AIR QUALITY SPECIALIST REPORT

KINGS RIVER EXPERIMENTAL WATERSHED PROJECT

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Abstract

This report analyzes the effects of the Alternatives proposed to meet the purpose and need for the Kings River Experimental Watershed Forest Health and Research Project (KREW, or the Project) to air quality and visibility. The federal Clean Air Act as amended in 1990 (CAAA) requires that any federal action will determine that actions conform to State Implementation Plans (SIPs). Total direct and indirect emissions were calculated for the management actions proposed by each alternative. These were compared to the federal de minimus levels for criteria pollutants where the San Joaquin Valley is in nonattainment and/or in a maintenance level. Two pollutants would be over de minimus levels (NOx and VOC, precursors to ozone), but when compared to annual average daily emissions for the San Joaquin Valley air basin were less than 10% of that emitted regionally, thus the project management actions are expected to conform with the State Implementation Plan. The direct, indirect and cumulative effects for the Alternatives proposed by KREW are expected to be of short duration and generally small in scale. These include the effects from prescribed burning (typically conducted during the late fall, winter and spring months), mechanical treatments (typically conducted during the summer months) and wildfire.
INTRODUCTION

Fire is an important part of California ecosystems, but it also produces combustion by-products that are potentially harmful to human health and welfare. Carbon dioxide (CO₂) and water are the two products of complete combustion and generally make up 90 percent of the total emissions from wildfire. In incomplete combustion that occurs under wildfire conditions, smoke is composed of carbon dioxide, water vapor, carbon monoxide (CO), particulate matter, hydrocarbons, and other volatile organic compounds (VOCs), nitrogen oxides (NOₓ), trace minerals and several thousand other compounds. Particulate matter is the principle pollutant of concern to human health from wildfire smoke for the short-term exposures typically experienced by firefighters and the public. Studies indicate that 90 percent of smoke particles emitted during wildland burning are particles that measure less than ten microns in size (PM₁₀), and about 90 percent of these are less than 2.5 microns in size (PM₂.₅). Hydrocarbons and nitrogen oxides from large wildfires contribute to increased ozone formation (which causes injury to plants) under certain conditions (Ahuja 2006).

There are two general strategies to managing wildfire smoke: (1) emission reduction and (2) emission redistribution. All pollutants except nitrous oxide are negatively correlated with combustion efficiency, so actions that reduce one pollutant result in the reduction of all. Emission redistribution techniques may effectively keep smoke impacts away from sensitive areas, but does little to reduce the amount of emissions produced. But optimal use of reduction techniques can reduce emissions by approximately 20 to 25 percent, assuming all other factors (vegetation types, acres, etc.) were held constant and land management goals were still met. Emission reduction techniques can include reducing the area burned, reducing fuel loading, reducing fuel production, reducing fuel consumption, and scheduling burning before new fuel appears and increasing combustion efficiency (Ahuja 2006). These reduction techniques, which can include prescribed fire, mechanical harvesting (which includes road work, cutting, and hauling of material) and vegetation management treatments (mastication and mechanical piling) can produce emissions that can affect human health and visibility.

The purpose and need of this project is to treat the Providence and Bull units of the Kings River Experimental Watershed to improve forest health and exam the short and long term effects of these treatments. This report analyzes the direct, indirect and cumulative effects to Air Quality and visibility from the alternatives proposed to meet this purpose and need as well determines the General Conformity of these actions to the Clean Air Act.

AFFECTED ENVIRONMENT

The KREW project is within the San Joaquin Valley air basin and is regulated by the San Joaquin Valley Unified Air Pollution Control District (SJVAPCD). The SJVAPCD is responsible for implementing and regulating sources that degrade air quality and are responsible for meeting Federal and State air quality standards. The California Air Resources Board (CARB) has oversight authority to monitor performance.
The affected environment (geographic scale) in this analysis includes areas that would or could experience degradation of air resources as a result of the proposed actions. The San Joaquin Valley is considered the air basin downwind of the project and is the area the direct, indirect and cumulative impact analysis is focused on.

The dispersion of pollutants is affected by local meteorological conditions. Pollutants can stay trapped in one place if there is no mixing caused by wind and temperatures. Prescribed burns are conducted on days when atmospheric ventilation transports smoke and pollutants away from the San Joaquin Valley and pollutants are not normally a problem. Burns are conducted on authorized burn days only in consultation with the SJVAPCD. Poor ventilation occurs during summer and fall months when the valley is characterized by relatively stable air masses. Ozone concentrations can reach peak levels when strong sunshine and temperatures above 95 degrees F accompany periods of poor ventilation. Although ozone is not released directly to the atmosphere, it is produced by chemical reactions involving Visual organic compounds (VOCs) and nitrous oxides (NOx). The meteorological factors favorable to significant ozone formation occur only during the summer.

The Fresno Metropolitan area, the communities of Shaver Lake, Auberry, Tollhouse, and Providence including Class I Airsheds, schools airports and recreation sites are considered smoke sensitive receptors where smoke and air pollutants can adversely affect public health, safety and welfare. These areas could be affected by smoke if weather patterns produce a stable air mass and smoke is unable to vent into the upper atmosphere. Since PM10, PM2.5 and ozone are public health hazards, prescribed burns would be planned during periods of unstable air, which would allow for proper ventilation and temperatures less than 95 degrees. However, since prescribed underburns could last for several days or weeks there is the potential for recurring shifts in air masses toward more stable conditions. For this reason, all prescribed fire activities are coordinated with SJVAPCD and would be implemented under optimum conditions using best available control measures (listed in Chapter 2 under Air Quality [Fuels]) to prevent smoke concentrations from affecting local communities. Sensitive receptors were considered within 100 kilometers (10 miles) of the project area and are listed in Table 1 below.
Table 1. Sensitive receptors identified within 10 miles of KREW.

<table>
<thead>
<tr>
<th>Sensitive Receptor Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Towns, Communities</td>
<td>Exchequer, Shaver Lake, Petersen Mill, Cressman Road, Wishon</td>
</tr>
<tr>
<td>Recreation Areas</td>
<td>Dinkey Creek Recreation Area, Wishon Reservoir, Shaver Lake Recreation Area.</td>
</tr>
<tr>
<td>Campgrounds</td>
<td>Dinkey Creek, Sawmill Flat, Bretz Mill, Dorabella, Swanson Meadow, Camp Edison, Camp Fresno.</td>
</tr>
<tr>
<td>FS Work Center/Ranger Station</td>
<td>Dinkey Creek Ranger Station, Glen Meadow Work Center, Dinkey Creek Work Center, Wishon Work Center, Blue Canyon Work Center, Mountain Rest Station.</td>
</tr>
<tr>
<td>Roads</td>
<td>State Highway 168, Forest Service and County Roads</td>
</tr>
<tr>
<td>Class I Federal areas</td>
<td>See Table 2 for Class I areas</td>
</tr>
<tr>
<td>Other</td>
<td>Private lands within and adjacent to the project area</td>
</tr>
</tbody>
</table>

Regulatory Setting (Applicable Laws, Policies, and Regulations)

The Sierra National Forest Land and Resource Management Plan (SNF LRMP) as amended provides the standards and guidelines for the proposed action. It states that “Forest activities will be managed so air quality is compatible with federal, state and local laws; including a program that achieves the Clean Air Act responsibilities” (SNF LRMP 1992, pg. 4-2). The SNF LRMP has Standards and Guidelines for Air Quality (SNF LRMP 1992, pgs. 4-25) that include the following:

- Avoid cumulative impacts to air quality by coordinating prescribed burning activities within the Forest, with burning activities conducted by others (SNF LRMP 1992 S&G # 216).
- Mitigate fugitive dust impacts on air quality by including dust abatement as a requirement for construction activities that have potential to generate dust (SNF LRMP 1992 S&G # 217).
- Avoid prolonged effects from prescribed burning activities on air quality by burning only on Air Quality Control Board (AQCB) approved burn days when satisfactory wind dispersion conditions prevail (SNF LRMP 1992 S&G # 218).
- Participate with Air Quality Control Board (AQCB) to qualitatively define air quality control regulations and guidelines and effects of air quality on the Forest, from sources outside the Forest (SNF LRMP 1992 S&G # 219).
- Obtain appropriate permits prior to conducting prescribed burning activities (SNF LRMP 1992 S&G # 220).
- Incorporate air quality management considerations into fire management (SNF LRMP 1992 S&G # 230).

**Federal Conformity Requirements**

The CAAA require that all projects receiving federal funds must conform to the appropriate SIP. Federal actions are subject to either the Transportation Conformity Rule (40 CFR 51[T]), which applies to federal highway or transit projects, or the General Conformity Rule (40 CFR 51[W]), which applies to all other federal actions. Because the Sugar Pine Adaptive Management Project is not a federal highway or transit project, it is subject to the General Conformity Rule.

**General Conformity Rule Requirements**

The purpose of the General Conformity Rule is to ensure that federal actions conform to applicable SIPs so that they do not interfere with strategies employed to attain the National Ambient Air Quality Standards (NAAQS). The rule applies to federal actions in areas designated as nonattainment, or in some cases maintenance, for any of the six criteria pollutants. The rule applies to all federal actions except:

- Programs specifically included in a transportation plan or program that is found to conform under the federal transportation conformity rule.
- Projects with associated emissions below specified *de minimus* threshold levels.
- Certain other projects that are exempt or presumed to conform.

A general conformity determination would be required if a proposed federal action’s total direct and indirect emissions fail to meet one of these two conditions:

- Emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the NAAQS are below the *de minimus* levels indicated in Table 2.
- Emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the NAAQS are regionally insignificant (total emissions are less than 10% of the area’s total emissions inventory for that pollutant).

If either of these conditions is met, the requirements for general conformity do not apply because the proposed action is presumed to conform to the applicable SIP for each affected pollutant. As a result, no further analysis or determination would be required. If neither of these conditions is met, a general conformity determination must be performed to demonstrate that total direct and indirect emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards would conform to the applicable SIP.

The Project is located entirely within the SJVAPCD. Currently, the valley is classified by both the federal and state standards as *severe non-attainment* for ground-level ozone and as
maintenance status for PM10. The valley is designated as in attainment for all other criteria pollutants. (www.valleyair.org)

The EPA, for determining conformity, has developed de minimus (levels that are so small that the law does not take it into consideration) levels for each of the criteria pollutants based on an air basins attainment status for each pollutant. The table below shows these de minimus level thresholds and are bolded based on air basin status.

Table 2. Federal de minimus Threshold Levels for Criteria Pollutants based on Air Basin attainment status.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Area Type</th>
<th>Tons/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone (NOx or VOC)</td>
<td>Severe nonattainment (SJV Air Basin)</td>
<td>25</td>
</tr>
<tr>
<td>Carbon monoxide, SO2 and NO2</td>
<td>All nonattainment &amp; maintenance</td>
<td>100</td>
</tr>
<tr>
<td>PM10</td>
<td>Moderate nonattainment and maintenance (SJV Air Basin)</td>
<td>100</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>All nonattainment &amp; maintenance</td>
<td>25</td>
</tr>
</tbody>
</table>

Note: Federal de minimus threshold levels in bold type are those where status is non-attainment or maintenance.
Definition of de minimus: so small or minimal in differences that it does not matter or the law does not take it into consideration.

California Clean Air Act

Responsibility for achieving California’s air quality standards, which are more stringent than federal standards, is placed on the Air Resource Board (ARB) and local air districts, and is to be achieved through district-level air quality management plans that are incorporated into the State Implementation Plan (SIP). In California, the EPA has delegated authority to prepare SIPs to the ARB, which in turn has delegated that authority to individual air districts.

The ARB has traditionally established state air quality standards, maintaining oversight authority in air quality planning, developing programs for reducing emissions from motor vehicles, developing air emission inventories, collecting air quality and meteorological data, and approving SIPs.

Responsibilities of air districts include overseeing stationary source emissions, approving permits, maintaining emissions inventories, maintaining air quality stations, overseeing agricultural burning permits, and reviewing air quality–related sections of environmental documents required by California Environmental Quality Act (CEQA).
The California Clean Air Act (CCAA) of 1988 substantially added to the authority and responsibilities of air districts. The CCAA designates air districts as lead air quality planning agencies, requires air districts to prepare air quality plans, and grants air districts authority to implement control measures. The CCAA focuses on attainment of the state ambient air quality standards, which, for certain pollutants and averaging periods, are more stringent than the comparable federal standards.

The CCAA requires designation of attainment and nonattainment areas with respect to state ambient air quality standards. The CCAA also requires that local and regional air districts expeditiously adopt and prepare an air quality attainment plan if the district violates state air quality standards for CO, sulphur dioxide (SO\textsubscript{2}), NO\textsubscript{2}, or ozone. These air quality attainment plans are specifically designed to attain these standards and must be designed to achieve an annual 5% reduction in district-wide emissions of each nonattainment pollutant or its precursors. Where an air district is unable to achieve a 5% annual reduction in district-wide emissions of each nonattainment pollutant or its precursors, the adoption of “all feasible measures” on an expeditious schedule is acceptable as an alternative strategy (Health and Safety Code Section 40914(b)(2)). No locally prepared attainment plans are required for areas that violate the state PM\textsubscript{10} standards, but the ARB is currently addressing PM\textsubscript{10} attainment issues.

The CCAA requires that the state air quality standards be met as expeditiously as is practicable but, unlike the federal CAA, the CCAA does not set precise attainment deadlines. Instead, the CCAA establishes increasingly stringent standards for areas that will require more time to achieve the standards.

**Local Air Districts**

Local districts are given the responsibility to develop programs and plans for achieving both Federal and State air quality standards and are given the authority to implement control measures to reduce emissions of each nonattainment pollutant or its precursors. This is implemented through the use of Rules and Regulations.

**Smoke Management**

*In accordance with the California Code of Regulations, Title 17, all persons or entities subject to subchapter 2 Smoke Management Guidelines for Agricultural and Prescribed Burning shall comply with the requirements therein and those requirements adopted by applicable districts in local smoke management regulations. Such persons or entities proposing to conduct prescribed burning must submit a smoke management plan to the air district of jurisdiction and: 1) receive a permit to burn, 2) receive authorization to burn on a given day, and 3) maintain communication with the local air district and report on the status of the burn until it is concluded.*

**San Joaquin Valley Air Pollution Control District**

As agreed upon by San Joaquin Valley Air District staff and the Southern Sierra Interagency Smoke Management Group, all land managers planning to implement prescribed fire treatments will follow the Unified Guidelines and Procedures for Smoke Management, which includes the submission of a required Prescribed Fire Burn Plan and Smoke Management Plan.
Summary. These are reviewed by district personnel and are conditionally approved. Burners are required to register prescribed burns prior to the fall burn season and authorization to burn is required prior to ignition based on air quality conditions and forecasts. For Prescribed Understory burning, seven days prior to ignition a Prescribed Fire Ignition Advisory form must be completed and submitted to district meteorology and compliance staff to begin receiving forecast for burn day potential. Participation on daily smoke management conference calls for burn project coordination is also required on a daily basis prior to and during implementation. On the day of ignition, final approval must be received from the compliance officer at the district. Pile burning approval is received through the calling the Hazard Reduction Burning phone number on a daily basis. A burn fee is applied to the total blackened acres accomplished on a yearly basis. These conditions are enforced through Air District Rules and Regulations (Rule 4103, Rule 4106).

**Prevention of Significant Deterioration**
The Prevention of Significant Deterioration (PSD) provisions of the CAA require measures to “preserve, protect and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreation, scenic or historic value.” The most stringent requirements for air quality apply to those established as Class I areas. These include international parks, national wilderness areas greater than 5,000 acres, national memorial parks greater than 5,000 acres, and national parks greater than 5,000 acres, and national parks greater than 6,000 acres established prior to August 7, 1977. There are no Class I airsheds within the project area. However, there are Class I airsheds nearby that must be considered and protected. These airsheds are listed in the Table below.

**Table 3. Class I Airsheds near the KREW project.**

<table>
<thead>
<tr>
<th>Class I Airshed</th>
<th>Proximity to Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kings Canyon National Park</td>
<td>Western Park boundary approximately 7 miles East of project area.</td>
</tr>
<tr>
<td>Dinkey Lakes Wilderness</td>
<td>Southern wilderness Boundary is approximately 8 miles north of the projects area.</td>
</tr>
<tr>
<td>John Muir and Monarch Wilderness Areas</td>
<td>Western wilderness boundaries approximately 4 miles east of project area.</td>
</tr>
</tbody>
</table>

**Visibility Protection**
Visibility is an air-quality related value that is protected in all federal Class I areas. Since 1984, states have been required to protect the visibility in national parks and wilderness areas, as mandated by the 1977 Clean Air Act Amendments. The 1977 amendments established a national goal for the “prevention of any future and the remedying of any existing impairment of visibility in mandatory Class I federal areas which impairment results
from manmade pollution.” The regulations specifically require states to consider strategies for reducing visibility impairment from prescribed burning.

Existing Condition

The air quality in the San Joaquin Valley is among the poorest in the state. On average, the San Joaquin Valley experiences 35–40 days when it exceeds the federal health-based standards for ground-level ozone, and more than 100 days when it exceeds the state ozone standard. While levels of airborne particulates exceed the federal standard less than five times annually, the state standard is set at a lower and more protective level. The valley exceeds the state particulate standard an average of 90–100 days per year (www.arb.ca.gov; Trends Summary).

Desired Conditions

The desired condition for Air Quality and Visibility in KREW is to meet the purpose and need for KREW while accomplishing the Sierra National Forest Land and Resource Management Plan goal to manage Forest activities so air quality is compatible with federal, state and local laws, including a program that achieves the Clean Air Act responsibilities.

ENVIRONMENTAL CONSEQUENCES

Methodology

For each alternative proposed for KREW, associated emissions are calculated. This is used to determine if any alternatives total direct and indirect emissions fail to be (1) below Federal de minimus thresholds, in this case thresholds for ozone (precursors NOx and VOC) and PM10, or (2) considered regionally insignificant (less than 10% of the area’s total emissions inventory for that particular pollutant). If any alternative’s estimated emissions do not meet either of these conditions, a General Conformity Determination must be performed to ascertain how the proposed action would conform to the applicable SIP.

Emissions Modeling-Smoke

Four pieces of information are needed to calculate potential emissions produced from either wildfire or prescribed fire; acres burned, fuel loading, fuel type and type of burning (pile, understory or wildfire) that can determine the amount of fuel consumed. The actions proposed by each alternative are used to estimate these as well as information within the Fire/Fuels Report-Kings River Experimental Watershed Forest Health and Research Project. Associated emissions for criteria pollutants are derived utilizing an emissions spreadsheet developed and approved for prescribed fire emission reporting purposes. This form was developed and built by the Interagency Smoke Management Group and San Joaquin Valley APCD staff from emission formulas from publications (EPA, AP-42).

Modeling Used in Analysis

Associated emissions for criteria pollutants are derived utilizing an emissions spreadsheet developed and approved for prescribed fire emission reporting purposes. This form was developed and built by the Interagency Smoke Management Group and San Joaquin Valley APCD staff from emission formulas from publications (EPA, AP-42).
ProbAcre 2004 (M. R. Wiitala, Aviation and Fire Management, USDA Forest Service, Pacific Northwest Region). ProbAcre is a computer program that predicts the chance that a protection area will receive catastrophic consequences from a single or series of wild fire events over time. The modeling is based upon historical fire frequency records of the Sierra National Forest dating back to 1911.

Forest Vegetation Simulator with the Fire/Fuels Extension was used to model PM2.5 emissions to show a comparison between the action and no-action alternatives. PM2.5 was used as a surrogate for PM10 emissions. FVS models a fire in the year 2022, 10-years after treatments.

Emissions Modeling- Vegetation Harvesting Equipment
Information needed to calculate associated emissions produced by vehicular traffic from road work and mechanical treatments included in Alternatives 2, 3, 4 and 5 (thinning operations, mastication and dozer piling) are; type of equipment and the number of hours this equipment is expected to run. The actions proposed by each are used to estimate these. Equipment hours are based on average production rates from similar projects. Equipment typically used for this type of work include heavy duty diesel-powered vehicles (tractor-trailers [log trucks], wheeled skidders and loaders, track type dozers/masticators, and road graders). Emission factors for criteria pollutants are from “A Desk Reference for NEPA Air Quality Analysis” (CH2Hill 1995) and converted to total tons of pollutant.

Fugitive Dust Emissions
The Forest Service routinely requires timber sale operators to abate dust during use of the forest development roads. This is required for several reasons among which are: retaining road surface fines which help keep the larger supporting aggregate together; reduce dust visibility traffic hazards; reduce environmental dust plumes; and minimize loose fine material accumulations which can create muddy, road rutting conditions. (Lowe, 1994) Fugitive (visible) dust emissions (VDE) by general vehicle movement are calculated at 10 pounds per day for 5 vehicles per day on unpaved roads. This figure is reduced to 3.63 pounds per day per mile of VDE after dust abatement. This is accomplished through watering of roads or other dust abatement measures which are incorporated into the project design. Dust abatement is required for roads below 3000 feet in elevation in the San Joaquin Valley Air Basin. KREW is above 3,000 feet in elevation and is exempt from Regulation VIII, Rule 8011 General Requirements (www.valleyair.org), though dust abatements are still required by the Forest Service.

Because of this exemption and the use of abatement measures when they are not a requirement, specific calculations for fugitive dust emissions are not used in the analysis of potential emissions from this project, but are considered part of the direct, indirect and cumulative effects.

Indicators
No adverse effects; all prescribed burning will be in compliance with approved Burn Plan; fugitive dust will be minimized by required contract specifications (road watering).
Assumptions
This determination assumes that prescribed burning will occur under optimal atmospheric conditions for the transport of smoke and pollutants away from the San Joaquin Valley as regulated by SJVAPCD. Burning of natural and activity created dead and down woody material would occur under Best Available Control Measures for Air Quality as defined in Chapter 2.

Alternative 1 – No Action
No actions would be taken to reduce the potential for wildland fire. The opportunity would be loss for undertaking treatments to reduce the impacts that a wildland fire, starting in hot dry conditions, would cause the environment; both the forest environment and the airshed.

Direct and Indirect Effects

Direct Effects
No direct effects from management actions to air quality or visibility would occur under this alternative since no treatments would be completed outside of that which is already permitted or authorized.

Indirect Effects
Indirect effects include the potential for unplanned and uncontrolled wildfire that could occur within the area. The resultant smoke caused by these would have large amounts of emissions released and could potentially be of long duration. Values measured such as PM10 and visibility range used to determine the Health-Protective Value would be in the ranges assumed to be Unhealthy. Values associated with this rating are PM10 ranging from 176 to 300 µg/m³ and visibility of 1.24 to 2 miles (considered moderate smoke conditions). This would be considered the lower of the Health-Protective Values a wildfire would produce, if it occurred in the area. It is anticipated that for short periods of time the values may rise to the levels considered Very Unhealthy or perhaps Hazardous. The Statewide Emission Inventory in 2002 reported emissions (tons/day, annual average) from wildfires (Ahjua 2006) and is demonstrated in Table 4.

Table 4. Statewide Emission Inventory 2002 for Natural Sources-Wildfire

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Sources:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wildfire</td>
<td>6,522</td>
<td>3,046</td>
<td>17,474</td>
<td>3,441</td>
<td>302</td>
<td>2,418</td>
</tr>
</tbody>
</table>

Total Organic Gases (TOC) and Reactive Organic Gases (ROC) are similar to Volatile Organic Gases (VOC) and all are used by the air resources board to describe gases that lead to Ozone formation.

The high summer temperatures and light wind speeds that occur during the summer months, places a cap on valley air with no means for cleansing itself by dispersion or
transport. Because of the poor air quality associated with the San Joaquin Valley Air Basin it does not take large amounts of additional emissions to degrade air quality into unhealthy ranges especially in the summer and fall months, where storm systems are less likely to occur and disperse smog and emissions. Emissions from a wildfire could potentially have long lasting impacts beyond the initial burning period because of this. Uncontrolled wildfires are clearly responsible for the most widespread, prolonged, and severe periods of air quality degradation (Ahuja, 2006). For comparison purposes with the proposed action alternatives; Table 5 below demonstrates the emissions produced from a wildfire if the acres in KREW were affected by an uncontrolled wildfire during typical fire season conditions.

Table 5. Potential emissions if a wildfire were to burn within the entire KREW area.

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Total Acres</th>
<th>Fuel Loading (Tons/acre)</th>
<th>Total tons</th>
<th>Tons PM\textsubscript{10}</th>
<th>Tons PM\textsubscript{2.5}</th>
<th>Tons NOx</th>
<th>Tons SO\textsubscript{2}</th>
<th>Tons VOC</th>
<th>Tons CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td>3000</td>
<td>35</td>
<td>105000</td>
<td>1286.0</td>
<td>1155</td>
<td>183.7</td>
<td>5.35</td>
<td>761.25</td>
<td>12232.5</td>
</tr>
</tbody>
</table>

Based on 40 years of historical fire occurrence data (1965-2005) the ProbAcre model predicts a 30% chance of a 3,000 acre fire occurring on the High Sierra Ranger District in a 20 year period.

The 1994 Big Creek Fire on the High Sierra Ranger District serves as an actual example of emissions produced from a wildfire burning in untreated fuels. It burned with high intensity causing 84% mortality in the timber stands. The 5600 acre fire created 2,388 tons of PM\textsubscript{10}. (District Forest Vegetation Simulator files 2005).

**Cumulative Effects**

Typically the High Sierra Ranger District (HSRD) underburns 2000 acres per year, this program would continue unaffected by the alternative chosen. The district’s underburn program covers approximately 17,000 acres. None of these are within the project area. The underburns are in ponderosa pine or mixed conifer vegetation and have had at least one entry of prescribed fire. They are considered to be in maintenance status and will continue to be burned on a rotational schedule. Cumulative effects may also be the occurrence of respiratory or pulmonary distress if a wildland fire were to occur in the area while a prescribed fire was being conducted. This would be a rare occurrence. Table 3-1 displays the tons of estimated emissions from the HSRD underburns each year. The 73.5 tons of PM\textsubscript{10} emissions is the cumulative effect for the underburn program by project. It reflects the potential smoke emissions affecting residents of the Fresno metropolitan area and local foothill communities.
Table 6. Tons of Estimated Pollutants per Individual Project—Annual Underburn Program of Work

<table>
<thead>
<tr>
<th>PM10</th>
<th>PM2.5</th>
<th>NOx</th>
<th>SO2</th>
<th>VOC</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>73.5</td>
<td>66.0</td>
<td>10.5</td>
<td>0.30</td>
<td>43.5</td>
<td>699.0</td>
</tr>
</tbody>
</table>

PM10 = Particulate matter <10 microns in size, PM2.5 = Particulate matter <2.5 microns in size, NOx = Nitrous oxide, SO2 = Sulfur dioxide, VOCs = Volatile Organic Compounds, CO = Carbon monoxide

Past analysis has shown that emissions associated with thinning operations and road use is minimal due to contractual dust abatement requirements.

Common to Alternatives 2, 3, 4, and 5

Treatments are proposed to reduce surface, ladder fuels, and some aerial fuels to meet the purpose and need of reducing stand densities to improve forest health and reduce the potential for uncharacteristically severe wildfire. This is to occur, if these alternatives were chosen, through the use of mechanical methods as well as management ignited fire in the form of prescribed fires such as pile burning, and understory burning. Prescribed fire would be applied to the project area for three purposes: (1) as a final “cleaning” after vegetation management treatments to further reduce 1, 10 and 100 hours fuels (those fuels that have the greatest influence on fire spread); (2) to maintain the lower levels of the 1, 10, and 100 hours fuels; (3) to reintroduce the fire element back into a fire dependent ecosystem.

As part of the KREW research, all treatment activities need to be completed in a two year time frame from initial implementation. All thinning treatments would be completed in year one and post thinning burn treatments would need to be completed in year two (this means all post-thinning burn treatments need to be ignited within one season) after beginning implementation to evaluate the watershed scale effects of the management activities. Each project, Providence and Bull, would be implemented in successive years to allow for firing operations to be completed in successive years and not in a single year.

Dependent on where and how prescribed fire treatments are being utilized, the fuel loading can range from 15 to 34 tons per acre and be in the form of machine or hand created piles and/or in concentrations across a broad area such as the case in understory burning. On average the fuel loading for an area requiring prescribed fire as a primary treatment, maintenance and/or post activity treatment would be 35 tons/acre.

The main focus of prescribed fire implementation is to reduce surface fuel loadings that contribute to fire behavior rates of spread and flame length. These are the 1, 10 and 100 hour time lag categories (mainly needles, twigs and branches less than 3 inches in diameter). Prescribed fire burn plans set objectives for what percent consumption of these fuels are to be accomplished by the implementation of the prescribed fire. For pile burning, burn plan objectives typically set the objective at 80 to 90 percent consumption. Pile burning is conducted when the fuels have had a period of time to dry and are no longer green. For understory burning, burn plan objectives typically set the objectives at approximately 70 percent consumption (or reduction) of these fuels, though this would not be across the entire burn area. A typical understory burn is implemented to create a “mosaic” burn pattern, leaving patches of unburned areas amongst burned areas.
Alternative 2—Uneven Aged Structural Restoration

Associated emissions from mechanical equipment used in thinning and hauling operations and emissions produced from burning are shown below. Hazard fuels treatments, including prescribed fire, proposed for this proposed action can be found in Chapter 2 – Alternatives Considered in Detail of the KREW Environmental Impact Statement.

Direct Effects

Smoke Emissions
This alternative proposes to accomplish a total of 2,294 acres of prescribed fire; both underburning and pile burning combined. When completed, prescribed fire activities proposed under this action would create the following emissions.

Table 7. Total Emissions from All Prescribed Fire Treatments Proposed in this Action (in tons)

<table>
<thead>
<tr>
<th>Treatment Type</th>
<th>Tons per acre</th>
<th>Total Acres</th>
<th>PM10</th>
<th>PM2.5</th>
<th>NOx</th>
<th>SO2</th>
<th>VOC</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand Pile</td>
<td>15</td>
<td>15</td>
<td>0.88</td>
<td>0.82</td>
<td>0.59</td>
<td>0.00</td>
<td>0.71</td>
<td>7.43</td>
</tr>
<tr>
<td>Dozer Pile</td>
<td>35</td>
<td>725</td>
<td>98.96</td>
<td>92.62</td>
<td>65.08</td>
<td>0.13</td>
<td>79.93</td>
<td>837.38</td>
</tr>
<tr>
<td>Mastication/Underburn</td>
<td>35</td>
<td>68</td>
<td>28.73</td>
<td>25.80</td>
<td>4.10</td>
<td>0.12</td>
<td>17.00</td>
<td>274.19</td>
</tr>
<tr>
<td>Underburn Only</td>
<td>20</td>
<td>838</td>
<td>205.31</td>
<td>184.36</td>
<td>29.33</td>
<td>0.84</td>
<td>121.51</td>
<td>1952.54</td>
</tr>
<tr>
<td>Lop &amp; Scatter/Underburn</td>
<td>35</td>
<td>648</td>
<td>277.83</td>
<td>249.48</td>
<td>39.69</td>
<td>1.13</td>
<td>164.43</td>
<td>2642.22</td>
</tr>
</tbody>
</table>

PM10 = Particulate matter <10 microns in size, PM2.5 = Particulate matter <2.5 microns in size, NOx = Nitrous oxide, SO2 = Sulfur dioxide, VOCs = Volatile Organic Compounds, CO = Carbon monoxide

The following table is a product of FVS modeling. It compares the estimated PM2.5 emissions from the no action and action alternatives of a simulated wildfire occurring approximately 10 years after the completion of all project activities.
After ten years the effects on air quality of the proposed treatments are still noticeable. Applying Alternative 1 the wildfire produces approximately 220 tons per acre of PM2.5. Under the Alternatives 2 through 5 the wildfire produces approximately 98-104 tons per acre.

**Vegetation Harvesting Equipment**

Equipment hours are based on average production rates from similar projects on the HSRD. Most of the material would be thinned by chainsaw and skidded. Piling and mastication of activity created slash and brush would be with a track type tractor. For this analysis, all emissions are based upon use of wheeled skidders and loaders, heavy duty diesel powered highway truck and track type dozer or dozer with mastication head.

**Table 8. Total Emissions from all Thinning Operations (in tons)**

<table>
<thead>
<tr>
<th>Type of Equipment</th>
<th>Total Number of Hours</th>
<th>PM10</th>
<th>Exhaust Hydrocarbons</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheeled skidder</td>
<td>1280</td>
<td>0.087</td>
<td>0.12</td>
<td>0.081</td>
<td>2.3</td>
<td>0.058</td>
</tr>
<tr>
<td>Wheeled Loader</td>
<td>360</td>
<td>0.031</td>
<td>0.045</td>
<td>0.034</td>
<td>0.103</td>
<td>0.033</td>
</tr>
<tr>
<td>Heavy Duty Diesel Powered Truck</td>
<td>4000</td>
<td>0.512</td>
<td>0.384</td>
<td>8.32</td>
<td>3.58</td>
<td>0.908</td>
</tr>
<tr>
<td>Track Dozer</td>
<td>1254</td>
<td>0.070</td>
<td>0.076</td>
<td>0.80</td>
<td>0.22</td>
<td>0.086</td>
</tr>
</tbody>
</table>
**Fugitive Dust Emissions**

The Forest Service routinely requires timber sale operators to abate dust during use of the forest development roads. This is required for several reasons, including retaining road surface fine particles, which helps keep the larger supporting aggregate together; reducing dust visibility traffic hazards; reducing environmental dust plumes; and minimizing loose fine material accumulations which can create muddy, road rutting conditions (Lowe 1994 as cited in USDA Forest Service 2008).

Visible dust emissions (VDE \([PM_{10}]\)) by general vehicle movement are calculated at 10 lbs per day for 5 vehicles per day on unpaved roads. This figure is reduced to 3.63 pounds per day per mile of VDE after dust abatement through watering of roads or other dust abatement measures, which are incorporated into the project design features. For the proposed action, 3.63 pounds per day x 22 days to haul = 79.86 pounds, which is below de minimus. De minimus is set at 100 pounds per day for 50 vehicle trips on unpaved roads. Dust abatement is required for roads below 3,000 feet in elevation. The Dinkey South project area is above 3,000 feet in elevation and is exempt from Regulation VIII, Rule 8011 General Requirements, though dust abatement is still required by the Forest Service.

**Table 9. Emissions conformity to General Conformity Rule for Criteria Pollutants**

<table>
<thead>
<tr>
<th>TOTAL Emissions (smoke and equipment)</th>
<th>PM10</th>
<th>PM2.5</th>
<th>NOx</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>612.4</td>
<td>553.1</td>
<td>148.9</td>
</tr>
<tr>
<td>Percent of Areas Total</td>
<td>1.45%</td>
<td>0.5%</td>
<td>0.08%</td>
</tr>
</tbody>
</table>

Criteria Pollutants are those that determined by EPA to have de minimus levels

**Determination**

The conformity decision for the Clean Air Act prohibits federal agencies from permitting or approving any activity that does not conform to the SIP. The California Air Resources Board under the General Conformity Rule regulates actions that require conformity determinations for specific pollutants. The California Air Resources Board rules indicate that projects would be determined to conform to the applicable SIP if it meets the following criteria:

1. The total direct and indirect emissions from the action is in compliance with all requirements of SIP, because the actions meet one or more of the following:
   a. The emissions from the action are identified and accounted for in the applicable SIPs attainment or maintenance demonstrations,
   b. The emissions are offset,
   c. Based on air quality monitoring, the actions do not:
      i. Cause or contribute to any new violation of any standard in any area, or
      ii. Increase the severity or frequency of any existing violations of any standard,
   d. The state commits to modify SIP in accordance with the EPA rules, or
Where the EPA has not approved a revision of the relevant SIP, the total emissions do not exceed the historical level (based on the calendar year 1990 or other appropriately agreed to year).

This project meets the General Conformity Rule; it does not interfere with the strategies employed to attain NAAQS. The emissions from this project are considered regionally insignificant (total emissions are less than 10%) of the area's total emissions inventory for PM$_{10}$ and NO$_x$. This conformity is accomplished by maintaining burn ignitions and acres within rules and guidelines developed by the San Joaquin Valley Unified Pollution Control District (District), as provided for by the California Air Resources Board, under the Unified Guidelines for Smoke Management as developed by the Southern Sierra Interagency Smoke Management Group. These guidelines and rules are based on the requirements found in the following:

- **Title 17 of the California Code of Regulations – Subchapter 2, Smoke management Guidelines for Agriculture and Prescribed Burning**
- **San Joaquin Valley Unified Air Pollution Control District Rule 3160 (Prescribed Burning Fee), Rule 4106 (Prescribed Burning and Hazard Reduction Burning), and the District’s Smoke Management Program, Rule 4103 (Agricultural Burning)**
- **Wildland Fires Coordination and Communication Protocol as it applies to the Current Smoke Management Program**
- **Public Resource Code 4291 – for hazard Reduction Burning in the foothill and mountain areas of the District.**

Based upon meeting the SIP standards of CARB, the Unified Smoke guidelines discussed above and SJVUAPCD rules, the project is determined to be in compliance with SIPs General Conformity Rule and Title 17 of the California Code of Regulations. It is important when considering the determination that compliance with SIP is based upon meeting rules and guidelines managed by SJVUAPCD. These rules and guidelines are designed to meet historical emissions levels and keep projects from violating the SIP. The alternatives propose activities that will meet the rules and guidelines. Rules and guidelines along with daily SJVUAPCD direction control acres and ignitions. Meeting the acres and ignition rules and guidelines meets conformity with the SIP emission standards.

Exhaust hydrocarbons and pollutant levels produced from thinning activities are lower than historical levels of logging and similar activities for the Sierra National Forest. Historical timber harvesting and thinning operations were at all time highs in 1987 with 154 million board feet of timber harvested. This alternative only thins to 2.5% of that historical level.

**Indirect Effects**

The Fresno Metropolitan area, the communities of Shaver Lake, Auberry, Tollhouse, Providence Creek, Exchequer, the Dinkey Creek and Wishon Recreation Areas are considered smoke sensitive areas. These areas could be affected by smoke if weather
patterns produce a stable air mass and smoke is unable to vent into the upper atmosphere. Since PM$_{10}$ and ozone are public health hazards, prescribed burns would be planned during periods of unstable air, which would allow for proper ventilation of smoke and temperatures less than 95 degrees. However, since prescribed underburns could last for several days or weeks there is the potential for recurring shifts in air masses toward more stable conditions. For this reason, all prescribed fire activities are coordinated with SJVAPCD and would be implemented under optimum conditions using best available control measures (listed in the Proposed Action) to prevent smoke concentrations from affecting local communities.

Indirect effects may also be the occurrence of respiratory or pulmonary distress if a wildland fire were to occur in the area while a prescribed fire was being conducted. This would be a rare occurrence. Emissions from wildfires subside into the San Joaquin Valley during stable summer air patterns; smoke emissions from wildfires cause air pollution alerts not only in local mountain communities but also in the valley.

**Cumulative Effects**

The potential cumulative effects are from exposure to organic hydrocarbons (precursors to smog under high daytime temperatures), large particulate matter, and PM$_{10}$ and PM$_{2.5}$ produced from prescribed burning. These emissions are easily inhaled and cause respiratory and pulmonary distress.

The dispersion of pollutants is affected by local meteorological conditions. Pollutants can stay trapped in one place if there is no mixing caused by wind and temperatures. Prescribed burns are conducted on days when atmospheric ventilation transports smoke and pollutants away from the San Joaquin Valley and pollutants are not normally a problem. Burns are conducted on authorized burn days only in consultation with the APCD. Poor ventilation occurs during summer and fall months when the valley is characterized by relatively stable air masses. Ozone concentrations can reach peak levels when strong sunshine and temperatures above 95 degrees F accompany periods of poor ventilation. Although ozone is not released directly to the atmosphere, it is produced by chemical reactions involving VOCs and NO$_X$. The meteorological factors favorable to significant ozone formation occur only during the summer.

**Cumulative Effects—On-Going District Projects**

The HSRDs prescribed fire program would continue as part of the district program of work. All of the prescribed fire projects have gone through an air quality analysis during the NEPA process. The cumulative effect of smoke emissions and degradation of visibility may occur if prescribed burns were to continue during stable atmospheric conditions that are present when wildfires occur. For this reason, all prescribed fire activities are coordinated with SJVAPCD and would be implemented under optimum conditions using best available control measures to prevent smoke concentrations from affecting local communities.

**Cumulative Effects – Past, Present and Reasonably Foreseeable Projects**

Other past, present and foreseeable projects on the High Sierra District that could contribute to cumulative effects include the afore-mentioned district prescribed burn program, The Dinkey North
and South projects, cattle grazing, the district plantation and vegetation management program (Snowy-Patterson project), the proposed Dinkey Landscape projects (Soaproot and Eastfork), Off Highway Vehicle (OHV) use, and private land management activities and timber sales. Cumulative effects to air quality include any vegetation management program (public or private) in which vegetation will be burned, or where vehicle and heavy equipment use contributes to exhaust emissions or fugitive dust. The projects that could and possible will contribute to air quality cumulative effects from particulate matter PM$_{10}$ and NOx include Southern California Edison (SCE) Company’s forestry and prescribed fire program, the HSRD plantation and vegetation management program, and the vegetation treatments as prescribed in the Dinkey Collaborative Forest Landscape Restoration program (CFLR) which includes the Dinkey North and South projects and the proposed Soaproot and Eastfork projects. Cumulative effects to air quality from exhaust emissions and fugitive dust can be expected from the SCE forestry program, the CFLR, OHV use and the HSRD vegetation management program including plantation management. It is unknown how much heavy equipment use or prescribed burning may take place as part of the SCE program but it is anticipated that up to 1500 acres of vegetation management and 400 acres of prescribed burning may occur. It is unknown how much vegetation management may occur on private property. All prescribed burn activities on private and public lands follow the same general conformity rules and are governed by the decisions of the SJVAPCD as the SNF.

**Alternatives 3, 4 and 5,**

**Direct, Indirect, and Cumulative Effects**

The same acreage of burning and thinning as described in Alternative 2 will be conducted under Alternatives 3, 4 and 5. The effects of these alternatives are similar to those under Alternative 2. The changes in the diameter limit of thinning among the alternatives alter the amount of trees removed under each alternative. These changes alter the amount of emissions that would be generated by prescribed fire. The differences in each alternative are represented by the amount of smoke that would be produced by a wildfire. Figure 1 shows that there is little difference in the action alternatives and the amount of smoke that is produced 10 years post burn by a wildfire.

**Comparison of Alternatives**

The emission of pollutant PM$_{2.5}$ is used as a surrogate to represent PM$_{10}$. Table 3.1-10 below shows that the proposed action and the action alternative are effective in reducing total tons of pollutants as compared to the No Action Alternative.
Table 3.1-10. Comparison of alternatives, effectiveness of treatments in reducing smoke particulates.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Total Tons of PM2.5</th>
<th>Tons per acre of PM 2.5</th>
<th>Percent Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1 – No Action</td>
<td>672510</td>
<td>220</td>
<td>*</td>
</tr>
<tr>
<td>Alternative 2 – Uneven Aged Management (Structural Restoration)</td>
<td>317928</td>
<td>104</td>
<td>47%</td>
</tr>
<tr>
<td>Alternative 3 – Fuels Reduction</td>
<td>302643</td>
<td>99</td>
<td>45%</td>
</tr>
<tr>
<td>Alternative 4 – North GTR (Process restoration)</td>
<td>299586</td>
<td>98</td>
<td>45%</td>
</tr>
<tr>
<td>Alternative 5 – Proposed Action (Hybrid Forest Health Restoration)</td>
<td>308757</td>
<td>101</td>
<td>46%</td>
</tr>
</tbody>
</table>

*Percent reduction in emissions in tons per acre in action alternatives versus no action alternative.

**Design Criteria**

**Air Quality**

The following are best available control measures (BACMs) for prescribed fire as required under Section 190 of the Clean Air Act, as amended in 1990. The U.S. Environmental Protection Agency (EPA) developed implementation strategies and BACM for areas that are designated serious non-attainment for particulate matter less than 10 microns (PM10) in 1992. Specific techniques to reduce fire emissions include the following:

- Employ commonly used reduction techniques such as burning units after harvest before new live fuels appear; burning in the springtime prior to “green-up,” burning when 1,000-hour fuels (woody debris larger than 3 inches in diameter) moistures are high, and burning when the duff is wet (after fall precipitation, or during winter and spring).
- Employ avoidance techniques such as burning on cloudy days when the plume and residual smoke cannot be seen, burning during periods of atmospheric instability for better smoke dispersal, and burning during periods of low visitor use.
- Employ techniques to optimize flaming combustion, including burning piled fuels rather than broadcast burning, reducing the amount of soil in piles, and employing rapid ignition to create a high intensity fire.
- Ensure that all activities conform to the State Implementation Plan (SIP).
- Conduct a full conformity analysis, as required by the Clean Air Act and the SIP to assess whether the proposed action produces less than de minimus emissions. (For full
determination, refer to the Kings River Project Air Determination, available in the project record.)
References


www.epa.gov, Website for Environmental Protection Agency.
www.arb.ca, Website for California Air Resources Board.
www.valleyair.org, Website for the San Joaquin Valley Unified Air Pollution Control District.