started.
- The Southern Idaho Smoke Management Analyst will be responsible for completing the enhanced documentation for 8-hour ozone concentrations in all of southern Idaho except the Southwest Idaho SMA, where the Boise Regional Office will perform this.

Regional office staff are responsible for the following tasks regarding enhanced documentation:

- Complete enhanced documentation for all required burns.
    - Preburn enhanced documentation, when required, must be completed prior to the final burn approval. If the preburn enhanced documentation requirement is triggered after the final burn approval but prior to the start of the burn, the preburn enhanced documentation should be completed while the information remains fresh (typically within a day or two).
    - Postburn enhanced documentation should also be completed within a day or two.

- File completed enhanced documentation forms in TRIM and note completion and summary information in tracking log.

### 4.6.2 Preburn Enhanced Documentation

Preburn enhanced documentation must be completed when DEQ will be providing, or has provided, final burn approval and a measured pollutant concentration in the area exceeds a preburn trigger level shown in Table 2. Preburn enhanced documentation requires DEQ to evaluate elevated pollutant concentrations in the area prior to the start of the burn and assess how smoke from the approved burning may affect the concentrations. Preburn enhanced documentation, when triggered, must be completed prior to the final burn approval, and the final burn approval must be based on the enhanced documentation assessment. If the trigger occurred after final burn approval but prior to the start of the burn, enhanced documentation should be completed in a timely manner. Therefore, for a final burn approval to be made, the assessment must be that smoke from the approved burn would not cause or contribute to a measured concentration above a program concentration limit and would not result in an adverse impact.

Preburn enhanced documentation is required when a trigger limit is met any time from 5:00 a.m. up to the start of the burn.

### 4.6.3 Postburn Enhanced Documentation

Postburn enhanced documentation must be completed when an approved crop residue burn is reasonably suspected of having caused or contributed to a possible adverse impact or public roadway safety hazard or when a measured pollutant concentration has exceeded a trigger level (Table 2). Postburn enhanced documentation protocol requires DEQ to review the applicable monitoring data, assess other potential sources of air pollutants, analyze the meteorological conditions, consider unique or unanticipated events or circumstances, and assess whether smoke from approved burning affected pollutant concentrations. When required, postburn enhanced documentation should be completed in a timely manner following the burn so that details are not forgotten and the assessment can be put to use quickly as a learning tool for future burn decisions.

Postburn enhanced documentation is required when a 1-hour or 4-hour $PM_{2.5}$ trigger limit is met any time from the start of the burn until 10:00 p.m. on the burn day or a 24-hour $PM_{2.5}$ trigger or 8-hour ozone trigger is met any time from the start of the burn until midnight.

The purpose of evaluating and determining whether an adverse impact to an ISP occurred is to gauge how well implementation of the program complies with the SIP and to provide information for improving burn decisions. DEQ currently conducts enhanced evaluation and documentation when smoke dispersion does not go as planned. All monitors in the state are at ISPs with the exception of the Porthill and Franklin monitors. DEQ will use the following procedure to evaluate whether an adverse impact at an ISP occurred.

- When a monitor is present and the maximum hourly $PM_{2.5}$ concentration is below 20 $\mu g/m^3$ (or visibility is at least 10 miles if no monitor is available):
    - Conclude that no adverse impact occurred
    - No additional documentation needed unless DEQ received a complaint from an ISP

        - If a complaint was received from an ISP, full evaluation and enhanced documentation will be completed.

- When a monitor is present and the maximum hourly $PM_{2.5}$ concentration is between 20 and 26.25 µg/m$^3$:
    - Conclude adverse impact unlikely
    - Brief evaluation needed to determine whether an adverse impact occurred. The following items will be reviewed for the evaluation:
        - Monitoring data
        - Weather data
        - Field notes
    - If a complaint was received from an ISP, full enhanced documentation and evaluation will be completed.
- When a monitor is present and the maximum hourly $PM_{2.5}$ concentration is greater than 26.25 µg/m$^3$ (or visibility is less than 10 miles if no monitor is present):
    - Adverse impact possible
    - Full enhanced documentation and evaluation will be completed to determine whether an adverse impact occurred. The full evaluation will include reviewing the following:
        - Monitoring data
        - Weather data
        - Field notes
        - Contact with the ISP—questions identified on the enhanced documentation form will be asked to the ISP and responses documented

### 4.6.4 Tracking Enhanced Documentation and Impacts to ISPs

Events that trigger enhanced documentation must be tracked on a spreadsheet saved in TRIM. The purpose of tracking is to record the trigger events, track that enhanced documentation was completed, and to provide a process to efficiently document those situations where circumstances unrelated to the approved burning resulted in the triggering of the enhanced documentation without having to complete either the full or brief enhanced documentation. In these cases, a short explanation of why the approved burning was not a cause of the trigger will be entered on the tracking spreadsheet and no additional enhanced documentation will be required.

The same tracking form is used to track impacts to ISPs. DEQ should take note if an ISP is impacted repeatedly and evaluate the burn decision and burn approval decision making involved with those impacts with the goal being to avoid further impacts to the ISP.

The tracking log includes date, monitor locations, burn location, trigger reason, brief description, ISPs affected, type of enhanced documentation, responsible staff, completion date, and summary. The tracking log is stored in TRIM (2014ACW24 – Enhanced Documentation and ISP Tracking Log).

### 4.6.5 Monitors

Table 3 lists the $PM_{2.5}$ and ozone monitors that should be reviewed for evaluating compliance with the standards described above. According to the DEQ Air Quality Monitoring Standard Operating Procedures and the US Environmental Protection Agency's guidelines for air quality monitoring, negative values of 10 or greater (i.e., -10–0) are to be kept and included in the averaging of the $PM_{2.5}$ 24-hour concentrations. Values less than negative 10 are to be thrown out.

**Table 3. Crop residue burning program air quality monitors.**

| Site Name | Location | Pollutants[a] | Smoke Management Area |
|---|---|---|---|
| ***DEQ Boise Regional Office Monitors*** | | | |
| Garden Valley | Garden Valley | $PM_{2.5}$ | Boise and Valley Counties |
| McCall USFS | McCall | $PM_{2.5}$ | |
| Idaho City | Idaho City | $PM_{2.5}$ | |
| Fire Station #5 | Boise | $PM_{10}$ | Southwest Idaho |
| Nampa | Nampa | $PM_{2.5}$ / $PM_{10}$ | |
| White Pine Elementary | Boise | $O_3$ (seasonal) | |
| St. Luke's Hospital | Meridian | $O_3$ / $PM_{2.5}$ | |
| Weiser High School | Weiser | $PM_{2.5}$ (seasonal) | Weiser and Lower Payette Valleys |
| ***DEQ Twin Falls Regional Office Monitors*** | | | |
| Twin Falls | Twin Falls | $PM_{2.5}$ | Southern Magic Valley |
| Paul Elementary School | Paul | $PM_{2.5}$ (seasonal) | Northern Magic Valley |
| Ketchum | Ketchum | $PM_{2.5}$ | Blaine and Camas Counties |
| ***DEQ Idaho Falls Regional Office Monitors*** | | | |
| Penford | Idaho Falls | $PM_{2.5}$ | Eastern Idaho |
| Rexburg | Rexburg | $PM_{2.5}$ (seasonal) | |
| Salmon | Salmon | $PM_{2.5}$ | Custer and Lemhi Counties |
| ***DEQ Pocatello Regional Office Monitors*** | | | |
| Pocatello G&G | Pocatello | $PM_{2.5}$ / $PM_{10}$ | Southeast Idaho |
| Soda Springs | Soda Springs | $PM_{2.5}$ (seasonal) | |
| Franklin | Franklin | $PM_{2.5}$ | |
| ***DEQ Lewiston Regional Office Monitors*** | | | |
| Grangeville | Grangeville | $PM_{2.5}$ | Central |
| Cottonwood | Cottonwood | $PM_{2.5}$ (seasonal) | |
| Potlatch | Potlatch | $PM_{2.5}$ (seasonal) | |
| Kendrick | Kendrick | $PM_{2.5}$ (seasonal) | |
| Moscow | Moscow | $PM_{2.5}$ | |
| Lewiston | Lewiston | $PM_{2.5}$ | |

| Site Name | Location | Pollutants[a] | Smoke Management Area |
|---|---|---|---|
| ***DEQ Coeur d'Alene Regional Office Monitors*** | | | |
| Lancaster | Coeur d'Alene | $PM_{2.5}$ | Kootenai County |
| Athol | Athol | $PM_{2.5}$ (seasonal) | |
| Garwood Elementary | Rathdrum | $PM_{2.5}$ (seasonal) | |
| Sandpoint | Sandpoint | $PM_{2.5}$ | Shoshone |
| Pinehurst | Pinehurst | $PM_{2.5}$ | |
| St. Maries | St. Maries | $PM_{2.5}$ | |
| Mt. Hall School | Copeland | $PM_{2.5}$ (seasonal) | Boundary County |
| Kootenai Tribe of Idaho | Kootenai Tribe Mission | $PM_{2.5}$ (seasonal) | |
| Porthill | Canadian Border | $PM_{2.5}$ (seasonal) | |
| ***National Park Service Monitors*** | | | |
| Yellowstone | Yellowstone National Park | $O_3$ | Multiple smoke management areas |
| Craters of the Moon | Craters of the Moon | $O_3$ | |
| ***Utah Department of Environmental Quality Monitors*** | | | |
| Cache County | Logan | $O_3$ | Southeast Idaho |
| Box Elder County | Brigham City | $O_3$ | Southeast Idaho |
| ***Washington Department of Ecology Monitors*** | | | |
| Colbert-Greenbluff Road | Spokane | $O_3$ | Kootenai County |

[a] $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter
$O_3$ = ozone
$PM_{10}$ = particulate matter less than 10 microns in diameter

## 4.7 Complaint Response, Compliance, and Enforcement

It is the responsibility of the regional offices to respond to all crop residue burning complaints, investigate all apparent crop residue burning violations, and refer apparent violations to the State Office for formal enforcement consideration, when appropriate. Appendix D provides information about determining compliance with permit conditions. DEQ can receive complaints via the toll-free phone system or directly to regional offices.

To maintain consistency in all regions and ensure compliance with the applicable state rules, regional office staff shall address all crop residue burning complaints in the following manner:

- Respond to all crop residue burning complaints as soon as practicable; ideally, this should be no later than the next business day after receiving the complaint.
- Log all complaints into the DEQ complaint tracking system. This includes all complaints received through the toll-free phone system that are CRB-related.
- Document, as appropriate, information pertaining to the complaint. This could include law enforcement or fire agency reports, physical evidence, photos, GPS locations, field descriptions, or statements.

- When an apparent crop residue burning violation is observed, the Regional Office Analyst should identify, verify, and secure the information and evidence necessary to support enforcement activities.

# 5 Program Evaluation and Annual Review

DEQ is required to review the CRB program and this operating guide annually. However, DEQ staff continually review air quality and burn decision data to determine the efficacy of the program. The following are examples of evaluation and analysis that will take place annually:

- Days with approved crop residue burning that had elevated air pollutant concentrations will be analyzed to determine whether the crop residue burning may have caused or contributed to the measured concentration.
- Days with approved crop residue burning that had low air pollutant concentrations will be analyzed to determine which parameters may have contributed to that day's good smoke dispersion characteristics.

Program feedback and recommendations will be sought from the public, participating growers, the US Environmental Protection Agency, fire districts, tribes, and other smoke management agencies.

Although the program will undergo this thorough annual review, DEQ staff should also be striving to constantly improve program operation. Burns are continuously monitored throughout the day to determine how well they are going and if unexpected weather conditions or smoke management issues occur, why they have occurred. This information will help staff make necessary adjustments in the decision-making process for subsequent burn days.

# Appendix A. Spot Burning, Baled Agricultural Residue Burning, and Propane Flaming

Spot burning, baled agricultural residue burning, and propane flaming rules were developed after the second year of DEQ's CRB Program and were implemented in spring 2013. These permits were developed to reduce the administrative requirements for burning very small amounts of residue while still protecting public health.

## Spot and Baled Agricultural Residue Burn Permit

The spot and baled agricultural residue burn permit (spot and bale burn permit) can be used to burn small areas of residue or weeds or equivalent piled or baled residue under the following conditions:

- No more than 1 acre of spots and/or equivalent piled or baled agricultural residue may be burned per day. For the purposes of this permit, 2 tons of piled or baled agricultural residue is equivalent to 1 acre of spots.
    - A spot or pile burn may include weed patches, spots of heavy residue, equipment plugs or dumps, pivot corners, and very small pastures but does **not** include the open burning of wind rows.
    - Baled agricultural residue may be burned to dispose of broken, mildewed, diseased, or otherwise pest-ridden bales still in the field where they were generated. Once a bale has been removed from the field, it cannot be returned to the field and then burned.
- No more than 10 acres of spots and/or equivalent piled or baled agricultural residue may be burned per calendar year.

### *Grower Requirements*

- Burning under the spot and bale burn permit shall only be allowed on DEQ-designated burn days for the county where the field is located and within the designated burn window. Spot and bale burns shall not smolder and generate smoke outside of the designated burn window. DEQ burn decisions are available at *http://www.deq.idaho.gov/air-quality/burning/daily-crop-burn-decision/spot-and-bale-burn -decision.aspx*.
- Burning under a spot and bale burn permit may be allowed on weekdays, weekends, and holidays.
- All burning must be conducted in accordance with the permit issued by DEQ. The permit includes general requirements that apply to all burning conducted under the spot and bale burn permit and field-specific requirements due to location (e.g., proximity to a school).
- The permittee must record the date, time frame, type of burn, type of crop, and amount burned on the date of the burn. Records shall be retained for 2 years and made available to DEQ upon request.
- A spot and bale burn permit is valid for 1 calendar year. All permits issued in a given calendar year will expire on December 31 of that calendar year.
- The permittee must attend a crop residue burning training session provided by DEQ online at *http://deq.idaho.gov/air-quality/burning/crop-residue-burning.aspx*.

### *Permit Process*

Registration and fee payment is available online at *http://www.deq.idaho.gov/air-quality/burning/crop-residue-burning.aspx*.

- Submit a registration to DEQ at least 14 days prior to the first desired burn date of the calendar year. The registration must include the following information:
  - The location of each field where the grower wants to conduct a spot or bale burn.
  - The applicant's name, mailing address, telephone number, and cell phone number.
- Pay a nonrefundable permit fee of $20 to DEQ at least 14 days prior to the first desired burn date of the calendar year.

## Propane Flaming Permit

The propane flaming permit only applies to very specific activities. Propane flaming is the use of flame-generating equipment to briefly apply flame and/or heat to the topsoil of a cultivated field of pre-emerged or plowed-under crop residue with less than 550 pounds of burnable, nongreen residue per acre. Propane flaming is allowed for control of diseases, insects, pests, and weed emergence; is *not* used for crop residue disposal; and must be conducted on the field where the residue was generated.

### *Residue Loading Requirement*

The picture below shows a field with 550 pounds of burnable, nongreen residue per acre. A field with less than this amount of residue would qualify for propane flaming as long as other requirements are met. This picture is taken from the "Picture your Residue" publication by the United States Department of Agriculture Soil Conservation Service (available at *http://www.deq.idaho.gov/media/977017-picture_your_residue.pdf*).

### *Grower Requirements*

Unlike other types of DEQ-regulated crop residue burning, propane flaming, as defined above, does not require growers to register fields or pay a fee. Instead, growers shall be deemed to have a permit by rule if they comply with the following:

- The permittee must ensure that adequate measures are taken so the burn does not create a hazard for travel on a public roadway.
- Propane flaming shall only be allowed on DEQ-designated burn days for the county where the field is located and within the designated burn window. Burns shall not smolder and generate smoke outside of the designated burn window. DEQ burn decisions are available at *www.deq.idaho.gov/air-quality/burning/daily-crop-burn-decision/propane-flaming-decisions*.
- Burning conducted under a propane flaming permit may be allowed on weekdays, weekends, and holidays.
- The permittee must record the date, time frame, type of burn, crop type, and amount burned on the date of the burn. Records shall be retained for 2 years and made available to DEQ upon request.
- The person conducting burning must carry a portable form of communication such as a cellular phone in order to receive information necessary to protect air quality.
- The permittee must attend a crop residue burning training session provided by DEQ online at *www.deq.idaho.gov/air-quality/burning/crop-residue-burning*.
- All persons intending to conduct propane flaming shall obtain any additional permits from federal, state, or local fire control authorities prior to burning. DEQ's spot and bale burning web application will assist the grower in obtaining Idaho Department of Lands burn permits.

### *Burning Restrictions*

- Burning is not allowed if the proposed burn location is within 3 miles of an institution with sensitive population and the surface wind speed is greater than 12 mph or if the smoke is adversely impacting or expected to adversely impact an ISP.
- All open burning, including propane flaming, is prohibited when DEQ issues an air quality emergency episode notice as defined by Idaho rules (IDAPA 58.01.01.552).
- Tires and other restricted materials described in Idaho rules (IDAPA 58.01.01.603) are not allowed for ignition in fields.

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# Appendix B. Burn Decision Procedures for DEQ Staff

## Smoke Management Analysts

### *Day Before Burn*

1. Review current monitor readings and trends for particulate matter and ozone within the smoke management area (SMA). Compare to the regulations (i.e., 75% of any National Ambient Air Quality Standard [NAAQS] and 80% of the 1-hour trigger for particulate matter).

   - 64 micrograms per cubic meter (µg/m$^3$) for $PM_{2.5}$ (1-hour average)
   - 26 µg/m$^3$ for $PM_{2.5}$ (24-hour average)
   - 112 µg/m$^3$ for $PM_{10}$ (24-hour average)
   - 56 parts per billion (ppb) for ozone (8-hour average)

   A no-burn decision may be made at this point and the following steps will not be needed.

2. Briefly review meteorological forecast models, tools, and real-time data.
3. Review wildland fire and prescribed burn information.
4. Make preliminary burn decision (burn/no-burn/conditional) for each county based on the information and tools reviewed.
5. Review the burn forecast from the meteorologist (available by 3:00 p.m.) during the fall burn season or the National Weather Service (NWS) forecast discussion during the spring burn season.
6. Participate in the conference call with the meteorologist, Regional Office Analysts, Seasonal Smoke Coordinators, and other smoke managers (such as tribes or neighboring states) at 3:30 p.m. local time. (Applies to fall burn season only.) This conference call includes a summary of the meteorologist's forecast, a summary by the Seasonal Smoke Coordinators of the current day's burns, a description of any noteworthy air quality readings, and a brief discussion of the next day's burn decision.

### *Day of Burn*

1. Review the preliminary burn decision. If it was no-burn, no further action is needed.
2. Review current $PM_{2.5}$ and ozone monitor readings and trends within the SMA for the following data.

   - Current 1-hour, 4-hour, and 24-hour average $PM_{2.5}$ concentrations
   - Current 1-hour and 8-hour ozone concentration (if applicable)

   Compare monitoring data to trigger levels for enhanced documentation.

   **Compare data to the regulations (i.e., 75% of any NAAQS and 80% of the 1-hour trigger level for particulate matter).**

   - 64 µg/m$^3$ for $PM_{2.5}$ (1-hour average)
   - 26 µg/m$^3$ for $PM_{2.5}$ (24-hour average)

- 112 µg/m$^3$ for $PM_{10}$ (24-hour average)
- 56 ppb for ozone (8-hour average)

**A no-burn decision may be made at this point and the following steps will not be needed.**

3. Review meteorological forecast models, tools, and real-time data included in accordance with DEQ's CRB burn decision standard operating procedure.
4. Review wildland fire and prescribed burn information.
5. Review the ready-to-burn fields, noting field locations and size for each SMA.
6. Review the burn forecast from the meteorologist (available by 8:00 a.m.) during the fall burn season or the NWS forecast discussion during the spring burn season.
7. Participate in the conference call with the meteorologist, Regional Office Analysts, Seasonal Smoke Coordinators, and other smoke managers at 8:30 a.m. local time.
8. Make the final burn decision (burn/no-burn and number of acres) based on review of information and consultation with regional office staff by 10:00 a.m.
9. Throughout the burn day, monitor the air quality and meteorological conditions. If air quality and/or meteorological conditions result in the burn decision being changed during the day, proper documentation should be maintained to support decisions to increase or decrease the acres to be burned. An increase in acres during the burn day is only allowed if it was noted in the final burn decision. If the burn decision changes, coordinate with the Regional Office Analysts to document the change as follows:
   a. Thoroughly document the reasons and conditions supporting the change.
   b. Ensure all applicable staff are updated.
   c. Continue to monitor air quality conditions.

## Seasonal Smoke Coordinators

### *Day Before Burn*

1. Review the pollutant and meteorological real-time monitoring data.
2. Review the meteorologist's forecast (available by 3:00 p.m.) during the fall burn season or the NWS forecast discussion during the spring burn season.
3. Participate in the afternoon CRB conference call. Be prepared to discuss the current day's completed burns, any issues that came up during the day, or other applicable observations made during the day.
4. Provide input on the preliminary burn decision if needed.
5. Review and maintain the ready-to-burn list and plan the following day.

### *Day of Burn*

1. Review the pollutant and meteorological monitoring data. Review and document visibility conditions and fire safety issues.

2. Review the meteorologist's forecast (available by 8:00 a.m.) during the fall burn season or the NWS forecast discussion during the spring burn season.
3. Participate in the morning CRB conference call. Be prepared with a current list of growers who are ready to burn.
4. Based on the burn decision, determine what fields will be approved to burn. Approval priority will be as follows:
   a) Favorable conditions exist for sensitive areas (e.g., fields near towns, roads, and canyons) and institutions with sensitive populations.
   b) The forecasted conditions favor the unique or specific requirements of the area to be burned.
   c) The earliest burn requests received from growers.
5. Post the notifications of final approval and contact the approved growers to notify them of final approval. Supply the grower with the following information:
   a. Approved burn window or ignition time
   b. Approved burn locations or specific field
   c. Specific permit requirements (conditions) for the burn (e.g., expected wind direction or speed, any conditions necessary to protect institutions with sensitive populations, potential for rain, etc.)
   d. Other relevant information
6. Receive any updated instructions for the day from the Regional Office Analyst. These instructions may include driving to the burn location to monitor burns, responding to complaints, or investigating illegal burns.
7. When in the field, be aware of current atmospheric conditions that may affect burning (e.g., incoming storms or changes in temperature, humidity, wind speed and direction, cloud type, and visibility conditions) and effects of the surrounding terrain.
8. Record field conditions and observations.
9. If meteorological conditions in the field differ from those forecasted, immediately contact the Regional Office Analyst for direction. If conditions deteriorate, the Seasonal Smoke Coordinator has the authority to require the burn extinguished or to require withholding of additional fuel so the fire burns down.
10. Remain in contact with growers throughout the day either by cell phone or in person. Acreage of burn may be increased (an increase must be in accordance with the acreage listed on the final burn decision) or decreased during the burn day, depending on improving or deteriorating conditions. The Smoke Management Analyst has the authority to increase acreage. If acreage is increased, the Seasonal Smoke Coordinator will be contacted with the necessary information.
11. When all approved burns have been completed, update logs and databases as needed. Copy field notes to the network drive or TRIM.

## Regional Office Analysts

A Regional Office Analyst may also have to take on some or all of the duties listed above for the Seasonal Smoke Coordinator if the coordinator is unavailable. Routine responsibilities include the following.

### *Day Before Burn*

1. Review the pollutant and meteorological real-time monitoring data.
2. Review the forecast from the meteorologist (available by 3:00 p.m.) during the fall burn season or the NWS forecast discussion during the spring burn season.
3. Participate in the afternoon conference call with the meteorologist, Smoke Management Analyst, other Regional Office Analysts, and Seasonal Smoke Coordinators at 3:30 p.m. local time.
4. Provide input to the preliminary burn decision if needed.

### *Day of Burn*

1. Review the forecast from the meteorologist (available by 8:00 a.m.) during the fall burn season or the NWS forecast discussion during the spring burn season.
2. Participate in the morning conference call with the meteorologist, Smoke Management Analysts, other Regional Office Analysts, Seasonal Smoke Coordinators, and other smoke managers at 8:30 a.m. local time.
3. Provide input on the final burn decision if needed.

# Appendix C. State Implementation Plan Requirements for Burn Decision Criteria

This appendix contains the specific information that was included in the *Open Burning of Crop Residue State Implementation Plan (SIP) Revision*.[1] This information will be used in conjunction with the rest of the guidance in this operating guide. Some of the information included in this appendix is also discussed elsewhere in this guide. The purpose of this appendix is to ensure that DEQ captures all the requirements from the SIP.

## Meteorological Data

The goal of smoke management is to assure good to excellent ventilation (smoke rises and disperses above the ground) and good to excellent dispersion (smoke goes into the transport winds and moves out of the area). Aspects of the meteorological data that should be evaluated include:

Ventilation index is a calculation based on the surface wind speed and the mixing height. The ventilation index for the burn area should be 'marginal' to 'excellent' throughout the duration of the approved burn.

- Burns should be grouped by areas of best ventilation.
- Burning under poor ventilation should not be conducted.
- Burning under marginal ventilation may be successfully conducted if the other prescription criteria are met and should only be approved on a case-by-case basis.
- Ventilation characteristics may be established using forecasted characteristics or from observed smoke behavior and cloud formation.

Cloud cover should be "mostly sunny" to "partly cloudy."

- Uplifting, billowy clouds (fair weather cumulus) show the most unstable conditions (best ventilation and dispersion).
- Clear, bright blue skies are often indicative of high pressure systems which are likely to have poor ventilation. Before burning under clear skies all other prescription criteria should be met.
- Burning under low-lying, solid cloud cover should be avoided if the mixing height is at or near the same elevation as the cloud layer. If the solid cloud cover is at a higher elevation burning may be successfully accomplished if other prescription parameters are met.

Surface wind speeds should be in the 3-8 mph range or at a speed sufficient to carry the fire.

- Winds speeds of less than 3 mph can often result in fire spreading unpredictably. Wind that is too light and variable can create poor dispersion conditions.

[1] Idaho Department of Environmental Quality. 2008. *Open Burning of Crop Residue State Implementation Plan (SIP) Revision*. Boise, ID: Idaho Department of Environmental Quality. Available at *http://www.deq.idaho.gov/crop-residue-burning*.

- When burning within 3 miles of an ISP, sustained surface wind speeds shall not exceed 12 mph, and, generally, the wind speed should be within 3-8 mph, which is the optimum range.
- Burning when surface winds are greater than 12 mph should be done with extreme caution. Too strong of surface winds can inhibit plume rise, pushing smoke along the surface. Strong surface winds can also make control of the fire difficult.

Surface wind direction can vary depending upon the location of the burn.

- Burning should be conducted to keep smoke away from ISPs, public roadways, airports, and populated areas. Burning should not be conducted when conditions are such that smoke is likely to reach such receptors.
- Take caution if the surface wind direction is forecasted to shift at some point during the burn window. A shift in direction can result in smoke impacts or increased fire risk.

Transport wind speed should be 7 – 20 mph for best dispersion.

- Be cautious of burning when transport wind speeds exceed 20 mph. Transport wind speeds that are above 20 mph may produce turbulence that causes smoke to return to ground level.

Transport wind direction is dependent upon the location of the burn.

- Burning should be conducted to keep smoke away from ISPs, public roadways, airports, and populated areas. Burning should not be conducted when conditions are such that smoke is likely to reach such receptors.
- Take caution if the transport wind direction is forecasted to shift at some point during the burn window. A shift in direction can result in smoke impacts.

Mixing heights should be at least 1,000 feet above ground level.

- Mixing heights may vary throughout the airshed based on changes in elevation and other surface features, such as large bodies of water.

Relative humidity (RH) should be considered for smoke management and fire safety reasons.

- Low RH levels (i.e., below 25%) may be preferable for smoke management. However, because lower RH levels can make it difficult to control a fire, caution should be used.
- For bluegrass residue burning, RH levels over 30% may inhibit plume rise and smoke dispersion, so ventilation conditions should be especially considered.
- High RH levels (i.e., above 60%) are likely to inhibit plume rise and smoke dispersion and may result in incomplete burning of residue.
- The response to changes in relative humidity occurs more rapidly with fine dead fuel suspended above the ground because these fuels are not in contact with the damp lower layer and are more exposed to the sun and wind.

Radiation inversions. Under optimum conditions the burn window may be narrow due to radiation inversions.

- Burning should not be permitted before the inversion has mixed out unless transport conditions after breakup would not protect population centers.

- A sufficient amount of time should be allowed at the end of the burn day for any residual smoke to disperse from the area before a radiation inversion returns.

## Specific Attributes of the Burn Management Areas

Idaho has diverse terrain, topography, climate, soils and crops. To better address this diversity, DEQ has developed Burn Management Areas (BMAs) that divide the state into more manageable parts.[2] Within the BMAs, DEQ may develop specific prescriptions designed to maximize smoke dispersion and to minimize air quality impacts.

Some examples of prescriptions that may apply to all, or part, of a BMA are:

- Burns near canyon rims should be conducted only when both transport and surface winds are blowing away from the canyon.
    - Ensure that conditions are such that adequate plume rise will occur. In some cases a test burn may be necessary. Smoke that drifts over a canyon is likely to descend toward ground level if the temperatures in the canyon are cooler than the temperatures over the surrounding land.
    - For fire safety reasons burns should be conducted before the surface wind speed increases (typically by 12:00PM). Avoid burning if 'whirlwinds' are visible.
- Burns near large bodies of water should be conducted only when both transport and surface winds are blowing away from the water. The air will usually be cooler and more stable over large bodies of water. This can cause 'lake-breezes' in the afternoon that will pull smoke downward - winds at the surface blow from the lake to shore, which causes air above the lake to sink downward. Even in the absence of a true lake-breeze, the interaction between lake-generated winds and prevailing winds is complex and can cause variable conditions that can change quickly. Knowledge of the expected prevailing wind direction and wind strength is important. It is also important to know the direction of transport winds aloft to avoid smoke drifting over the water. Surface and transport winds can be from vastly different directions. A good guide would be to burn downwind of major lakes so that the smoke is never carried over the lake.
- Favorable Winds. Certain areas have fairly predictable predominant winds and fairly predictable daily wind shifts. In such areas, burning should be timed to match the local wind pattern to achieve the most favorable smoke dispersion characteristics.

## Visibility

Visibility conditions should be considered when deciding whether or not to approve burning. When deciding to allow burning on a given day, if visibility is less than 10 miles and is expected to remain so throughout that day, a no burn decision will be made.

## Individual Fields/Institutions with Sensitive Populations

DEQ will consider the following factors in developing specific prescriptions and burn approvals.

[2] Burn management areas are now referred to as smoke management areas (SMAs). Please see Figure 2 in the main document for SMA names and boundaries.

- Burn location is identified on the permit at the township/range/section/¼ ¼ section level.
- Elevation and aspect are also considered. Due to microclimatic variations in wind speed, direction, lift and dispersion, burn location information is very important. Fields that have slopes that face toward the south will receive more solar heating than other fields and will tend to have lower soil moisture and fuel moisture levels.
- Proximity to Institutions with Sensitive Populations. The proximity of the burn to institutions with sensitive populations, including public schools while in session; hospitals; residential health care facilities for children, the elderly or infirm; and other institutions with sensitive populations as approved by the Department. The Department shall not authorize a burn if conditions are such that institutions with sensitive populations will be adversely impacted or when the plume is predicted to impact such institutions.
- Proximity to Public Roadways. Proximity to public roadways.
- Proximity to Airports. Proximity to airports
- Proximity of Other Burns. The proximity of other burns and other potential emission sources within the area to be affected by the proposed burn.
- Size of the burn includes the area (acres or feet) of the burn as well as the height of the burn if the burn is a pile.
- Burning method refers to the lighting method such as match/lighter, propane torch, or diesel burners, as well as the pattern of lighting. Generally, the hotter the fire, the less smoke it produces, and the better the smoke is pushed upward for dispersion.
    - If a field is lit slowly section by section and/or is lit from the top of a slope downward, the burn can take longer, not burn as hot, and may produce more smoke than burning a field more effectively.
    - A typical, more effective burn begins with lighting a backfire along the downwind perimeter of a burn. A backfire moves slowly and with relatively low flames because it burns into the wind. When a backfired portion of the burn is safe, flank fires are generally lit beginning at the backfire along burn perimeters parallel with the wind. Flank fires have moderate flame heights and speed because they move perpendicular to the wind. When the back and flank portions of the fire are safe, a head fire is typically lit to quickly consume the remaining fuel. A head fire moves relatively fast with longer flames because it burns with the wind. Usually, fires that burn uphill act as head fires and those that burn downhill act as backfires, regardless of wind direction.
- Fuel type affects smoke generation and dispersion. Generally, the more dense the fuel, the more smoke it produces when it burns. For example, fuel density can change with crop type and variety (e.g. generally, wheat stubble is less dense than bluegrass stubble, and certain wheat or bluegrass varieties can be denser than others).
- Fuel loading/expected emissions. Fuel loading is a function of fuel type, acreage of the burn, density of material remaining in the field, and burn type. Generally, the greater the fuel loading, the greater the expected emissions and the potential for smoke.
- Fuel moisture is dependent upon fuel type and relative humidity. In general, fuel moisture should be as dry as possible throughout the residue layer to promote plume rise.
    - Fuel moisture influences smoke quantity and plume rise. In general, the greater the fuel moisture, the more smoke and poorer plume rise.
    - Fuel moisture should be initially assessed independently of RH.

- Relative Humidity and temperature controls fuel moisture content up to about 32 percent. Liquid moisture such as rain or dew must contact a fuel for moisture content to rise above 32% and the increase depends upon the duration as well as the amount of precipitation.
- The moisture content for fine or dead fuel, such as pine needles and dried grasses, responds rapidly to changes in relative humidity.
- There is a lag time involved for fuel moisture content to reach equilibrium with the RH of the surrounding atmosphere.
- Previous drying and wetting of the fuel will influence fuel moisture.

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# Appendix D. Determining Compliance with Permit Conditions

This appendix provides a detailed description of how the Idaho Department of Environmental Quality (DEQ) determines compliance with permit conditions. Permit conditions are an important part of proper smoke management. Failure by the grower to comply with permit conditions may result in the issuance of a compliance document (notice to comply or notice of violation), civil or criminal charges, and monetary penalties.

A Seasonal Smoke Coordinator or Regional Office Analyst that is on site at a burn might identify permit conditions that are inaccurate due to an error during the registration review process or because they are not representative of the conditions in the field. If this occurs, the on-site DEQ staff **must** contact the appropriate North or South Smoke Management Analyst prior to ignition to have the permit conditions changed. If the coordinator is unable to contact the Smoke Management Analyst (e.g., lack of cell service, analysts not available), he must have the grower proceed with the burn as specified on the current permit or not conduct the burn at all.

## Permit Conditions

**Wind Speed**—Crop residue burning (CRB) permits often contain a condition that restricts burning if "sustained surface wind speeds" are above 12 miles per hour (mph). The purpose of this condition is to restrict burning during those times when strong surface winds could blow smoke along the ground toward institutions with sensitive populations (ISPs), populated areas, public roadways, or other features that should be protected. DEQ is required to restrict burning at fields that are within 3 miles of an ISP when the sustained surface wind speed exceeds 12 mph. DEQ may also choose to include a wind speed restriction on fields that are near roadways, airfields, or populated areas to better protect these features. DEQ defines sustained wind speed as the average wind speed for a 1-minute period.

**Wind Direction**—CRB permits often contain a condition that restricts burning if the surface wind is from a particular direction or combination of directions. The purpose of this condition is to restrict burning during those times when the wind could carry smoke toward ISPs, populated areas, public roadways, or other features that should be protected.

DEQ uses the 4 cardinal wind directions and 12 intercardinal wind directions (north-northeast, northeast, east-northeast, east-southeast, southeast, south-southeast, south-southwest, southwest, west-southwest, west-northwest, northwest, and north-northwest) to describe the wind direction restrictions. The restriction includes the listed direction plus or minus 11.25 degrees. For example, if a permit condition restricts burning when winds are from the west-southwest (i.e., 247.5 degrees), burning is restricted when the sustained wind direction is anywhere from 236.25 to 258.75 degrees. To simplify these guidelines, DEQ has rounded these numbers to the nearest degree (Figure 1).

| Direction | Degree Range | |
|---|---|---|
| | From | To |
| North (N) | 349° | <11 |
| North-northeast (NNE) | 11° | <34 |
| Northeast (NE) | 34° | <56 |
| East-northeast (ENE) | 56° | <79 |
| East (E) | 79° | <101 |
| East-southeast (ESE) | 101° | <124 |
| Southeast (SE) | 124° | <146 |
| South-southeast (SSE) | 146° | <169 |
| South (S) | 169° | <191 |
| South-southwest (SSW) | 191° | <214 |
| Southwest (SW) | 214° | <236 |
| West-southwest (WSW) | 236° | <259 |
| West (W) | 259° | <281 |
| West-northwest (WNW) | 281° | <304 |
| Northwest (NW) | 304° | <326 |
| North-northwest (NNW) | 326° | <349 |

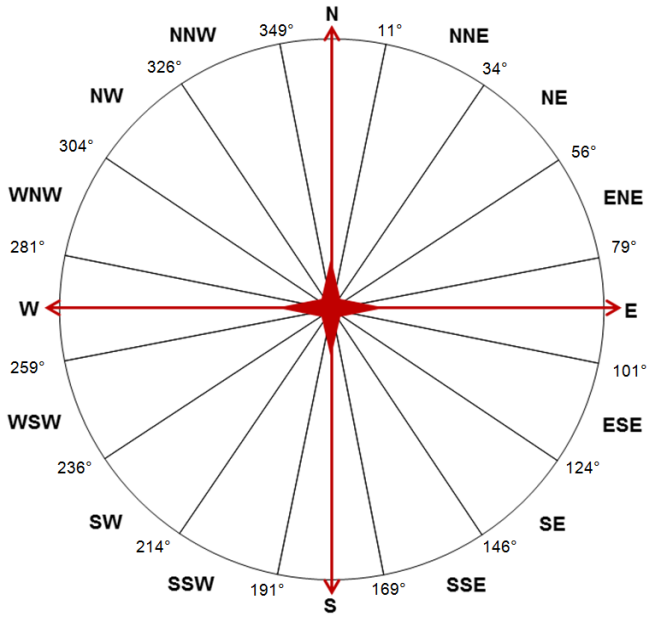


**Figure 1. Compass directions for wind direction permit condition compliance.**

**Burn Window**—When DEQ issues a CRB permit, a start time and end time (burn window) will be specified. The burn window is based on several smoke management factors, including forecasted mixing height and ventilation, forecasted wind speeds and directions, forecasted relative humidity, and other relevant factors. The purpose of the burn window is to limit burning to the portion of the day when smoke from the burn is expected to disperse without causing an impact to the environment or public health. Burns may not be ignited prior to the start time and must be completed (fire out) by the end time.

**Visibility Hazard on a Public Roadway**—The following procedure is used to evaluate whether smoke from an approved burn has created a hazardous condition for travel on a public roadway.

DEQ documents any observations of smoke on a public roadway while field staff observe crop residue burns. DEQ staff will not observe all burns that are near public roadways but will observe burns that have been determined to pose a risk of creating a hazardous condition for travel on a public roadway.

DEQ uses the stopping sight distance as a function of speed information (Table 1) to determine if smoke is creating a hazardous condition for travel on a public roadway. If visibility is greater than the appropriate stopping sight distance, crop residue burning did not result in a hazardous condition. If visibility is less than the stopping sight distance for the appropriate speed limit, DEQ will determine whether the grower has an approved traffic control plan for burning and has followed that plan. If the grower has an approved traffic control plan in place and followed the plan, the grower will be deemed to be in compliance with the permit requirement. If the grower did not have an approved traffic control plan or did not follow the plan, the grower will be deemed to be in violation of the permit requirement.

**Table°1. Stopping sight distance as a function of speed.**

| Speed (miles per hour) | Stopping Sight Distance (feet) |
|---|---|
| 20 | 115 |
| 25 | 155 |
| 30 | 200 |
| 35 | 250 |
| 40 | 305 |
| 45 | 360 |
| 50 | 425 |
| 55 | 495 |
| 60 | 570 |
| 65 | 645 |
| 70 | 730 |
| 75 | 820 |

*Source: Manual on Uniform Traffic Control Devices for Streets and Highways*: 2009 Edition, Table 6C-2 (page 555), published by the US Department of Transportation, Federal Highway Administration. Available at *http://mutcd.fhwa.dot.gov*.