June 26, 2017

Via email and certified mail

Regional Forester, Objection Review Officer
USDA Forest Service
Attn: 333 Broadway Blvd., SE
Albuquerque, NM 87102
FAX Number: (505) 842-3173
Email: objections-southwestern-regional-office@fs.fed.us

RE: Objections to the Final Environmental Impact Statement and Draft Record of Decision for the Luna Restoration Project located on the Quemado Ranger District of the Gila National Forest

Dear Reviewing Officer:

Objector [redacted] files this objection to the Draft Record Decision (DROD) notice and Final Environmental Impact Statement (FEIS), for the Luna Restoration Project located on the Quemado Ranger District of the Gila National Forest, dated June 26, 2019. These objections are submitted pursuant to 36 C.F.R. § 218 (e-CFR 6-20-19) and are directly related to comments submitted by Objector [redacted]. I incorporate by reference my prior comments (North DEIS comments, 6-3-18, comments: 1a -page 1, 1d - page 3, 1g – page 5) on the draft Environmental Impact Statement (DEIS) for the Luna Restoration Project located on the Quemado Ranger District of the Gila National Forest, that are addressed by the issues raised in Specific Objections of this document.

The Draft Environmental Impact Statement ("DEIS") comments are all still relevant to the Luna Restoration Project located on the Quemado Ranger District of the Gila National Forest project as proposed by the May 18, 2018 draft DEIS.

[redacted]

The following pages 1 thru 14 are Objector Requirements, Specific Objections, Proposed Remedy and Appendices and are provided for an "Objection" response to the US Forest Service – Gila National Forest - Draft Environmental Impact Statement (DEIS), Final Environmental Impact Statement (FEIS) and Draft Record of Decision (DROD) for the Luna Restoration Project located on the Quemado Ranger District of the Gila National Forest.

OBJECTOR REQUIREMENTS

As required by 36 C.F.R. § 218.8(d) (e-CFR 6-20-19), Objectors provide the following information:

1. The names, addresses, and telephone numbers of the objector:

Objector Name: [redacted]
Address:

Cell Number:
Email:

2. In addition to the electronic signatures, verification of authorship is available upon request.

3. The objector is: [redacted]

4. The proposed project being objected to is the: FEIS and DROD for the Luna Restoration Project located on the Quemado Ranger District of the Gila National Forest. The Responsible Official is Adam Mendonca, Forest Supervisor for the Gila National Forest.

5. A description of the aspects of the proposed project being objected to is included below in "SECTION 1 - SPECIFIC OBJECTIONS".

6. All issues addressed in the Specific Objections of this document directly relate to project "Air Quality", prior specific comments made during the designated comment period for the DEIS, for achievement of: "40 CFR part 50 – criteria air pollutants, National Ambient Air Quality Standards - NAAQS primary standards: provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly and NAAQS secondary standards: provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings" and utilize "best available scientific information" (North DEIS comments, 6-3-18, comments: 1a - page 1, 1d - page 3 and 1g - page 5) for the Luna Restoration Project located on the Quemado Ranger District of the Gila National Forest for this project. The Objector submitted DEIS comments for the Luna Restoration Project on June 3, 2018 during the comment period.

These objections are a result of the continued project Air Quality inadequacies in the DEIS, FEIS and DROD analysis of the Luna Restoration Project located on the Quemado Ranger District of the Gila National Forest, as put forth in the May 2019 issuance of the (DROD) notice and (FEIS), for the Luna Restoration Project located on the Quemado Ranger District of the Gila National Forest.

SECTION 1 - SPECIFIC OBJECTIONS:

THE FOREST SERVICE FAILED TO ENSURE COMPLIANCE WITH THE DEIS, FEIS AND DROD FOR THE LUNA RESTORATION PROJECT AND SPECIFICALLY VIOLATED LAW, REGULATIONS, STANDARDS AND/OR POLICIES FOR AIR QUALITY; NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS), NATIONAL ENVIROMENTAL POLICY ACT (NEPA), CLEAN AIR ACT (CAA) AND NATIONAL FOREST MANAGEMENT ACT (NFMA)

SECTION 1.1 – DEIS, FEIS AND DROD STATEMENTS

DROD Statement A:

The Luna Restoration Project Draft Record of Decision (DROD) (April 2019, p. 21, Clean Air Act) states: "Alternative C is designed to be consistent with the provisions of the Clean Air Act, its implementing regulations, and associated federal and state air quality standards. The selected alternative meets all conditions of the New Mexico Smoke Management Program, which meets the requirements of the Clean Air Act and the Regional Haze Rule (40 CFR 51.309). The primary concern with this project in regard to air quality is smoke emissions from prescribed fires. No exceedance of National Ambient Air Quality Standards is expected from the operation of vehicles (including exhaust and fugitive dust) or prescribed fire treatments. There is a potential for health impacts because of exposure to PM2.5. Prescribed fire will be planned, designed, and implemented to minimize smoke effects on air quality and public health and safety, complying with the New Mexico Smoke Management Plan".

FEIS Statement B:

Luna Restoration Project Final Environmental Statement (FEIS) (April 2019, Air Quality, Page 107) states: "The Gila National Forest personnel are responsible for following the State's smoke management requirements. The current Smoke Management regulation in New Mexico is part of the State's Regional Haze Rule, Environmental Protection Air Quality (Statewide) Smoke Management. Title 20 Chapter 2 Part 65 of the 20.2.65.103".

DEIS Statement C:

Luna Restoration Project Draft Environmental Statement (DEIS), (March 2018, Air Quality, Page 106) states: "Emission reduction techniques, can reduce the impacts to air quality while meeting fire-related objectives. These techniques are outlined in New Mexico's smoke management plan (NM 2005). The Gila National Forest personnel are responsible for following the state's smoke management requirements."

The three underlined statements from the DEIS, FEIS and DROD make it clear that the US Forest Service – Gila National Forest "Luna Restoration Project" management fire prescriptions will not be planned, designed and implemented to meet Federal Ambient Air Quality Standards that have been adopted and implemented. These specifically include the NAAQS primary and secondary criteria air pollutants for PM2.5 – 40 C.F.R.: § 50.7, § 50.13 and § 50.18 (6-20-19 e-CFR), PM10 40 C.F.R.: § 50.6 (6-20-19 e-CFR), and Ozone - 40 C.F.R.: § 50.9, § 50.10, § 50.15 and § 50.19 (6-20-19 e-CFR), only New Mexico "Smoke Management Requirements, thereby violating the National Forest Management Act and Clean Air Act.

SECTION 1.2 - NATIONAL FOREST MANAGEMENT ACT:

The US Forest Service's planning rules, as stated in the National Forest Management Act (NFMA), are explicit with regards to setting forth the agency's obligations, "Plans must comply with all applicable laws and regulations, including NFMA, MUSYA, the Clean Air Act, the Clean Water Act, the Wilderness Act, and the Endangered Species Act", 36 C.F.R. § 219.1(f) (e-CFR 6-20-19). The NFMA planning rules also require the Forest Service to develop Plans that "provide a range of social, economic, and ecological benefits for the present and into the future. These benefits include clean air and water; habitat for fish, wildlife, and plant communities; and opportunities for recreational, spiritual, educational, and cultural benefits" 36 C.F.R. § 219.1(c) (e-CFR 6-20-19).

In other words, the applicable planning rules require that the Forest Service is obligated to independently ensure compliance with Federal, State, and local air quality standards. To this end, it is not enough to simply assert that an activity or use will comply with relevant Federal, State, and local air quality standards or regulations. Rather the Agency must affirmatively demonstrate that management actions are consistent with maintaining air quality at levels meeting or exceeding such laws and regulations, while complying with NFMA Role of Science in Planning - 36 C.F.R. § 219.3 and § 219.1 (c) (e-CFR 6-25-19). This affirmative duty is well founded in NFMA, as well as a number of the Forest Service's other overarching environmental mandates.

US Forest Service – Gila National Forest must protect Federal air quality standards and applicable legal obligations under NFMA, including the applicable planning rule, and confirm that the agency has an affirmative and independent duty to demonstrate that its actions will protect such air quality standards. The US Forest Service has failed to do so with regards to NAAQS specifically, primary and secondary criteria air pollutants for PM2.5 – 40 C.F.R.: § 50.7, § 50.13 and § 50.18 (6-20-19 e-CFR), PM10 40 C.F.R.: § 50.6 (6-20-19 e-CFR), and Ozone – 40 C.F.R.: § 50.9, § 50.10, § 50.15 and § 50.19 (6-20-19 e-CFR), thereby violating the National Forest Management Act, Clean Air Act and National Ambient Air Quality Standards.

SECTION 1.3 - CLEAN AIR ACT

The Environmental Protection Agency Clean Air Act, Title I – Air Pollution Prevention and Control, laws and regulations are also explicit with regards to setting forth the agency's obligations, "Control of Pollution from Federal Facilities: (a) General compliance - Each department, agency, and instrumentality of the executive, legislative, and judicial branches of the Federal Government (1) having jurisdiction over any property or facility, or (2) engaged in any activity resulting, or which may result, in the discharge of air pollutants, and each officer, agent, or employee thereof, shall be subject to, and comply with, all Federal, State, interstate, and local requirements, administrative authority, and process and sanctions respecting the control and abatement of air pollution in the same manner, and to the same extent as any nongovernmental entity. The preceding sentence shall apply (A) to any requirement whether substantive or procedural (including any recordkeeping or reporting requirement, any requirement respecting permits and any other requirement whatsoever), (B) to any requirement to pay a fee or charge imposed by any State or local agency to defray the costs of its air pollution regulatory program, (C) to the exercise of any Federal, State, or local administrative

authority, and (D) to any process and sanction, whether enforced in Federal, State, or local courts, or in any other manner. This subsection shall apply notwithstanding any immunity of such agencies, officers, agents, or employees under any law or rule of law. No officer, agent, or employee of the United States shall be personally liable for any civil penalty for which he is not otherwise liable." 42 U.S.C. § 7418 (Public Law 116-21, 6-12-19 current release point). Again, to this end, as with 36 C.F.R. § 219.1(f) (e-CFR 6-20-19), it is not enough to simply assert that an activity or use will comply with relevant Federal, State, and local air quality standards or regulations. Rather the Agency must affirmatively demonstrate that management actions are consistent with maintaining air quality at levels meeting or exceeding such laws and regulations.

US Forest Service – Gila National Forest must protect Federal air quality standards and applicable legal obligations under CAA specifically 42 U.S.C. § 7418 (Public Law 116-21, 6-12-19 current release point), which includes obligations of NFMA 36 C.F.R. § 219.1(f) and 36 C.F.R. § 219.1(c) (e-CFR 6-20-19) and the applicable planning rule, and confirm that the agency has an affirmative and independent duty to demonstrate that its actions will protect such air quality standards, while complying with NFMA Role of Science in Planning 36 C.F.R. § 219.3 and § 219.1 (c) (e-CFR 6-25-19). The US Forest Service has failed to do so with regards to NAAQS specifically, primary and secondary criteria air pollutants for PM2.5 – 40 C.F.R.: § 50.7, § 50.13 and § 50.18 (6-20-19 e-CFR), PM10 40 C.F.R.: § 50.6 (6-20-19 e-CFR), and Ozone – 40 C.F.R.: § 50.9, § 50.10, § 50.15 and § 50.19 (e-CFR 6-20-19), thereby violating the National Forest Management Act, Clean Air Act and National Ambient Air Quality Standards.

SECTION 1.4 - NATIONAL AMBIENT AIR QUALITY STANDARDS

The Clean Air Act (CAA) required EPA to set these National Ambient Air Quality Standards (NAAQS) for pollutants that are common in outdoor air, considered harmful to public health and the environment, and that come from numerous and diverse sources. The CAA identified two types of NAAQS. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. The underlined statement in "Section 1.1 – DEIS, FEIS and DROD" makes it clear that the US Forest Service - Gila National Forest management project restoration fire prescriptions will not be planned, designed and implemented to meet Federal Ambient Air Quality Standards that have been adopted and implemented. These specifically include the NAAQS primary and secondary criteria air pollutants for PM2.5 – 40 C.F.R.: § 50.7, § 50.13 and § 50.18 (e-CFR 6-20-19), PM10 40 C.F.R.: § 50.6 (6-20-19 e-CFR), and Ozone - 40 C.F.R.: § 50.9, § 50.10, § 50.15 and § 50.19 (e-CFR 6-20-19). Ultimately, if the US Forest Service is consistent with maintaining air quality at a level that meets or exceeds all CAA and NAAQS primary and secondary criteria air pollutant limits for PM2.5, then there should be no "potential for health impacts because of exposure to PM2.5" DROD (April 2019, p. 21, Clean Air Act), since the NAAQS set limits to protect human health.

Appendices 1 and 2 provide details of a US Forest Service - Gila National Forest Management Prescription for prescribed fire that was "planned, designed and implemented to minimize smoke effects on air quality and public health and safety, complying with the New Mexico Smoke Management Plan" (DROD 2019, page 21, Clean Air Act) and did not

achieve the requirements of and comply with the NFMA 36 C.F.R. § 219.1(f) (e-CFR 6-20-19), CAA 42 U.S.C. § 7418 (6-12-19 current release point 2019 Edition) and violated NAAQS primary and secondary criteria air pollutants for PM2.5 40 C.F.R.: § 50.7, § 50.13 and § 50.18 (e-CFR 6-20-19).

US Forest Service – Gila National Forest must protect Federal air quality standards and applicable legal obligations under the Clean Air Act, National Forest Management Act and National Ambient Air Quality Standards, specifically primary and secondary criteria air pollutants for PM2.5 – 40 C.F.R.: § 50.7, § 50.13 and § 50.18 (6-20-19 e-CFR), PM10 40 C.F.R.: § 50.6 (6-20-19 e-CFR), and Ozone - 40 C.F.R.: § 50.9, § 50.10, § 50.15 and § 50.19 (6-20-19 e-CFR), and confirm that the agency has an affirmative and independent duty to demonstrate that its Actions will protect such air quality standards, while complying with the NFMA Role of Science in Planning - 36 C.F.R. § 219.3 and § 219.1 (c) (e-CFR 6-25-19). However, the Luna Restoration Project – Gila National Forest Management Prescription for prescribed fire will only be "planned, designed and implemented to minimize smoke effects on air quality and public health and safety, complying with the New Mexico Smoke Management Plan" (DROD 2019, page 21, Clean Air Act). This is a violation of the Clean Air Act, National Forest Management Act and National Ambient Air Quality Standards.

SECTION 1.5 - NATIONAL ENVIROMENTAL POLICY ACT

Regulations implementing NEPA require the Forest Service to supplement draft or final EISs whenever "[t]here are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts." 40 C.F.R. § 1502.9(c)(1)(ii) (e-CFR 6-24-19).

Here, the Forest Service is required to supplement the Draft Environmental Impact Statement (DEIS, March 2018) and Final Environmental Impact Statement (FEIS, April 2019) and Draft Record of Decision (DROD, April 2019) for the Luna Restoration Project located on the Quemado Ranger District of the Gila National Forest, before Final Record of Decision approval and implementation of Forest Service management prescriptions for Project Restoration fire prescriptions, in order to address significant new circumstances and information relevant to, inter alia, air quality impacts.

Neither the DEIS (March 2018), FEIS (April 2019) or DROD (April 2019) address National Ambient Air Quality Standards for primary and secondary criteria air pollutants for PM2.5 – 40 C.F.R.: § 50.7, § 50.13 and § 50.18 (6-20-19 e-CFR), PM10 40 C.F.R.: § 50.6 (6-20-19 e-CFR), and Ozone - 40 C.F.R.: § 50.9, § 50.10, § 50.15 and § 50.19 (6-20-19 e-CFR) to protect the Public Health. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly and Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. In fact, the DEIS (March 2018) does not even mention any of the relevant NAAQS air quality standards that are applicable. The DEIS, FEIS and DROD do not mention, let alone assess, disclose and analyze, the potentially significant impacts of National Forest land management prescriptions for prescribed fire activities from Ozone, PM2.5, and PM10 or the effect to the Public's health from

acute and chronic exposure and do not comply with the NFMA Role of Science in Planning - 36 C.F.R. § 219.3 (e-CFR 6-25-19). Additionally, the National Forest Service co-authored: National Wildfire Coordinating Group (NWCG) – Smoke Management Guide for Prescribed Fire publication identification PMS-420/NFES 001279, dated February 2018, explicitly defines in "Chapter 2 – Smoke Impacts" as detailed in pages 30 to 42, that demonstrate the US Forest Service's knowledge of the acute and chronic impacts to the Public's health from prescribed fire smoke for Ozone, PM10 and PM2.5.

This significant flaw must be addressed. The Agency did not undertake such an assessment, disclose and analyze Ozone, PM2.5 and PM10, but instead implied that under the Forest Plan, air quality would be adequately protected. Because it did not asses, disclose and analyze whether new information regarding air quality impacts is significant, the Forest Service has violated NEPA. The Forest Service has an ongoing duty to ensure that its programmatic NEPA adequately justifies current management decisions. In this case, the Forest Service at least has a duty to assess, disclose and analyze whether new information regarding air quality impact should trigger the preparation of a supplemental EIS, if not a duty to actually supplement. The Forest Service failed to address whether its programmatic NEPA was adequate in the context of air quality impacts, and its refusal to assess, disclose and analyze Ozone, PM2.5 and PM10 impacts on Public health from acute and chronic exposure basis for past and present, violates National Environmental Policy Act and National Forest Management Act, and therefore the agency's Draft Record of Decision violates NEPA.

Section 1.6 - Summary

The Forest Service – Gila National Forest has no reasonable basis to conclude that Project Restoration fire prescriptions that are "planned, designed, and implemented to minimize smoke effects on air quality and public health and safety, complying with the New Mexico Smoke Management Plan" (DROD 2019, page 21, Clean Air Act) only, will achieve the requirements of and comply with the Clean Air Act 42 U.S.C. § 7418 (6-12-19 current release point 2019 Edition), NFMA 36 C.F.R. § 219.1(f) (e-CFR 6-20-19) and 36 C.F.R. § 219.1(c) (e-CFR 6-20-19), National Ambient Air Quality Standards for primary and secondary criteria air pollutants for PM2.5 – 40 C.F.R.: § 50.7, § 50.13 and § 50.18 (6-20-19 e-CFR), PM10 40 C.F.R.: § 50.6 (6-20-19 e-CFR), and Ozone - 40 C.F.R.: § 50.9, § 50.10, § 50.15 and § 50.19 (6-20-19 e-CFR) to protect the Public Health and National Environmental Policy Act 40 C.F.R. § 1502.9(c)(1)(ii) (e-CFR 6-24-19). The DEIS, FEIS and DROD violate NFMA, CAA, NAAQS and NEPA, accordingly, the Draft Record of Decision must be set aside and the Forest Service directed to consider values that comply with all Federal, State, and local laws, standards, regulations and policies in conducting any future Luna Restoration Project EIS, FEIS and DROD.

PROPOSED REMEDY:

I respectfully request that the Forest Service set aside the Draft Record of Decision (DROD) and Final Environmental Impact Statement (FEIS), for the Luna Restoration Project located on the Quemado Ranger District of the Gila National Forest, dated April 2019. Prepare a new DROD and FEIS that specifically address:

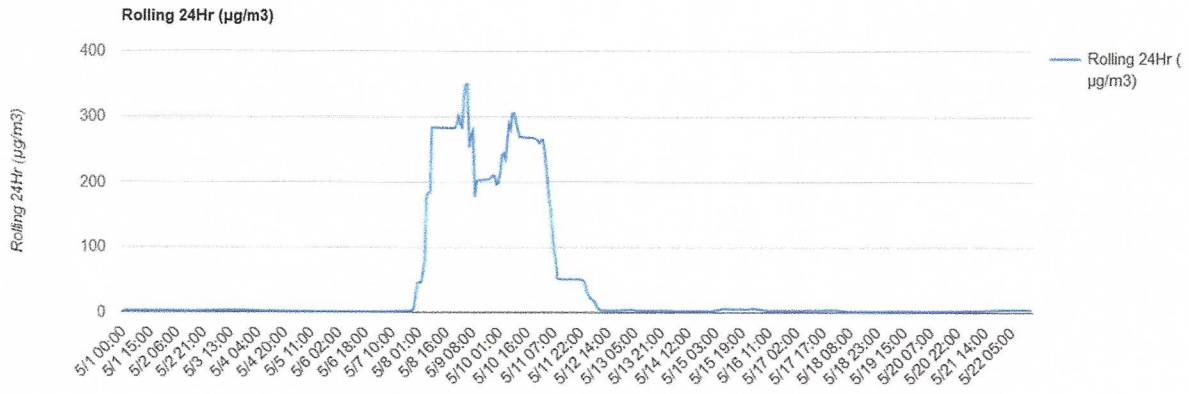
1. US Forest Service - Gila National Forest Management Prescriptions on national forest lands, will be consistent with maintaining air quality at a level that meets or exceeds all applicable Federal, State and Local laws, standards, regulations and policies for NFMA, CAA, NAAQS and NEPA.
2. The US Forest Service – Gila National Forest Management Prescriptions specifically must achieve the requirements of and comply with:
   (a) National Forest Management Act (NFMA) 36 C.F.R. § 219.1(f) (e-CFR 6-20-19) and 36 C.F.R. § 219.1(c) (e-CFR 6-20-19).
   (b) Clean Air Act (CAA) 42 U.S.C. § 7418 (Public Law 116-21, 6-12-19 current release point)
   (c) National Ambient Air Quality Standards (NAAQS) for primary and secondary criteria air pollutant limit levels for: PM2.5 – 40 C.F.R.: § 50.7, § 50.13 and § 50.18 (6-20-19 e-CFR), PM10 40 C.F.R.: § 50.6 (6-20-19 e-CFR), and Ozone - 40 C.F.R.: § 50.9, § 50.10, § 50.15 and § 50.19 (6-20-19 e-CFR) to protect the Public Health and be utilized and achieved when prescribed fire is planned, designed, and implemented and to minimize smoke effects on air quality, public health and safety, and complying with the New Mexico Smoke Management Plan NM 20.2.65 (2019) (DROD April 2019, p. 21, Clean Air Act).
3. Assess, disclose and analyze, the potential and significant impacts of National Forest land management prescriptions for prescribed fire activities from Ozone, PM2.5 and PM10 on the Public's health from acute and chronic exposure. Specifically related to:
   (a) Actual and factual at risk populations (e.g. children, working teens and adults, disabled, elderly, individuals with preexisting respiratory conditions and the economically disadvantaged).
   (b) Human health effects of prescribed fire smoke exposure and including specific effects from PM2.5, PM10 and Ozone.
   (c) Mechanisms of health effects from PM2.5, PM10 and Ozone exposure.
   (d) Respiratory and cardiovascular effects from PM2.5, PM10 and Ozone exposure, including any significant new circumstances and information relevant to, inter alia, air quality impacts.

APPENDICES:

Appendix 1:

Indian Peaks Prescribed Burn Black Range - Poverty Creek
USFS 1035: Lat 33 deg 28' 28.06" N. Lon 107 deg 48' 2.7"
(location Straight Gulch Rd off of RT 59)
Data downloaded from app.airsis.com/usfs @ 5/22/18 4:45 pm

Rolling 24 hr. PM 2.5 Average



Appendix 2:

Indian Peaks Prescribed Burn Black Range - Poverty Creek
USFS 1035: Lat 33 deg 28' 28.06" N. Lon 107 deg 48' 2.7"
(location Straight Gulch Rd off of RT 59)
Data downloaded from app.airsis.com/usfs @ 5/22/18 4:45 pm

USFS 1035 Data Monitor File dates 5/7/18 to 5/12/18 – demonstrating USFS Gila National Forest NAAQS PM2.5 limit violation.

Date (Mountain Daylight Time)	Reading Time UTC	Rolling 24Hr (Âµg/m3)	ConcRT (Âµg/m3)
5/7/2018 0:09	5/7/2018 6:00		
5/7/2018 0:10	5/7/2018 6:00	0.75	1
5/7/2018 1:11	5/7/2018 7:00	0.791666667	2
5/7/2018 2:11	5/7/2018 8:00	0.875	2
5/7/2018 3:12	5/7/2018 9:00	0.875	1
5/7/2018 4:12	5/7/2018 10:00		
5/7/2018 5:13	5/7/2018 11:00	0.916666667	2
5/7/2018 6:14	5/7/2018 12:00	0.958333333	2
5/7/2018 7:14	5/7/2018 13:00	1	2
5/7/2018 8:15	5/7/2018 14:00	1	1
5/7/2018 9:15	5/7/2018 15:00	1.083333333	4
5/7/2018 10:16	5/7/2018 16:00	1.041666667	0
5/7/2018 11:16	5/7/2018 17:00	1.125	2
5/7/2018 12:04	5/7/2018 18:00	1.416666667	8
5/7/2018 12:09	5/7/2018 18:00		
5/7/2018 13:05	5/7/2018 19:00	1.416666667	1
5/7/2018 14:05	5/7/2018 20:00	1.5	2
5/7/2018 15:06	5/7/2018 21:00	1.583333333	2
5/7/2018 16:06	5/7/2018 22:00	1.583333333	1
5/7/2018 17:07	5/7/2018 23:00	1.666666667	2
5/7/2018 18:07	5/8/2018 0:00	1.791666667	3
5/7/2018 19:08	5/8/2018 1:00	1.833333333	2
5/7/2018 20:08	5/8/2018 2:00	1.916666667	2
5/7/2018 21:09	5/8/2018 3:00	2.125	6
5/7/2018 22:09	5/8/2018 4:00	5.708333333	86
5/7/2018 23:10	5/8/2018 5:00	26.25	494
5/8/2018 0:09	5/8/2018 6:00		
5/8/2018 0:10	5/8/2018 6:00	44.83333333	448
5/8/2018 1:11	5/8/2018 7:00	45.16666667	9
5/8/2018 2:11	5/8/2018 8:00	45.5	10
5/8/2018 3:12	5/8/2018 9:00	60.79166667	369
5/8/2018 4:12	5/8/2018 10:00	77.5	402

5/8/2018 5:13	5/8/2018 11:00	179.52	2628
5/8/2018 6:14	5/8/2018 12:00	182.92	87
5/8/2018 7:14	5/8/2018 13:00	185.08	56
5/8/2018 8:15	5/8/2018 14:00	282.84	2446
5/8/2018 9:15	5/8/2018 15:00	283	5
5/8/2018 10:16	5/8/2018 16:00	282.84	0
5/8/2018 11:16	5/8/2018 17:00	282.84	0
5/8/2018 12:04	5/8/2018 18:00	282.8	1
5/8/2018 12:09	5/8/2018 18:00		
5/8/2018 13:05	5/8/2018 19:00	282.48	0
5/8/2018 14:05	5/8/2018 20:00	282.44	0
5/8/2018 15:06	5/8/2018 21:00	282.44	2
5/8/2018 16:06	5/8/2018 22:00	282.36	0
5/8/2018 17:07	5/8/2018 23:00	282.32	0
5/8/2018 18:07	5/9/2018 0:00	282.32	2
5/8/2018 19:08	5/9/2018 1:00	282.2	0
5/8/2018 20:08	5/9/2018 2:00	282.16	1
5/8/2018 21:09	5/9/2018 3:00	282.2	3
5/8/2018 22:09	5/9/2018 4:00	288.76	170
5/8/2018 23:10	5/9/2018 5:00	301.12	395
5/9/2018 0:09	5/9/2018 6:00		
5/9/2018 0:10	5/9/2018 6:00	288.04	167
5/9/2018 1:11	5/9/2018 7:00	283.44	333
5/9/2018 2:11	5/9/2018 8:00		
5/9/2018 3:12	5/9/2018 9:00	328.4166667	815
5/9/2018 4:12	5/9/2018 10:00	349.4166667	873
5/9/2018 5:13	5/9/2018 11:00	350.25	422
5/9/2018 6:14	5/9/2018 12:00	252.5416667	283
5/9/2018 7:14	5/9/2018 13:00	272.125	557
5/9/2018 8:15	5/9/2018 14:00	278.5416667	210
5/9/2018 9:15	5/9/2018 15:00	176.625	0
5/9/2018 10:10	5/9/2018 16:00		
5/9/2018 12:04	5/9/2018 18:00	201.6666667	2
5/9/2018 12:09	5/9/2018 18:00		
5/9/2018 13:05	5/9/2018 19:00	201.8571429	4
5/9/2018 14:05	5/9/2018 20:00	202.5714286	15
5/9/2018 15:06	5/9/2018 21:00	202.8571429	8
5/9/2018 16:06	5/9/2018 22:00	203.1428571	6
5/9/2018 17:07	5/9/2018 23:00	203.2380952	2
5/9/2018 18:07	5/10/2018 0:00	203.4761905	7
5/9/2018 19:08	5/10/2018 1:00	204.2380952	16
5/9/2018 20:08	5/10/2018 2:00	206.6190476	51

5/9/2018 21:09	5/10/2018 3:00	210.1428571	77
5/9/2018 22:09	5/10/2018 4:00	209.3809524	154
5/9/2018 23:10	5/10/2018 5:00	196.1904762	118
5/10/2018 0:09	5/10/2018 6:00		
5/10/2018 0:10	5/10/2018 6:00	198.5238095	216
5/10/2018 1:11	5/10/2018 7:00	212.7142857	631
5/10/2018 2:11	5/10/2018 8:00	239.9090909	811
5/10/2018 3:12	5/10/2018 9:00	244.1363636	908
5/10/2018 4:13	5/10/2018 10:00	234.7272727	666
5/10/2018 5:13	5/10/2018 11:00	259.2272727	961
5/10/2018 6:14	5/10/2018 12:00	288.9090909	936
5/10/2018 7:14	5/10/2018 13:00	279.7272727	355
5/10/2018 8:15	5/10/2018 14:00	304.2727273	750
5/10/2018 9:15	5/10/2018 15:00	305	16
5/10/2018 10:16	5/10/2018 16:00	292	6
5/10/2018 11:16	5/10/2018 17:00	279.875	1
5/10/2018 12:04	5/10/2018 18:00	268.76	2
5/10/2018 12:09	5/10/2018 18:00		
5/10/2018 13:05	5/10/2018 19:00	268.68	0
5/10/2018 14:05	5/10/2018 20:00	268.56	1
5/10/2018 15:06	5/10/2018 21:00	268.04	2
5/10/2018 16:06	5/10/2018 22:00	267.84	3
5/10/2018 17:07	5/10/2018 23:00	267.68	2
5/10/2018 18:07	5/11/2018 0:00	267.68	2
5/10/2018 19:08	5/11/2018 1:00	267.44	1
5/10/2018 20:08	5/11/2018 2:00	266.92	3
5/10/2018 21:09	5/11/2018 3:00	265.56	17
5/10/2018 22:09	5/11/2018 4:00	263.12	16
5/10/2018 23:10	5/11/2018 5:00	259.52	64
5/11/2018 0:09	5/11/2018 6:00		
5/11/2018 0:10	5/11/2018 6:00	264.36	239
5/11/2018 1:11	5/11/2018 7:00	264.6	222
5/11/2018 2:11	5/11/2018 8:00	245.44	152
5/11/2018 3:12	5/11/2018 9:00	215.52	63
5/11/2018 4:12	5/11/2018 10:00	182.76	89
5/11/2018 5:13	5/11/2018 11:00	159.16	76
5/11/2018 6:14	5/11/2018 12:00	127.08	159
5/11/2018 7:14	5/11/2018 13:00	93.52	97
5/11/2018 8:15	5/11/2018 14:00	80.92	40
5/11/2018 9:15	5/11/2018 15:00	51.2	7
5/11/2018 10:16	5/11/2018 16:00	50.72	4
5/11/2018 11:16	5/11/2018 17:00	50.52	1

5/11/2018 12:04	5/11/2018 18:00	50.52	1
5/11/2018 12:09	5/11/2018 18:00		
5/11/2018 13:05	5/11/2018 19:00	50.52	2
5/11/2018 14:05	5/11/2018 20:00	50.56	1
5/11/2018 15:06	5/11/2018 21:00	50.56	1
5/11/2018 16:06	5/11/2018 22:00	50.64	4
5/11/2018 17:07	5/11/2018 23:00	50.6	2
5/11/2018 18:07	5/12/2018 0:00	50.6	2
5/11/2018 19:08	5/12/2018 1:00	50.6	2
5/11/2018 20:08	5/12/2018 2:00	50.6	1
5/11/2018 21:09	5/12/2018 3:00	50.52	1
5/11/2018 22:09	5/12/2018 4:00	49.92	2
5/11/2018 23:10	5/12/2018 5:00	49.36	2
5/12/2018 0:09	5/12/2018 6:00		
5/12/2018 0:10	5/12/2018 6:00	46.88	2
5/12/2018 1:11	5/12/2018 7:00	37.4	2
5/12/2018 2:11	5/12/2018 8:00	28.68	4
5/12/2018 3:12	5/12/2018 9:00	22.84	6
5/12/2018 4:12	5/12/2018 10:00	21.08	19
5/12/2018 5:13	5/12/2018 11:00	17.68	4
5/12/2018 6:14	5/12/2018 12:00	14.76	3
5/12/2018 7:14	5/12/2018 13:00	8.52	3
5/12/2018 8:15	5/12/2018 14:00	4.8	4
5/12/2018 9:15	5/12/2018 15:00	3.28	2
5/12/2018 10:16	5/12/2018 16:00		
5/12/2018 11:16	5/12/2018 17:00	3	1
5/12/2018 12:04	5/12/2018 18:00	3.041666667	2
5/12/2018 12:09	5/12/2018 18:00		
5/12/2018 13:05	5/12/2018 19:00	3	0
5/12/2018 14:05	5/12/2018 20:00	2.958333333	1
5/12/2018 15:06	5/12/2018 21:00	3	2
5/12/2018 16:06	5/12/2018 22:00	3.041666667	2
5/12/2018 17:07	5/12/2018 23:00	2.958333333	2
5/12/2018 18:07	5/13/2018 0:00	2.958333333	2
5/12/2018 19:08	5/13/2018 1:00	3	3
5/12/2018 20:08	5/13/2018 2:00	3.083333333	4
5/12/2018 21:09	5/13/2018 3:00	3.208333333	4
5/12/2018 22:09	5/13/2018 4:00	3.291666667	3
5/12/2018 23:10	5/13/2018 5:00	3.375	4

Appendix 3:

Exhibits:

1. e-CFR: Title 40 Chapter I Subchapter C Part 50 - § 50.6
2. e-CFR: Title 40 Chapter I Subchapter C Part 50 - § 50.7
3. e-CFR: Title 40 Chapter I Subchapter C Part 50 - § 50.9
4. e-CFR: Title 40 Chapter I Subchapter C Part 50 - § 50.10
5. e-CFR: Title 40 Chapter I Subchapter C Part 50 - § 50.13
6. e-CFR: Title 40 Chapter I Subchapter C Part 50 - § 50.15
7. e-CFR: Title 40 Chapter I Subchapter C Part 50 - § 50.18
8. e-CFR: Title 40 Chapter I Subchapter C Part 50 - § 50.19
9. 42 U.S.C. § 7418 (Public Law 116-21, 6-12-19 current release point)
10. e-CFR Title 40 Chapter V Part 1502 - § 1502.9
11. e-CFR: Title 36 Chapter II Part 219 - § 219.3
12. e-CFR: Title 36 Chapter II Part 219 - § 219.1
13. National Wildfire Coordinating Group (NWCG – Smoke Management Guide for Prescribed Fire, February 2018, pages I, ii, iii, iv, Chapter 2 – Smoke Impacts pages 30 to 42

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e-CFR data is current as of June 20, 2019

Title 40: Protection of Environment
PART 50—NATIONAL PRIMARY AND SECONDARY AMBIENT AIR QUALITY STANDARDS

§50.6 National primary and secondary ambient air quality standards for PM_{10}.

(a) The level of the national primary and secondary 24-hour ambient air quality standards for particulate matter is 150 micrograms per cubic meter ($\mu g/m^3$), 24-hour average concentration. The standards are attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$, as determined in accordance with appendix K to this part, is equal to or less than one.

(b) [Reserved]

(c) For the purpose of determining attainment of the primary and secondary standards, particulate matter shall be measured in the ambient air as PM_{10} (particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers) by:

(1) A reference method based on appendix J and designated in accordance with part 53 of this chapter, or

(2) An equivalent method designated in accordance with part 53 of this chapter.

[52 FR 24663, July 1, 1987, as amended at 62 FR 38711, July 18, 1997; 65 FR 80779, Dec. 22, 2000; 71 FR 61224, Oct. 17, 2006]

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Title 40: Protection of Environment
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§50.7 National primary and secondary ambient air quality standards for $PM_{2.5}$.

(a) The national primary and secondary ambient air quality standards for particulate matter are 15.0 micrograms per cubic meter ($\mu g/m^3$) annual arithmetic mean concentration, and 65 $\mu g/m^3$ 24-hour average concentration measured in the ambient air as $PM_{2.5}$ (particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers) by either:

(1) A reference method based on appendix L of this part and designated in accordance with part 53 of this chapter; or

(2) An equivalent method designated in accordance with part 53 of this chapter.

(b) The annual primary and secondary $PM_{2.5}$ standards are met when the annual arithmetic mean concentration, as determined in accordance with appendix N of this part, is less than or equal to 15.0 micrograms per cubic meter.

(c) The 24-hour primary and secondary $PM_{2.5}$ standards are met when the 98^{th} percentile 24-hour concentration, as determined in accordance with appendix N of this part, is less than or equal to 65 micrograms per cubic meter.

[62 FR 38711, July 18, 1997, as amended at 69 FR 45595, July 30, 2004]

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Title 40: Protection of Environment
PART 50—NATIONAL PRIMARY AND SECONDARY AMBIENT AIR QUALITY STANDARDS

§50.9 National 1-hour primary and secondary ambient air quality standards for ozone.

(a) The level of the national 1-hour primary and secondary ambient air quality standards for ozone measured by a reference method based on appendix D to this part and designated in accordance with part 53 of this chapter, is 0.12 parts per million (235 $\mu g/m^3$). The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 parts per million (235 $\mu g/m^3$) is equal to or less than 1, as determined by appendix H to this part.

(b) The 1-hour standards set forth in this section will remain applicable to all areas notwithstanding the promulgation of 8-hour ozone standards under §50.10. The 1-hour NAAQS set forth in paragraph (a) of this section will no longer apply to an area one year after the effective date of the designation of that area for the 8-hour ozone NAAQS pursuant to section 107 of the Clean Air Act. Area designations and classifications with respect to the 1-hour standards are codified in 40 CFR part 81.

[62 FR 38894, July 18, 1997, as amended at 65 FR 45200, July 20, 2000; 68 FR 38163, June 26, 2003, 69 FR 23996, Apr. 30, 2004; 77 FR 28441, May 14, 2012]

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PART 50—NATIONAL PRIMARY AND SECONDARY AMBIENT AIR QUALITY STANDARDS

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§50.10 National 8-hour primary and secondary ambient air quality standards for ozone.

(a) The level of the national 8-hour primary and secondary ambient air quality standards for ozone, measured by a reference method based on appendix D to this part and designated in accordance with part 53 of this chapter, is 0.08 parts per million (ppm), daily maximum 8-hour average.

(b) The 8-hour primary and secondary ozone ambient air quality standards are met at an ambient air quality monitoring site when the average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.08 ppm, as determined in accordance with appendix I to this part.

(c) Until the effective date of the final Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements Rule (final SIP Requirements Rule) to be codified at 40 CFR 51.1100 *et seq.,* the 1997 ozone NAAQS set forth in this section will continue in effect, notwithstanding the promulgation of the 2008 ozone NAAQS under §50.15. The 1997 ozone NAAQS set forth in this section will no longer apply upon the effective date of the final SIP Requirements Rule. For purposes of the anti-backsliding requirements of §51.1105, §51.165 and Appendix S to part 51, the area designations and classifications with respect to the revoked 1997 ozone NAAQS are codified in 40 CFR part 81.

[62 FR 38894, July 18, 1997, as amended at 77 FR 30170, May 21, 2012; 80 FR 12312, Mar. 6, 2015]

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e-CFR data is current as of June 20, 2019

Title 40: Protection of Environment
PART 50—NATIONAL PRIMARY AND SECONDARY AMBIENT AIR QUALITY STANDARDS

§50.13 National primary and secondary ambient air quality standards for $PM_{2.5}$.

(a) The national primary and secondary ambient air quality standards for particulate matter are 15.0 micrograms per cubic meter ($\mu g/m^3$) annual arithmetic mean concentration, and 35 $\mu g/m^3$ 24-hour average concentration measured in the ambient air as $PM_{2.5}$ (particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers) by either:

(1) A reference method based on appendix L of this part and designated in accordance with part 53 of this chapter; or

(2) An equivalent method designated in accordance with part 53 of this chapter.

(b) The annual primary and secondary $PM_{2.5}$ standards are met when the annual arithmetic mean concentration, as determined in accordance with appendix N of this part, is less than or equal to 15.0 $\mu g/m^3$.

(c) The 24-hour primary and secondary $PM_{2.5}$ standards are met when the 98th percentile 24-hour concentration, as determined in accordance with appendix N of this part, is less than or equal to 35 $\mu g/m^3$.

(d) Until the effective date of the final Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements rule to be codified at 40 CFR 51.1000 through 51.1016, the 1997 annual $PM_{2.5}$ NAAQS set forth in this section will continue in effect, notwithstanding the promulgation of the 2012 primary annual $PM_{2.5}$ NAAQS under §50.18. The 1997 primary annual $PM_{2.5}$ NAAQS set forth in this section will no longer apply upon the effective date of the final Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements rule; except that for areas designated nonattainment for the 1997 annual $PM_{2.5}$ NAAQS set forth in this section as of the effective date of the final Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements rule, the requirements applicable to the 1997 primary annual $PM_{2.5}$ NAAQS set forth in this section will apply until the effective date of an area's redesignation to attainment for the 1997 annual $PM_{2.5}$ NAAQS pursuant to the requirements of section 107 of the Clean Air Act. The 1997 secondary annual $PM_{2.5}$ NAAQS and the 1997 24-hour $PM_{2.5}$ NAAQS shall remain in effect. The area designations and classifications with respect to the 1997 annual and 24-hour $PM_{2.5}$ NAAQS remain codified in 40 CFR part 81 in order to provide information on where the 1997 primary annual $PM_{2.5}$ NAAQS has been revoked and to facilitate the implementation of the 1997 secondary annual $PM_{2.5}$ NAAQS and the 1997 24-hour $PM_{2.5}$ NAAQS.

[71 FR 61224, Oct. 17, 2006, as amended at 81 FR 58149, Aug. 24, 2016]

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e-CFR data is current as of June 20, 2019

Title 40: Protection of Environment
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§50.15 National primary and secondary ambient air quality standards for ozone.

(a) The level of the national 8-hour primary and secondary ambient air quality standards for ozone (O_3) is 0.075 parts per million (ppm), daily maximum 8-hour average, measured by a reference method based on appendix D to this part and designated in accordance with part 53 of this chapter or an equivalent method designated in accordance with part 53 of this chapter.

(b) The 8-hour primary and secondary O_3 ambient air quality standards are met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average O_3 concentration is less than or equal to 0.075 ppm, as determined in accordance with appendix P to this part.

[73 FR 16511, Mar. 27, 2008]

Need assistance?

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§50.18 National primary ambient air quality standards for $PM_{2.5}$.

(a) The national primary ambient air quality standards for $PM_{2.5}$ are 12.0 micrograms per cubic meter ($\mu g/m^3$) annual arithmetic mean concentration and 35 $\mu g/m^3$ 24-hour average concentration measured in the ambient air as $PM_{2.5}$ (particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers) by either:

(1) A reference method based on appendix L to this part and designated in accordance with part 53 of this chapter; or

(2) An equivalent method designated in accordance with part 53 of this chapter.

(b) The primary annual $PM_{2.5}$ standard is met when the annual arithmetic mean concentration, as determined in accordance with appendix N of this part, is less than or equal to 12.0 $\mu g/m^3$.

(c) The primary 24-hour $PM_{2.5}$ standard is met when the 98th percentile 24-hour concentration, as determined in accordance with appendix N of this part, is less than or equal to 35 $\mu g/m^3$.

[78 FR 3277, Jan. 15, 2013]

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e-CFR data is current as of June 20, 2019

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§50.19 National primary and secondary ambient air quality standards for ozone.

(a) The level of the national 8-hour primary ambient air quality standard for ozone (O_3) is 0.070 parts per million (ppm), daily maximum 8-hour average, measured by a reference method based on appendix D to this part and designated in accordance with part 53 of this chapter or an equivalent method designated in accordance with part 53 of this chapter.

(b) The 8-hour primary O_3 ambient air quality standard is met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average O_3 concentration is less than or equal to 0.070 ppm, as determined in accordance with appendix U to this part.

(c) The level of the national secondary ambient air quality standard for O_3 is 0.070 ppm, daily maximum 8-hour average, measured by a reference method based on appendix D to this part and designated in accordance with part 53 of this chapter or an equivalent method designated in accordance with part 53 of this chapter.

(d) The 8-hour secondary O_3 ambient air quality standard is met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average O_3 concentration is less than or equal to 0.070 ppm, as determined in accordance with appendix U to this part.

[80 FR 65452, Oct. 26, 2015]

Need assistance?

Subsecs. (c) to (e). Pub. L. 90–148 added subsecs. (c) to (e).

EFFECTIVE DATE OF 1977 AMENDMENT

Amendment by Pub. L. 95–95 effective Aug. 7, 1977, except as otherwise expressly provided, see section 406(d) of Pub. L. 95–95, set out as a note under section 7401 of this title.

MODIFICATION OR RESCISSION OF RULES, REGULATIONS, ORDERS, DETERMINATIONS, CONTRACTS, CERTIFICATIONS, AUTHORIZATIONS, DELEGATIONS, AND OTHER ACTIONS

All rules, regulations, orders, determinations, contracts, certifications, authorizations, delegations, or other actions duly issued, made, or taken by or pursuant to act July 14, 1955, the Clean Air Act, as in effect immediately prior to the date of enactment of Pub. L. 95–95 [Aug. 7, 1977] to continue in full force and effect until modified or rescinded in accordance with act July 14, 1955, as amended by Pub. L. 95–95 [this chapter], see section 406(b) of Pub. L. 95–95, set out as an Effective Date of 1977 Amendment note under section 7401 of this title.

TERMINATION OF ADVISORY COMMITTEES

Advisory committees in existence on Jan. 5, 1973, to terminate not later than the expiration of the 2-year period following Jan. 5, 1973, unless, in the case of a committee established by the President or an officer of the Federal Government, such committee is renewed by appropriate action prior to the expiration of such 2-year period, or in the case of a committee established by the Congress, its duration is otherwise provided by law. Advisory committees established after Jan. 5, 1973, to terminate not later than the expiration of the 2-year period beginning on the date of their establishment, unless, in the case of a committee established by the President or an officer of the Federal Government, such committee is renewed by appropriate action prior to the expiration of such 2-year period, or in the case of a committee established by the Congress, its duration is otherwise provided by law. See section 14 of Pub. L. 92–463, Oct. 6, 1972, 86 Stat. 776, set out in the Appendix to Title 5, Government Organization and Employees.

[1] *See Codification note below.*

[2] *See References in Text note below.*

§7418. Control of pollution from Federal facilities

(a) General compliance

Each department, agency, and instrumentality of the executive, legislative, and judicial branches of the Federal Government (1) having jurisdiction over any property or facility, or (2) engaged in any activity resulting, or which may result, in the discharge of air pollutants, and each officer, agent, or employee thereof, shall be subject to, and comply with, all Federal, State, interstate, and local requirements, administrative authority, and process and sanctions respecting the control and abatement of air pollution in the same manner, and to the same extent as any nongovernmental entity. The preceding sentence shall apply (A) to any requirement whether substantive or procedural (including any recordkeeping or reporting requirement, any requirement respecting permits and any other requirement whatsoever), (B) to any requirement to pay a fee or charge imposed by any State or local agency to defray the costs of its air pollution regulatory program, (C) to the exercise of any Federal, State, or local administrative authority, and (D) to any process and sanction, whether enforced in Federal, State, or local courts, or in any other manner. This subsection shall apply notwithstanding any immunity of such agencies, officers, agents, or employees under any law or rule of law. No officer, agent, or employee of the United States shall be personally liable for any civil penalty for which he is not otherwise liable.

(b) Exemption

The President may exempt any emission source of any department, agency, or instrumentality in the executive branch from compliance with such a requirement if he determines it to be in the paramount interest of the United States to do so, except that no exemption may be granted from

section 7411 of this title, and an exemption from section 7412 of this title may be granted only in accordance with section 7412(i)(4) of this title. No such exemption shall be granted due to lack of appropriation unless the President shall have specifically requested such appropriation as a part of the budgetary process and the Congress shall have failed to make available such requested appropriation. Any exemption shall be for a period not in excess of one year, but additional exemptions may be granted for periods of not to exceed one year upon the President's making a new determination. In addition to any such exemption of a particular emission source, the President may, if he determines it to be in the paramount interest of the United States to do so, issue regulations exempting from compliance with the requirements of this section any weaponry, equipment, aircraft, vehicles, or other classes or categories of property which are owned or operated by the Armed Forces of the United States (including the Coast Guard) or by the National Guard of any State and which are uniquely military in nature. The President shall reconsider the need for such regulations at three-year intervals. The President shall report each January to the Congress all exemptions from the requirements of this section granted during the preceding calendar year, together with his reason for granting each such exemption.

(c) Government vehicles

Each department, agency, and instrumentality of executive, legislative, and judicial branches of the Federal Government shall comply with all applicable provisions of a valid inspection and maintenance program established under the provisions of subpart 2 of part D or subpart 3 of part D except for such vehicles that are considered military tactical vehicles.

(d) Vehicles operated on Federal installations

Each department, agency, and instrumentality of executive, legislative, and judicial branches of the Federal Government having jurisdiction over any property or facility shall require all employees which operate motor vehicles on the property or facility to furnish proof of compliance with the applicable requirements of any vehicle inspection and maintenance program established under the provisions of subpart 2 of part D or subpart 3 of part D for the State in which such property or facility is located (without regard to whether such vehicles are registered in the State). The installation shall use one of the following methods to establish proof of compliance—

(1) presentation by the vehicle owner of a valid certificate of compliance from the vehicle inspection and maintenance program;

(2) presentation by the vehicle owner of proof of vehicle registration within the geographic area covered by the vehicle inspection and maintenance program (except for any program whose enforcement mechanism is not through the denial of vehicle registration);

(3) another method approved by the vehicle inspection and maintenance program administrator.

(July 14, 1955, ch. 360, title I, §118, formerly, §7, as added Pub. L. 88–206, §1, Dec. 17, 1963, 77 Stat. 399; renumbered §107, Pub. L. 89–272, title I, §101(3), Oct. 20, 1965, 79 Stat. 992; renumbered §111 and amended Pub. L. 90–148, §2, Nov. 21, 1967, 81 Stat. 499; renumbered §118 and amended Pub. L. 91–604, §§4(a), 5, Dec. 31, 1970, 84 Stat. 1678, 1689; Pub. L. 95–95, title I, §116, Aug. 7, 1977, 91 Stat. 711; Pub. L. 101–549, title I, §101(e), title II, §235, title III, §302(d), Nov. 15, 1990, 104 Stat. 2409, 2530, 2574.)

CODIFICATION

Section was formerly classified to section 1857f of this title.

AMENDMENTS

1990—Subsec. (a). Pub. L. 101–549, §235, inserted heading.

Pub. L. 101–549, §101(e), amended second sentence generally. Prior to amendment, second sentence read as follows: "The preceding sentence shall apply (A) to any requirement whether substantive or procedural (including any recordkeeping or reporting requirement, any requirement respecting permits and any other requirement whatsoever), (B) to the exercise of any Federal, State, or local administrative authority, and (C) to any process and sanction, whether enforced in Federal, State, or local courts or in any other manner."

Subsec. (b). Pub. L. 101–549, §302(d), substituted "section 7412(i)(4) of this title" for "section 7412(c) of this title".

Subsecs. (c), (d). Pub. L. 101–549, §235, added subsecs. (c) and (d).

1977—Subsec. (a). Pub. L. 95–95, §116(a), designated existing first sentence as subsec. (a) and inserted provisions enumerating the legal and administrative areas to which the compliance requirements apply and directing that agencies, officers, agents, and employees not be immune and that officers, agents, or employees of the United States not be personally liable for civil penalties for which they are not otherwise liable.

Subsec. (b). Pub. L. 95–95, §116(b), designated second and following existing sentences as subsec. (b) and inserted provisions authorizing the President to exempt weaponry, equipment, aircraft, vehicles, and other classes and categories of property of the Armed Forces and the National Guard from compliance but to reconsider the need for such an exemption at three-year intervals.

1970—Pub. L. 91–604, §5, struck out lettered designations (a) and (b), and, as so redesignated, substituted provisions requiring Federal facilities to comply with Federal, State, local, and interstate air pollution control and abatement requirements and provisions authorizing the President to exempt, under the specified terms and conditions, any emission source of any department, etc., in the executive branch from compliance with control and abatement requirements, for provisions requiring, to the extent practicable and consistent with the interests of the United States and within any available appropriations, Federal facilities to cooperate with the Department of Health, Education, and Welfare and with any air pollution control agency to prevent and control air pollution and provisions authorizing the Secretary to establish classes of potential pollution sources for which any Federal department or agency having jurisdiction over any facility was required to obtain a permit, under the specified terms and conditions, for the discharge of any matter into the air of the United States.

1967—Pub. L. 90–148 reenacted section without change.

EFFECTIVE DATE OF 1977 AMENDMENT

Amendment by Pub. L. 95–95 effective Aug. 7, 1977, except as otherwise expressly provided, see section 406(d) of Pub. L. 95–95, set out as a note under section 7401 of this title.

TERMINATION OF REPORTING REQUIREMENTS

For termination, effective May 15, 2000, of provisions in subsec. (b) of this section relating to annual reports to Congress, see section 3003 of Pub. L. 104–66, as amended, set out as a note under section 1113 of Title 31, Money and Finance, and the 12th item on page 20 of House Document No. 103–7.

TRANSFER OF FUNCTIONS

For transfer of authorities, functions, personnel, and assets of the Coast Guard, including the authorities and functions of the Secretary of Transportation relating thereto, to the Department of Homeland Security, and for treatment of related references, see sections 468(b), 551(d), 552(d), and 557 of Title 6, Domestic Security, and the Department of Homeland Security Reorganization Plan of November 25, 2002, as modified, set out as a note under section 542 of Title 6.

PENDING ACTIONS AND PROCEEDINGS

Suits, actions, and other proceedings lawfully commenced by or against the Administrator or any other officer or employee of the United States in his official capacity or in relation to the discharge of his official duties under act July 14, 1955, the Clean Air Act, as in effect immediately prior to the enactment of Pub. L. 95–95 [Aug. 7, 1977], not to abate by reason of the taking effect of Pub. L. 95–95, see section 406(a) of Pub. L. 95–95, set out as an Effective Date of 1977 Amendment note under section 7401 of this title.

MODIFICATION OR RESCISSION OF RULES, REGULATIONS, ORDERS, DETERMINATIONS, CONTRACTS, CERTIFICATIONS, AUTHORIZATIONS, DELEGATIONS, AND OTHER ACTIONS

All rules, regulations, orders, determinations, contracts, certifications, authorizations, delegations, or other actions duly issued, made, or taken by or pursuant to act July 14, 1955, the Clean Air Act, as in effect immediately prior to the date of enactment of Pub. L. 95–95 [Aug. 7, 1977] to continue in full force and effect until modified or rescinded in accordance with act July 14, 1955, as amended by Pub. L. 95–95 [this chapter], see section 406(b) of Pub. L. 95–95, set out as an Effective Date of 1977 Amendment note under section 7401 of this title.

EXECUTIVE ORDER NO. 11282

Ex. Ord. No. 11282, May 26, 1966, 31 F.R. 7663, which provided for the prevention, control, and abatement of air pollution from Federal activities, was superseded by Ex. Ord. No. 11507, Feb. 4, 1970, 35 F.R. 2573.

EXECUTIVE ORDER NO. 11507

Ex. Ord. No. 11507, Feb. 4, 1970, 35 F.R. 2573, which provided for the prevention, control, and abatement of air pollution at Federal facilities, was superseded by Ex. Ord. No. 11752, Dec. 17, 1973, 38 F.R. 34793, formerly set out as a note under section 4331 of this title.

§7419. Primary nonferrous smelter orders

(a) Issuance; hearing; enforcement orders; statement of grounds for application; findings

(1) Upon application by the owner or operator of a primary nonferrous smelter, a primary nonferrous smelter order under subsection (b) may be issued—

(A) by the Administrator, after thirty days' notice to the State, or

(B) by the State in which such source is located, but no such order issued by the State shall take effect until the Administrator determines that such order has been issued in accordance with the requirements of this chapter.

Not later than ninety days after submission by the State to the Administrator of notice of the issuance of a primary nonferrous smelter order under this section, the Administrator shall determine whether or not such order has been issued by the State in accordance with the requirements of this chapter. If the Administrator determines that such order has not been issued in accordance with such requirements, he shall conduct a hearing respecting the reasonably available control technology for primary nonferrous smelters.

(2)(A) An order issued under this section to a primary nonferrous smelter shall be referred to as a "primary nonferrous smelter order". No primary nonferrous smelter may receive both an enforcement order under section 7413(d) [1] of this title and a primary nonferrous smelter order under this section.

(B) Before any hearing conducted under this section, in the case of an application made by the owner or operator of a primary nonferrous smelter for a second order under this section, the applicant shall furnish the Administrator (or the State as the case may be) with a statement of the grounds on which such application is based (including all supporting documents and information). The statement of the grounds for the proposed order shall be provided by the Administrator or the State in any case in which such State or Administrator is acting on its own initiative. Such statement (including such documents and information) shall be made available to the public for a thirty-day period before such hearing and shall be considered as part of such hearing. No primary nonferrous smelter order may be granted unless the applicant establishes that he meets the conditions required for the issuance of such order (or the Administrator or State establishes the meeting of such conditions when acting on their own initiative).

(C) Any decision with respect to the issuance of a primary nonferrous smelter order shall be accompanied by a concise statement of the findings and of the basis of such findings.

(3) For the purposes of sections 7410, 7604, and 7607 of this title, any order issued by the State and in effect pursuant to this subsection shall become part of the applicable implementation plan.

(b) Prerequisites to issuance of orders

A primary nonferrous smelter order under this section may be issued to a primary nonferrous smelter if—

(1) such smelter is in existence on August 7, 1977;

(2) the requirement of the applicable implementation plan with respect to which the order is issued is an emission limitation or standard for sulfur oxides which is necessary and intended to be itself sufficient to enable attainment and maintenance of national primary and secondary ambient air quality standards for sulfur oxides; and

(3) such smelter is unable to comply with such requirement by the applicable date for compliance because no means of emission limitation applicable to such smelter which will enable

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e-CFR data is current as of June 24, 2019

Title 40: Protection of Environment
PART 1502—ENVIRONMENTAL IMPACT STATEMENT

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§1502.9 Draft, final, and supplemental statements.

Except for proposals for legislation as provided in §1506.8 environmental impact statements shall be prepared in two stages and may be supplemented.

(a) Draft environmental impact statements shall be prepared in accordance with the scope decided upon in the scoping process. The lead agency shall work with the cooperating agencies and shall obtain comments as required in part 1503 of this chapter. The draft statement must fulfill and satisfy to the fullest extent possible the requirements established for final statements in section 102(2)(C) of the Act. If a draft statement is so inadequate as to preclude meaningful analysis, the agency shall prepare and circulate a revised draft of the appropriate portion. The agency shall make every effort to disclose and discuss at appropriate points in the draft statement all major points of view on the environmental impacts of the alternatives including the proposed action.

(b) Final environmental impact statements shall respond to comments as required in part 1503 of this chapter. The agency shall discuss at appropriate points in the final statement any responsible opposing view which was not adequately discussed in the draft statement and shall indicate the agency's response to the issues raised.

(c) Agencies:

(1) Shall prepare supplements to either draft or final environmental impact statements if:

(i) The agency makes substantial changes in the proposed action that are relevant to environmental concerns; or

(ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.

(2) May also prepare supplements when the agency determines that the purposes of the Act will be furthered by doing so.

(3) Shall adopt procedures for introducing a supplement into its formal administrative record, if such a record exists.

(4) Shall prepare, circulate, and file a supplement to a statement in the same fashion (exclusive of scoping) as a draft and final statement unless alternative procedures are approved by the Council.

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e-CFR data is current as of June 25, 2019

Title 36: Parks, Forests, and Public Property
PART 219—PLANNING
Subpart A—National Forest System Land Management Planning

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§219.3 Role of science in planning.

The responsible official shall use the best available scientific information to inform the planning process required by this subpart for assessment; developing, amending, or revising a plan; and monitoring. In doing so, the responsible official shall determine what information is the most accurate, reliable, and relevant to the issues being considered. The responsible official shall document how the best available scientific information was used to inform the assessment, the plan or amendment decision, and the monitoring program as required in §§219.6(a)(3) and 219.14(a)(3). Such documentation must: Identify what information was determined to be the best available scientific information, explain the basis for that determination, and explain how the information was applied to the issues considered.

[81 FR 90737, Dec. 15, 2016]

ELECTRONIC CODE OF FEDERAL REGULATIONS

e-CFR data is current as of June 25, 2019

Title 36: Parks, Forests, and Public Property
PART 219—PLANNING
Subpart A—National Forest System Land Management Planning

§219.1 Purpose and applicability.

(a) This subpart sets out the planning requirements for developing, amending, and revising land management plans (also referred to as plans) for units of the National Forest System (NFS), as required by the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976 (16 U.S.C. 1600 *et seq.*) (NFMA). This subpart also sets out the requirements for plan components and other content in land management plans. This part is applicable to all units of the NFS as defined by 16 U.S.C. 1609 or subsequent statute.

(b) Consistent with the Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C. 528-531) (MUSYA), the Forest Service manages the NFS to sustain the multiple use of its renewable resources in perpetuity while maintaining the long-term health and productivity of the land. Resources are managed through a combination of approaches and concepts for the benefit of human communities and natural resources. Land management plans guide sustainable, integrated resource management of the resources within the plan area in the context of the broader landscape, giving due consideration to the relative values of the various resources in particular areas.

(c) The purpose of this part is to guide the collaborative and science-based development, amendment, and revision of land management plans that promote the ecological integrity of national forests and grasslands and other administrative units of the NFS. Plans will guide management of NFS lands so that they are ecologically sustainable and contribute to social and economic sustainability; consist of ecosystems and watersheds with ecological integrity and diverse plant and animal communities; and have the capacity to provide people and communities with ecosystem services and multiple uses that provide a range of social, economic, and ecological benefits for the present and into the future. These benefits include clean air and water; habitat for fish, wildlife, and plant communities; and opportunities for recreational, spiritual, educational, and cultural benefits.

(d) This part does not affect treaty rights or valid existing rights established by statute or legal instruments.

(e) During the planning process, the responsible official shall comply with Section 8106 of the Food, Conservation, and Energy Act of 2008 (25 U.S.C. 3056), Executive Order 13007 of May 24, 1996, Executive Order 13175 of November 6, 2000, laws, and other requirements with respect to disclosing or withholding under the Freedom of Information Act (5 U.S.C. 552) certain information regarding reburial sites or other information that is culturally sensitive to an Indian Tribe or Tribes.

(f) Plans must comply with all applicable laws and regulations, including NFMA, MUSYA, the Clean Air Act, the Clean Water Act, the Wilderness Act, and the Endangered Species Act.

(g) The responsible official shall ensure that the planning process, plan components, and other plan content are within Forest Service authority, the inherent capability of the plan area, and the fiscal capability of the unit.

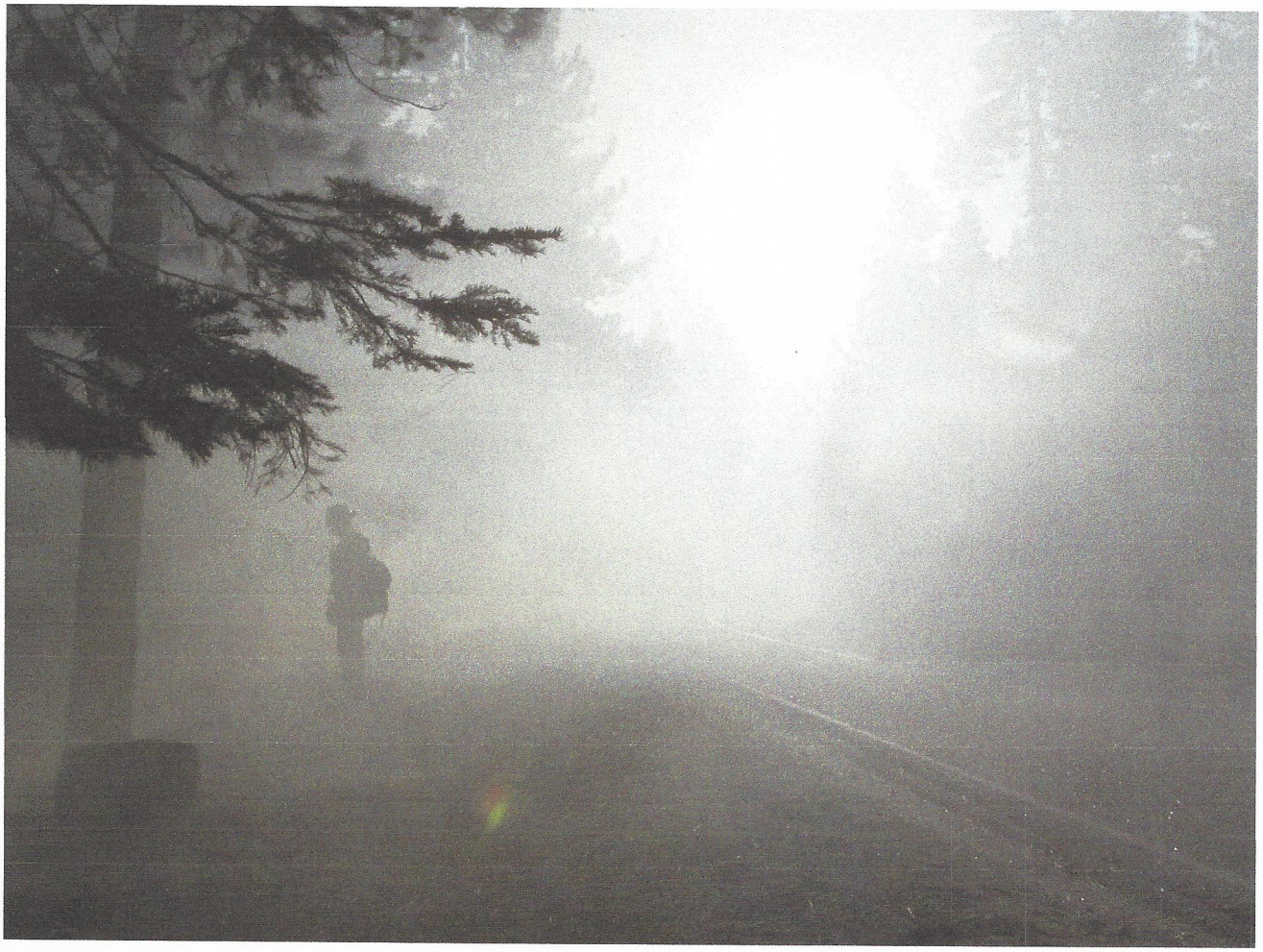
A publication of the
National Wildfire Coordinating Group

NWCG Smoke Management Guide for Prescribed Fire

PMS 420-2

February 2018

NFES 001279



NWCG Smoke Management Guide for Prescribed Fire

February 2018
PMS 420-2
NFES 1279

The *NWCG Smoke Management Guide for Prescribed Fire* contains information on prescribed fire smoke management techniques, air quality regulations, smoke monitoring, modeling, communication, public perception of prescribed fire and smoke, climate change, practical meteorological approaches and smoke tools. The primary focus of this document is to serve as the textbook in support of NWCG's RX-410, Smoke Management Techniques course which is required for the position of Prescribed Fire Burn Boss Type 2 (RXB2) The Guide is useful to all who use prescribed fire, from private land owners to federal land managers, with practical tools, and underlying science. Many chapters are helpful for addressing air quality impacts from wildfires. It is intended to assist those who are following the guidance of the NWCG's *Interagency Prescribed Fire Planning and Implementation Procedures Guide*, PMS 484, in planning for, and addressing, smoke when conducting prescribed fires.

For a glossary of relevant terminology, consult the *NWCG Glossary of Wildland Fire Terminology* at https://www.nwcg.gov/glossary/a-z. For smoke management and air quality terms not commonly used by NWCG, consult the *Smokepedia* at https://www.frames.gov/partner-sites/emissions-and-smoke/educational-resources/smokepedia/.

The National Wildfire Coordinating Group (NWCG) provides national leadership to enable interoperable wildland fire operations among federal, state, tribal, territorial, and local partners. NWCG operations standards are interagency by design; they are developed with the intent of universal adoption by the member agencies. However, the decision to adopt and utilize them is made independently by the individual member agencies and communicated through their respective directives systems.

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Contents

CHAPTER 2 – SMOKE IMPACTS

2.1 Public Health and Exposure to Smoke

Susan Lyon Stone, Martha Sue Carraway, Wayne E. Cascio, Scott Damon, and Paul Garbe

Introduction

The quality of the air we breathe is important for health and well-being. Gaseous and particle pollutants in the air can adversely affect human health. These gases and particles originate from many sources, including smoke from wildland fires (prescribed fire and wildfire).

Wildland fire smoke is an important source of air pollution that can be harmful to public health. This chapter discusses adverse effects of air pollution from wildland fires on human health, using fine particles as a specific example.

What is Particle Pollution?

In general, particle pollution (also known as particulate matter or PM) is a mixture of microscopic solids and liquid droplets suspended in air. It is made up of many components, including acids (such as nitrates and sulfates), organic chemicals, metals, smoke, soil or dust particles, and allergens (such as fragments of pollen or mold spores).

The size of particles is directly linked to their potential for causing health problems. Small particles less than 2.5 micrometers in diameter ($PM_{2.5}$) pose the greatest risk to human health because they can get deep into human lungs, and some may even get into the bloodstream. Exposure to these particles can affect the lungs, heart and blood vessels. Larger particles (larger than 10 micrometers in diameter) are of less concern, although they can irritate eyes, nose, and throat.

Small particles of concern include "fine particles" (such as those found in smoke and haze), which are 2.5 micrometers in diameter or less, and "coarse particles" (such as those found in wind-blown dust), which have diameters between 2.5 and 10 micrometers.

The terms *micron* and *micrometer* are both abbreviated as *μm* and are interchangeable. They are units of measure equaling one-millionth of a meter.

Particle Pollution and Wildland Fires

Characteristics of particle emissions from wildland fires depend on the type and amount of material being burned, fuel and soil conditions, and the temperature of the combustion phase (flaming, smoldering, or glowing). Atmospheric conditions, fuel source and composition, and the size distribution of the fine particles all affect the capacity of the smoke to harm–or technically speaking, to oxidize–the tissues of the human airways (Leonard *et al.* 2007). There are substantial differences in the composition of smoke from wildfire and prescribed fire in different fuel types, and it is not yet fully understood how these characteristics determine the toxicity of the smoke. For example, smoke generated from smoldering peat bog fires contains different components than that from hot-burning canopy wildfires (Robinson *et al.* 2011, See *et al.* 2007). Health effects associated with these two types of fires may be different (Rappold *et al.* 2011); this could relate not only to differences in components, but also to the relative quantity of the smoke, or the tendency of smoke from smoldering peat fires to stay closer to the ground.

Particle Pollution and Human Health

An extensive body of scientific evidence shows that particle exposure can lead to a variety of health effects. For example, numerous studies link particle levels to increased hospital admissions and hospital emergency department visits, and even to death from heart or lung diseases (EPA 2009). Both long- (months to years) and short-term (24-hours or longer) particle exposures have been linked to health problems.

Long-term exposures, such as those experienced by people living for many years in areas with high particle levels, have been associated with problems such as reduced lung function and the development of chronic bronchitis, and even premature death.

Short-term exposures to particles can aggravate lung disease, causing asthma attacks and acute bronchitis, and may also increase susceptibility to respiratory infections. In people with heart and vascular disease, short-term exposures have been linked to heart attacks, worsening of heart failure, stroke and arrhythmias (irregular heart rhythm). Short-term exposures have been linked to premature death. Healthy children and adults have not been reported to suffer serious effects from short-term exposures, although they may experience temporary minor irritation when particle levels are elevated.

Fine particle pollution levels in the United States have dropped dramatically in the past 20 years; yet even as recently as 2013, more than 33 million people lived in U.S. counties that did not meet the Environmental Protection Agency's (EPA) health standards for $PM_{2.5}$ (EPA 2014).

Some health effects linked to short-term (acute) PM exposure:

- Irritation of the eyes, nose, and throat
- Coughing and phlegm production
- Chest tightness and shortness of breath
- Triggering of heart attack and stroke
- Aggravation of heart diseases, such as heart failure or ischemic (coronary) heart disease
- Aggravation of lung diseases, such as asthma and chronic obstructive pulmonary disease (COPD)
- Premature death in older adults and people with heart or lung disease

Some health effects linked to long-term (chronic) PM exposure:

- Premature death in older adults and people with heart or lung disease
- Reduced lung growth in children exposed to PM over many years
- Possible development of atherosclerosis (hardening of the arteries) and chronic bronchitis in people exposed to PM over many years

Who is at risk from particle pollution?

Healthy children and adults have not been reported to suffer serious effects from short-term exposures to particle pollution, although they may experience temporary minor irritation when particle levels are elevated. However, people with heart or lung disease, older adults, children and adults of lower socioeconomic status are considered at greater risk from particles than other people, especially when they are physically active. Exercise and physical activity cause people to breathe faster and more deeply and to take more particles into their lungs.

- People with heart or lung diseases such as coronary artery disease, heart failure, and asthma or chronic obstructive pulmonary disease (COPD) are at increased risk because particles can aggravate these diseases.
- Older adults are at increased risk, possibly because they may have undiagnosed heart or lung disease or diabetes. Many studies show that when particle levels are high, older adults are more likely to be hospitalized, and some may die of aggravated heart or lung disease.
- Children are likely at increased risk for several reasons. Children's lungs are still developing, which increases their risk from prolonged exposure (months to years) to particle pollution. They also spend more time at high activity levels, and thus are often exposed to higher inhaled doses of particle pollution, increasing the likelihood of symptomatic effects. Children are more likely to have asthma or acute respiratory diseases that can be aggravated when particle levels are high. These preexisting diseases can put children at greater risk of needing medical attention during smoke events although healthy children are likely to have only symptomatic effects, such as airway irritation.
- People of lower socioeconomic status are likely at increased risk for several reasons. Generally, they have been found to have a higher prevalence of preexisting diseases, limited access to medical treatment, and increased nutritional deficiencies, which can increase their risk to PM-related health effects (EPA 2009).
- In addition, research suggests that people with diabetes, people with certain health conditions such as obesity, and pregnant women and newborns also may be at increased risk of PM-related health effects.

Human Health Effects of Wildland Fire Smoke Exposure

Fine particle pollution is the principal pollutant of concern in wildland fire smoke for the relatively short-term exposures typically experienced by the public. The individual particles in wildland fire smoke are very small; collectively, they are visible to the naked eye as smoke. Particles in wildland fire smoke are primarily $PM_{2.5}$ and can be inhaled into the lungs.

Besides PM, components of smoke with implications for human health include carbon monoxide (CO), a colorless, odorless gas produced by incomplete combustion of wood or other organic materials. At high levels, CO can cause dizziness, nausea, and impaired mental function. Carbon monoxide levels are highest during the smoldering stages of a fire, especially in close proximity to the fire.

Smoke also contains a number of toxic air pollutants such as aldehydes (including formaldehyde and acrolein) and organic compounds such as polycyclic aromatic hydrocarbons (PAHs) and benzene (U.S. EPA 2013). Acrolein and formaldehyde are potent eye and respiratory irritants. Benzene is a known carcinogen that can cause headaches, dizziness, and breathing difficulties.

Ground level ozone (O_3) is a secondary pollutant in that it is not emitted directly from wildland fires but can form downwind when volatile organic compounds (VOC's) and nitrogen oxides (NO_x) react in the presence of sunlight. Wildland fire smoke is an important source of VOCs as well as a source of NO_x. While there are instances in which ozone levels can be affected by wildland fire emissions, typically the NO_x involved in ozone formation originates from urban and industrial sources, such as vehicles and power plants.

Some health effects linked to short-term (acute) ozone exposure:

- Respiratory symptoms, including: coughing; throat irritation; pain, burning or discomfort in the chest when taking a deep breath
- Reduced lung function, leading to shallow breathing and a feeling of shortness of breath
- Airway inflammation
- Aggravation of asthma and other chronic lung diseases
- Increased susceptibility to respiratory infection
- Premature death in people with heart and lung disease

Some health effects linked to long-term (chronic) ozone exposure:

- Aggravation of asthma and other chronic lung diseases
- New-onset asthma
- Permanent lung damage
- Premature death in people with lung disease

The acute (short-term) effects of smoke exposure range from irritation of the eyes and respiratory tract to more serious injury of the respiratory tract resulting in bronchitis, pneumonia and acute injury of the lungs. These injuries may cause symptoms of persistent cough, phlegm production, wheezing, and physical discomfort when breathing. The exposure can result in reduced lung function, even in healthy people. In addition, exposure to the PM in smoke may aggravate underlying medical conditions of the heart and lungs. Inhaled particles can also alter immune function by diminishing the ability of immune cells to remove foreign materials like pollen and bacteria from the lung, predisposing a person to lung infections. Respiratory complications of smoke exposure may be of particular concern in the very young, and in older individuals (Delfino *et al.* 2009).

In recent years, evidence showing negative health effects from exposure to wildland fire smoke has increased. Some studies have examined the link between health effects and monitored increases in PM, while others have tied these effects to overall smoke coverage (e.g. from satellite images). Scientists at EPA recently found an increase in emergency department visits for cardiac and respiratory complaints associated with the smoke plume from a large pocosin (wetland) wildfire in rural Eastern North Carolina (Rappold *et al.* 2011). Further analysis of this incident indicates that socioeconomic factors, specifically lower socioeconomic status, were the most significant predictor of county residents' risk for asthma attacks and heart failure, respectively, due to the fire (Rappold *et al.* 2012).

Other studies have also shown increased emergency room visits for respiratory complaints linked to $PM_{2.5}$ from a wildfire in Australia (Morgan *et al.* 2010) and wildfire fires in southern California (Delfino *et al.* 2009). Some scientists have not found such clear-cut effects of wildland fire smoke affecting metropolitan centers (Vedal and Dutton 2006), and it is thought that it may be difficult to statistically separate the adverse effects of high background air pollution levels that already exist in larger cities. Work is ongoing to understand this problem, including specific medical effects, the importance of underlying medical conditions (risk factors), and how the source and characteristics of the fire play a role in the effects of smoke on humans who are exposed.

Mechanisms of Health Effects

Respiratory effects

The upper and lower respiratory tract are the initial point of contact between smoke and the internal body. Irritant gases, toxic chemicals and particles in smoke make contact with the mucosal surfaces of the respiratory tract. The level of contact (upper respiratory vs. lower respiratory) is determined by the dose and reactivity of the chemicals and gases, as well as the size of the particles contained in the smoke (figures 2.1.1 and 2.1.2).

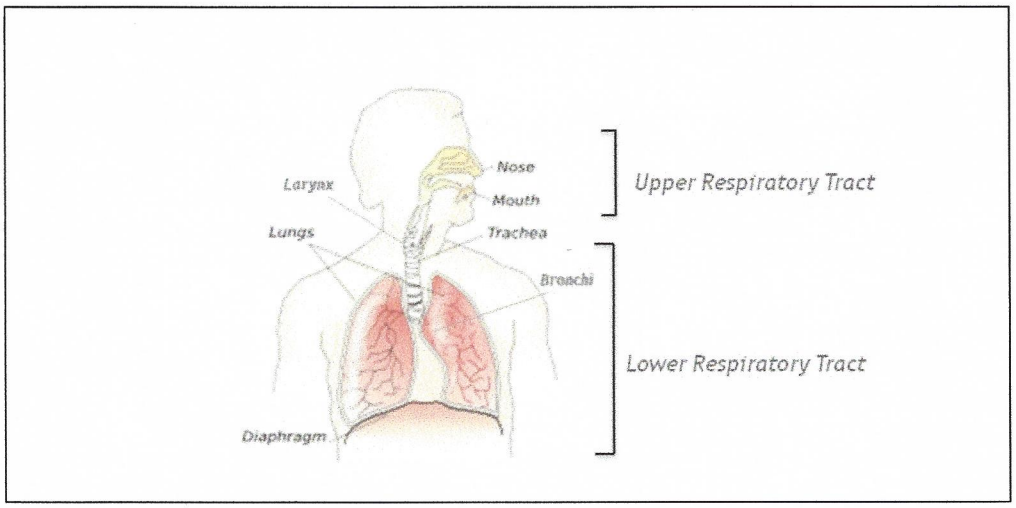

Figure 2.1.1 Respiratory tract anatomy. The upper respiratory tract includes the nose, mouth, and larynx. The lower respiratory tract begins below the larynx, and includes the trachea, bronchial tubes, and lungs.

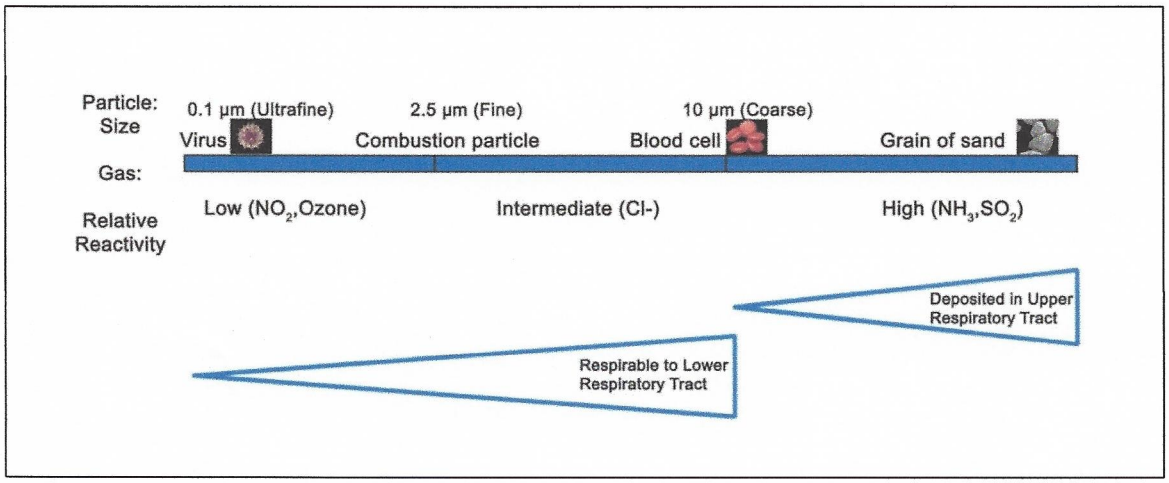

Figure 2.1.2. Anatomical deposition of inhaled particles and gases. The site of deposition of smoke components within the respiratory tract is determined by the particle size, and by the solubility and concentration of gases. Sizes of recognizable objects are shown for perspective.

Particles and gases that primarily contact the upper airway tend to cause nasal congestion, tearing of the eyes and coughing. Those that make it to the lower airways cause irritation or damage by direct toxicity to the respiratory epithelial cells that line the airway passages, leading to symptoms of coughing and

wheezing. Those smallest particles and gases that are inhaled to the extreme lower respiratory tract can damage the immune cells of the lung (alveolar macrophages) as well as the cells of the air sacs, which control oxygen uptake. These interactions lead to direct mechanical damage, and begin a cascade of inflammation that amplifies the injury, resulting in further recruitment of inflammatory cells and leakage of fluid from the blood into the lung. If mild, the injury may be reversible and self-limited, but can initiate wide-ranging systemic effects in the body due to the inflammatory effects. Also, even mild effects within the lung can augment respiratory problems or lead to lung infections in "susceptible groups" such as patients who have underlying respiratory diseases, older adults and children, including teenagers. If the injury is moderate or severe, it can result in overt symptoms, even in healthy people, and lead to respiratory impairment and long-term respiratory damage.

Cardiovascular effects

Particulate matter exposure can affect organs and systems other than the lungs. Inhalation of PM initiates a number of neurological and inflammatory pathways that can increase the risk of clinical vascular events (such as heart attacks and strokes) in the short-term, and promote the development of atherosclerosis (hardening of the arteries) in the long-term (Brook *et al.* 2010).

Such effects may occur either through neurological signaling and systemic responses starting in the lung, oxidative stress, inflammation, and/or through the transport of PM or its constituents to the circulatory system. The effects of particles originating from biomass combustion have not been studied with the same detail as that of urban ambient PM; however, the mechanisms are likely to be similar (Brook *et al.* 2010).

Short-term cardiovascular health effects are most likely caused by activation of autonomic nervous system reflexes, as indicated by changes in heart rate variability. This leads to the predominance of sympathetic activity (fight or flight response) with its associated physiological and biochemical responses. These include but are not limited to an increase in: vasoconstriction, heart rate, blood pressure, platelet aggregation, arrhythmia, neurally-mediated reactive oxygen species, and endothelial (inner lining of blood vessels) dysfunction (Brook *et al.* 2010).

Short-term effects probably begin within the lung from PM-induced oxidative stress and inflammation with a cascade of effects into the circulatory system that lead to many other biochemical and physiological effects. Exposure to ambient PM has been shown to increase several cellular inflammatory responses, such as an increase in the number of white blood cells, platelets, histamine and oxidized lipids, among others, while simultaneously decreasing antioxidant defenses. These responses also affect endothelial cell function and cause vasoconstriction. Associated increases in blood clot formation (thrombus formation) and decreases in blood clot destruction (fibrinolysis) increases the risk of thrombosis (blockage of a blood vessel) -- the root cause of most heart attacks and strokes.

Other effects include increasing insulin resistance, dyslipidemia (abnormal fat levels in the blood) and impaired HDL (good blood fat) function. In the long-term, these changes in biochemistry and vasomotor regulation are considered risk factors for the development of atherosclerosis. Another potential pathway for effects is through the translocation of ultrafine PM, soluble metals and organic compounds directly into the circulatory system (Brook *et al.* 2010).

Communicating With the Public About Health Impacts of Wildland Fire Smoke

A growing body of research specifically examines the effects of smoke from wildland fires on public health. Although questions remain, respiratory and cardiovascular health effects are likely, and it is clear that some populations are potentially at greater risk from smoke exposure.

EPA has developed the Air Quality Index, or AQI, to provide nationally uniform and easy-to-understand health advisories for several common air pollutants, including $PM_{2.5}$. The AQI provides cautions to people about the health risks associated with daily air quality, if any. Table 2.1.1 provides the AQI categories and their meaning for $PM_{2.5}$. The breakpoints listed in table 2.1.1 are based on 24-hour averages, reflecting the substantial body of evidence linking 24-hour exposures to adverse health outcomes.

The multi-agency Wildfire Guide for Public Health Officials – May 2016 (Stone *et al.* 2016), is a good reference for recommended actions that can be taken for protection of human health during wildfire smoke episodes. The basic recommendations from that document are integrated into table 2.1.1.

Table 0.1. The national Air Quality Index (AQI) for $PM_{2.5}$ links air quality conditions to health concern categories and includes recommended actions people can take to protect themselves (EPA 2014).

Levels of Health Concern	AQI Values	$PM_{2.5}$ 24-hr ave. ($\mu g/m^3$)	Recommended Action
Good	0-50	0-12	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51-100	12.1-35.4	Air quality is acceptable however there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101-150	35.5-55.4	Members of sensitive groups may experience health effects and should take steps to reduce their exposure. The general public is not likely to be affected.
Unhealthy	151-200	55.5-150.4	Everyone may begin to experience health effects and should take steps to reduce exposure by cutting back on outdoor exertion, by changing either time or intensity of exertion, or both. Members of sensitive groups may experience more serious health effects.
Very Unhealthy	201-300	150.5-250.4	Health warnings of emergency conditions. The entire population is more likely to be affected. Everyone should stay indoors and avoid prolonged or heavy outdoor exertion.
Hazardous	301-500	>250.5	Health alert: everyone may experience more serious health effects. Everyone should avoid all outdoor activity. People at greater risk may want to evacuate to a clean air shelter, if one is available–or leave the area, if it is safe to do so. This is especially important if they are having symptoms or smoke levels are expected to remain high. Symptoms such as chest pain or tightness, palpitations, shortness of breath, or unusual fatigue may indicate a serious problem. People with these symptoms should contact their health care provider.

Wildland fire smoke can cause dramatic, short-term, eg. two hours, changes in $PM_{2.5}$ concentration however, the AQI for particle pollution is a 24-hour average to reflect EPA's National Ambient Air Quality Standards and the science on PM exposures and health.

Scientific evidence does not support health advisories based on averages of less than 24 hours (Brook *et al.* 2010, EPA 2009). The majority of studies on $PM_{2.5}$ and health have examined health effects when a person is exposed for 24 hours or longer. Controlled human exposure and epidemiologic studies available at this time indicate that exposures of less than 24 hours do not result in health effects unless PM concentrations are extremely high (e.g., > 500 $\mu g/m^3$). However, very high short-term exposures will increase a person's 24-hour exposure, thereby increasing the likelihood that s/he will experience effects. To give the public the most up-to-date information on particle pollution possible, EPA uses a "NowCast" to estimate current air quality in the 24-hour AQI form, and uses the NowCast to generate the "current AQI" maps available at https://www.airnow.gov. In August 2013, EPA updated the NowCast so it is more responsive to rapidly changing air quality conditions, such as those that can occur during wildland fires. This change will give people information they can use to protect their health when air quality is poor, and help them get outdoors and get exercise when air quality is good.

The new method uses a weighted average of the previous 12 hours of monitored $PM_{2.5}$ concentrations to estimate the current AQI. When air quality is more stable, the hours are weighted more evenly; when air quality is more variable, the most recent hours are weighted more heavily.

The public will understandably have many questions and concerns during a wildland fire smoke event. A list of frequently asked questions and answers is included at the end of this chapter. Ideally, if a smoke event is serious and prolonged a local public health official will be available for direct communications and more detailed answers to public questions and concerns.

Conclusions

The health effects of wildland fire smoke are of real concern to fire managers, public health officials, air quality regulators and the public. Fire managers need to understand the potential health impacts of fine particulate matter and minimize public exposure to smoke.

Days or weeks of smoke exposure may result in serious health impacts. In part, this may be because the lung's ability to clear these particles out of the respiratory passages may be suppressed over time. Prolonged exposure may occur as the result of topographic or meteorological conditions that trap smoke in an area. Familiarity with the location and seasonal weather patterns can be invaluable in anticipating smoke impacts. Fire managers should be aware of at risk populations and sites that may be affected by wildland fires, such as medical facilities, schools or nursing homes.

Frequent Questions from the Public About Smoke (With Answers from EPA)

The text that follows these common questions can be used for outreach materials or for answering direct questions about smoke and public health.

What's in smoke from a wildland fire?

Wildland fire smoke is a complex mixture of water vapor, particulate matter (also called particle pollution), carbon monoxide, carbon dioxide, hydrocarbons and other organic chemicals, nitrogen oxides, and trace minerals. The individual compounds present in smoke number in the thousands. Smoke composition depends on many factors, including the fuel type and moisture content, the fire temperature, wind conditions and other weather-related influences, whether the smoke is fresh or "aged," and other variables.

Particulate matter is the principal pollutant of concern from wildland fire smoke for the relatively short-term exposures typically experienced by the public. Another pollutant of concern during smoke events is carbon monoxide, which is a colorless, odorless gas produced by incomplete combustion of wood or other organic materials. Carbon monoxide levels are likely to be highest in very close proximity to a smoldering fire. Smoke episodes can be, but are not always, associated with higher levels of ozone. Because fires do not generate ozone directly, but rather generate precursor emissions which can mix with emissions from other sources and lead to downwind increases in ozone, ozone production associated with smoke events can vary widely depending upon the characteristics of the source fire, the meteorological conditions associated with the smoke plume and any interactions with emissions from other sources.

Other air pollutants, such as the potent respiratory irritants acrolein and formaldehyde, as well as the carcinogen benzene, are present in smoke, but at much lower concentrations than particulate matter and carbon monoxide.

Is smoke bad for me?

Yes. Avoid breathing smoke if you can. If you are healthy, you usually are not at great risk from wildland fire smoke. But people with heart or lung diseases, such as congestive heart disease, chronic obstructive pulmonary disease (COPD), emphysema or asthma, and older adults and children are at greater risk. More specifically, people at greater risk of heart disease or stroke (and therefore at greater risk from particle pollution) include: men 45 years or older, and women 55 years or older; people with a family history of stroke or early heart disease (father or brother diagnosed before age 55; mother or sister diagnosed before age 65); people with high blood pressure or high blood cholesterol; people who are overweight or not physically active; and people who smoke cigarettes (EPA 2016).

How can I protect myself?

- Pay attention to your local air quality reports. Most areas report EPA's Air Quality Index (AQI) for fine particle pollution. Fine particle pollution is one of the biggest dangers from smoke. As smoke and air quality get worse, the AQI changes—and so do guidelines for protecting yourself.
- Use common sense. If it looks smoky outside, it's probably not a good time to go for a run and it probably is a good time for your children to remain indoors.
- Reducing physical activity is an effective strategy to lower your dose of inhaled air pollutants and thereby reduce health risks during a smoke event.
    - Here's why: During exercise, you can increase your air intake as much as 20 times over your resting level, bringing more pollution deep into the lungs. Also, when you breathe through your mouth during exercise you bypass the natural filtering ability of the nasal passages–again delivering more pollution to your lungs.
- If you're told to stay indoors, keep your windows and doors closed. Run your air conditioner if you have one. Keep the fresh air intake closed and the filter clean.
    - Be cautious when the weather is hot. If your home does not have air conditioning, and you depend on open windows and doors for ventilation, remaining inside with everything closed can be dangerous. Older individuals, or others in frail health run the risk of heat exhaustion or heat stroke. If outdoor temperatures are very high and you do not have air conditioning, it would be prudent to stay with friends or family members who do, to go to a cleaner air shelter in your community, or to leave the area.

- Keep indoor particle levels lower by not using anything that burns, such as wood stoves and gas stoves, or even candles.
- Don't smoke. That puts more pollution in your lungs–and those of the people around you.
- If you have asthma, be sure to take your medicines as prescribed. If your asthma action plan calls for you to measure your peak flows, make sure you do so. Call your doctor if your symptoms worsen.
- If you have heart disease, or another cardiovascular disease, limit your exposure to smoke and check with your doctor or health care provider about other ways to protect yourself.

How can I tell when smoke levels are dangerous? I don't live near a monitor.

Generally, the harder it is to see, the worse the smoke. Some states, especially in the western U.S., use a visibility guide to help you know when smoke levels may pose a concern for you. This technique is not particularly accurate and entirely invalid in areas of high humidity, especially in the southern U.S. Always stay alert for symptoms (see next question).

How do I know if I'm being affected?

You may have a scratchy throat, cough, sore sinuses, headache, a runny nose and stinging eyes. Children, older adults and people with lung diseases may find it hard to breathe as deeply as usual, and they may cough or feel short of breath. People with lung diseases such as asthma or chronic bronchitis, or heart diseases such as congestive heart failure, may find their symptoms worsening.

Should I leave my home because of smoke?

Maybe. The particles in smoke do get inside your home. If smoke levels are high for long enough (such as several days), these particles can build up to unsafe levels indoors.

- If you have symptoms (scratchy throat, cough, sore sinuses, headache, a runny nose, stinging eyes, or worsening of heart or lung disease symptoms), call your doctor. This is particularly important for people with heart or lung diseases, the elderly, and children. If you live in an area affected by wildland fire smoke, and the outside air clears, consider opening windows to clear the air inside your home. This also is a good time to do outdoor activities.

Are the effects of smoke permanent?

Not usually. Healthy adults and children generally find that their symptoms go away after the smoke is gone.

Do air filters help?

Indoor air filtration devices with HEPA filters can reduce the levels of particles indoors. Make sure to change your HEPA filter regularly. Don't use an air cleaner that works by generating ozone, which will put more pollution in your home.

Do dust masks help?

No. Paper "comfort" or "nuisance" masks trap large dust particles — not the tiny particles found in smoke. These masks generally will not protect your lungs from wildland fire smoke.

You may be able to buy disposable respirators, known as "N95" or "P100" masks at a hardware or home repair store or at a pharmacy. These respirators give some protection when used the right way. Check

with your doctor before using a mask: they can make breathing more difficult for people with existing heart or lung conditions. Guidelines for mask-fitting and respirator use can be found in the Wildfire Guide for Public Health Officials (Stone *et al.* 2016).

Literature Cited

Brook, R.D.; Rajagopalan, S; Pope. C.A. III; Brook, J.R.; Bhatnagar, A.; Diez-Roux, A.V.; Holguin, F.; Hong, Y.; Luepker, R.V.; Mittleman, M.A.; Peters, A.; Siscovick, D.; Smith, S.C.; Whitsel, L.; Kaufman, J.D. 2010. Particulate matter air pollution and cardiovascular disease, an update to the scientific statement of the American Heart Association. *Circulation*. 121: 2331–2378.

Delfino, R.J.; Brummel, S.; Wu, J; Stern, H.; Ostro, B.; Lipsett, M.; Winer, A.; Street, D.H.; Zhang, L.; Tjoa, T.; Gillen, D.L. 2009. The relationship of respiratory and cardiovascular hospital admissions to the southern California wildfires of 2003. *Occupational and Environmental Medicine*. 66 (3):189–197.

Environmental Protection Agency [EPA]. 2009. Integrated Science Assessment for Particulate Matter. Final Report: EPA/600/R-08/139F. Washington, D.C.: U.S. Environmental Protection Agency. 2228 p. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=216546. [27 March 2017].

Environmental Protection Agency [EPA]. 2013. 2011 National emissions inventory for wildland fire. https://www.epa.gov/air-emissions-inventories/2011-national-emissions-inventory-nei-documentation (Date accessed unknown).

Environmental Protection Agency [EPA]. 2014. Air Quality Index, A Guide to Air Quality and Your Health. Document number EPA-456/F-409-002. Research Triangle Park, NC: U.S. Environmental Protection Agency. 11 p. https://www3.epa.gov/airnow/aqi_brochure_02_14.pdf. (27 March 2017).

Environmental Protection Agency [EPA]. 2016. Heart Disease, Stroke and Outdoor Air Pollution. EPA-456/F-16-004. U.S. Environmental Protection Agency. https://www.epa.gov/sites/production/files/2016-01/documents/heartflyer.pdf. (27 March 2017).

Leonard, S.S.; Castranova, V.; Chen, B.T.; Schwegler-Berry, D.; Hoover, M.; Piacitelli, C.; Gaughan, D.M. 2007. Particle size-dependent radical generation from wildland fire smoke. *Toxicology*. 236: 103–113.

Morgan, G.; Sheppeard, V.; Khalaj, B.; Ayyar, A.; Lincoln, D.; Jalaludin, B.; Beard, J.; Corbett, S.; Lumley, T. 2010. Effects of bushfire smoke on daily mortality and hospital admissions in Sydney, Australia. *Epidemiology*. 21:47–55.

Rappold, A.G.; Stone, S.L.; Cascio, W.E.; Neas, L.M.; Kilaru, V.J.; Carraway, M.S.; Szykman, J.J.; Ising, A; Cleve, W.E.; Meredith, J.T.; Vaughan-Batten, H.; Deyneka, L.; Devlin, R.B. 2011. Peat Bog Wildfire Smoke Exposure in Rural North Carolina Is Associated with Cardiopulmonary Emergency Department Visits Assessed Through Syndromic Surveillance. *Environmental Health Perspectives*. 119: 1415–20. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3230437/pdf/ehp.1003206.pdf.

Rappold, A.G.; Cascio, W.E.; Kilaru, V.J.; Stone, S.L.; Neas, L.M.; Devlin, R.B.; Diaz-Sanchez, D. 2012. Cardio-respiratory outcomes associated with exposure to wildfire smoke are modified by measures of community health. *Environmental Health*. 11:71. http://www.ehjournal.net/content/11/1/71. (27 March 2017).

Robinson, M.S.; Zhao, M.; Zack, L.; Brindley, C.; Portz, L.; Quarterman, M.; Long, X.; Herckes, P. 2011. Characterization of PM (2.5) collected during broadcast and slash-pile prescribed burns of predominately ponderosa pine forests in northern Arizona. *Atmospheric Environment*. 45: 2087–2094.

See, S.; Balasubramanian, R.; Rianawati, E.; Karthikeyan, S.; Streets, D. 2007. Characterization and source apportionment of particulate matter ≤ 2.5 μm in Sumatra, Indonesia, during a recent peat fire episode. *Environmental Science and Technology*. 41(10): 3488–3494.

Stone, S.; Anderko, L.; Berger, M.; Brunner, G.; Butler, C.; Cascio, W.; Damon, S.; Davis, A.; Dickerson, P.; Fisk, W.; Fitch, M.; Garbe, P.; Haskell, W.; Hauptman, M.; Hyde, J.; Jenkins, P.; Lahm, P.; Larkin, N.; Materna, B.; O'Neill, S.; Ottmar, R.; Sacks, J.; Tarnay, L.; Vlasek, G.; Wayland, M.; White, J.; 2016. *Wildfire Smoke: A Guide for Public Health Officials*. 76 p. https://www3.epa.gov/airnow/wildfire_may2016.pdf

Vedal, S.; Dutton, S.J. 2006. Wildfire air pollution and daily mortality in a large urban area. *Environmental Research*. 102: 29-35.