Air Quality Sustainability Program in Coconino County

Prepared for

ARIZONA DEPARTMENT OF TRANSPORTATION

Prepared by

LIMA & ASSOCIATES
Transportation - G.I.S.

and

Cathy D. Arthur

Updated to July 15, 2004

LIST OF ACRONYMS

ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADT	Annual Average Daily Traffic count
APS	Arizona Public Service
CMAQ	Congestion Mitigation and Air Quality Improvement
CNG	Compressed Natural Gas
CO	Carbon Monoxide
EPA	United States Environmental Protection Agency
FMPO	Flagstaff Metropolitan Planning Organization
GRCA	Grand Canyon
IMPROVE	Interagency Monitoring of Protected Visual Environments
LNG	Liquefied Natural Gas
NAAQS	National Ambient Air Quality Standards
NACOG	Northern Arizona Council of Governments
NAU	Northern Arizona University
NH_3	Ammonia
NO_x	Nitrogen Oxides
PM	Particulate Matter
PM_{10}	Particulate Matter less than 10 microns in diameter
$PM_{2.5}$	Particulate Matter less than 2.5 microns in diameter
PSCAA	Puget Sound Clean Air Agency
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SOV	Single Occupant Vehicle
SWOT	Strengths, Weaknesses, Opportunities, and Threats analysis
TAC	Technical Advisory Committee
$\mu g/m^3$	Micrograms per cubic meter
VMT	Vehicle-Miles Traveled
VOC	Volatile Organic Compound
WRAP	Western Regional Air Partnership

TABLE OF CONTENTS

Page

1. INTRODUCTION 1
STUDY BACKGROUND 1
GOAL OF THE PROJECT 2
REPORT SUMMARY 2

2. BACKGROUND 5
SOCIOECONOMIC CONDITIONS IN COCONINO COUNTY 5
AIR QUALITY IN COCONINO COUNTY 7

3. VISIONING SESSION 16
PRESENTATIONS 16
FEEDBACK FROM VISIONING GROUP 17

4. CLEAN AIR ACTION PLAN 25
PREFERRED STRATEGIES FOR IMPROVING AIR QUALITY 25
CLEAN AIR ACTION PLAN 41

5. IMPLEMENTATION OF THE OUTREACH PROGRAM 43
GOALS AND OBJECTIVES FOR THE PROGRAM 43
THEME OF THE OUTREACH PROGRAM 43
TARGET AUDIENCES 44
OUTREACH SPONSORS 47
PROGRAM COMPONENTS 48
RECOMMENDED OUTREACH TECHNIQUES 48
EDUCATIONAL OUTREACH 52
OVERVIEW OF OUTREACH IMPLEMENTATION 53

APPENDIX A. SAMPLE OUTREACH FACT SHEETS 55

APPENDIX B. SAMPLE SLIDE SHOW SCRIPT 63

REFERENCES 66

LIST OF TABLES

Page

1. TECHNICAL ADVISORY COMMITTEE 3
2. PROFILE OF SELECTED COCONINO COUNTY SOCIOECONOMIC CHARACTERISTICS: 2000 - BY REGION 6
3. TONS OF AIR POLLUTANTS EMITTED ANNUALLY BY AREA INDUSTRIES (1999) 9
4. AIR QUALITY MONITORS IN COCONINO COUNTY 11
5. PERSONS WHO ATTENDED APRIL 30 VISIONING SESSION 17
6. IMPORTANT AIR QUALITY ISSUES FOR COCONINO COUNTY 18
7. S.W.O.T. ANALYSIS FOR COCONINO COUNTY 19
8. CATEGORIES USED IN CLASSIFYING AIR QUALITY IMPROVEMENT STRATEGIES 21
9. VOTING RESULTS FOR AIR QUALITY IMPROVEMENT STRATEGIES 23
10. HOW STRATEGIES SUPPORT THE AIR QUALITY GOALS 24
11. CHARACTERISTICS OF PREFERRED AIR QUALITY IMPROVEMENT STRATEGIES 26
12. SELECTED ENERGY EFFICIENCY BEST PRACTICES 27
13. CLEAN AIR ACTION PLAN FOR COCONINO COUNTY 42
14. MATRIX OF CONTROL STRATEGIES FOR SUSTAINING AIR QUALITY IN COCONINO COUNTY 45
15. POTENTIAL AIR QUALITY OUTREACH COMPONENTS 49
18. AIR QUALITY SUSTAINABILITY OUTREACH IMPLEMENTATION PLAN TEMPLATE 54

TABLE OF FIGURES

Page

1. LOCATIONS OF INDUSTRIES EMITTING CO, NOx, VOC, SO_2, PM_{10}, $PM_{2.5}$, OR NH_3 IN OR NEAR COCONINO COUNTY 10

2. ANNUAL PM10 TRENDS IN ARIZONA 12

3. TRENDS IN VISIBILITY AT GRAND CANYON NATIONAL PARK 13

4. 1996-2018 TOTAL COCONINO COUNTY MOBILE SOURCE EMISSIONS ... 14

5. POLLUTANTS THAT CONTRIBUTED TO REDUCED VISIBILITY ON THE WORST DAYS IN 1997 AT GRAND CANYON NATIONAL PARK 15

6. PROPOSED LOGO FOR THE AIR AWARE OUTREACH EFFORT 44

7. AIR AWARE OUTREACH DATABASE FORM 47

8. ADOT AIR AWARE WEB SITE HOME PAGE 50

9. EXAMPLE WEB PORTAL PAGE 51

1. INTRODUCTION

Coconino County is the largest county in Arizona and the second largest in the United States. The County is also one of the fastest growing regions in Arizona. The County's population grew from approximately 96,591 in 1990 to 116,320 in 2000. County population is projected to grow to 169,343 residents by 2020, a 46 percent increase in the 2000 population. [1], [2]

The 18,608 square mile county is one of the more topographically diverse regions of North America, containing scrub deserts, vast prairies, and numerous mountain ranges. In addition to the Grand Canyon, tourists visit Wupatki and Sunset Crater National Monuments, Walnut Canyon, and Oak Creek Canyon. Attractions in Northern Coconino County include Lake Powell National Recreation Area, Pipe Springs National Monument, Marble Canyon, and the Vermilion Cliffs.

The County has four communities incorporated under the laws of Arizona: Flagstaff, a statistical metropolitan area; Page; Williams; and Fredonia. Two other communities, Leupp and Tuba City, are designated urban centers of the Navajo Nation.

Improving both the air quality and the level of visibility in Coconino County are increasingly recognized as important goals.

STUDY BACKGROUND

Although Coconino County is currently in attainment of the National Ambient Air Quality Standards (NAAQS), the dramatic population growth expected during the next 20 years may threaten this classification status. Rapid growth over the past decade has increased the number and intensity of air pollution-generating activities in the County, including on-road automobile and truck traffic; off-road vehicles; rail traffic; residential; commercial and road construction; and wood-burning fireplaces.

Vehicle-miles traveled (VMT) and congestion have increased as a consequence of population growth. The County, the City of Flagstaff, and the Flagstaff Metropolitan Planning Organization (FMPO) are all committed to decreasing VMT and congestion by reducing the percentage of trips made in single occupant automobiles, increasing the use of transit, and facilitating more bicycle and pedestrian travel. Additional transit service has been introduced in Flagstaff, and more upgrades are anticipated. However, the automobile is the dominant means of travel in rural areas of the County. Moreover, many secondary County and U. S. Forest Service roads are unpaved, and the tires of vehicles using them in dry weather eject dust into the air. Increased usage of unpaved roadways in outlying areas commensurate with area population growth may degrade air quality unless action is taken to manage the growth and mitigate its impacts.

Unlike many growing areas of Arizona, Coconino County is in the enviable position of being classified by the U.S. Environmental Protection Agency (EPA) as an attainment area

for carbon monoxide (CO), ozone (one-hour standard), and fine particulate matter (PM_{10}). Another air quality issue that may need to be addressed, and is often of concern to Flagstaff area citizens due to visibility considerations, is the problem of urban haze or the "brown cloud."

GOAL OF THE PROJECT

Coconino County would like to retain its attainment status and maintain healthful and clear air quality for its residents by implementing proactive strategies to reduce or offset the effects of anticipated growth. Area jurisdictions and organizations can benefit from the development of a framework for air quality management. The goal of this study has been to identify air quality improvement strategies and develop a Clean Air Action Plan that will facilitate the involvement of the community in improving air quality in Coconino County.

The following objectives were carried out:

- A Visioning Process was initiated that accommodated area constituencies including elected officials, local government representatives, and other stakeholders.
- Local formulation of a Vision Statement representing stakeholder consensus was facilitated.
- Current air quality was described and key pollutants that pose the greatest threats to clean air improvement were identified.
- The best practices for controlling the amounts of the key pollutants in the air as area population grows were selected and documented.
- A comprehensive Outreach Program designed to kick-off the Clean Air Action Plan has been developed.
- An Implementation Plan framework that will enable each stakeholder jurisdiction and organization to participate in the clean air program and facilitate coordination among all the stakeholders has been outlined.

The Project was conducted under the guidance of a Technical Advisory Committee (TAC) and in coordination with key stakeholders. Members of the TAC are listed in Table 1.

REPORT SUMMARY

Chapter 2 provides an overview of current and future demographics and traffic conditions, a technical assessment of air quality trends at the local and national levels, and an inventory of local policies and plans that contribute to cleaner air. The chapter also summarizes the socioeconomic conditions in Coconino County and examines the status of air quality in the County, including data on current emission levels. The characteristics and health impacts of major pollutants are reviewed.

TABLE 1. TECHNICAL ADVISORY COMMITTEE

Organization	Representative
Arizona Department of Transportation	Pat Cupell, Sr. Transportation Planner
Arizona Department of Transportation	Beverly Chenausky, Sr. Transportation Planner
Arizona Department of Transportation	James Zumpf, FMPO Liaison
Coconino County	Jerry Flannery, Assistant County Manager
Flagstaff Metropolitan Planning Organization	David Wessel, Planner
National Park Service-	Sam Henderson, Superintendent - Flagstaff Areas
National Weather Service	Mike Campbell, Meteorologist-in-Charge
Northern Arizona University	Craig A. Roberts, Ph.D., P.E., Department of Civil Engineering
U. S. Forest Service	James W. Golden, Coconino Forest Supervisor
U. S. Forest Service	Pete Lahm, Air Quality Specialist
Project Team	
Lima & Associates	Peter M. Lima, Ph.D., P.E., Principal Robert H. Bohannan, AICP, Transportation Planner Cathy D. Arthur, Independent Consultant

Chapter 3 describes the Visioning Session that took place on April 30, 2003, including presentations made by the Project Team and by Northern Arizona University Professor Terry Baxter and the feedback obtained from Session participants. The Visioning Session included elected officials, local government representatives, and other stakeholders. At the session, background information was presented by the project team. Attendees submitted ideas to the project team that were subsequently developed into a Vision Statement. The project team next facilitated an exercise in which measures and programs for sustaining air quality were identified and prioritized. Using the results of the Visioning Session, the project team developed a draft Clean Air Action Plan that was mailed to attendees and members of the TAC for review and comment.

Chapter 4 presents the foundation for a Clean Air Action Plan for the County including the ten air quality improvement strategies preferred by Visioning Session participants. These strategies are:

1. Encourage Energy Efficiency and Renewable Sources of Energy
2. Conduct Education/Outreach Program to Sustain Clean Air

3. Encourage Alternatives to Single Occupant Vehicle Travel
4. Dust Control Plans with Mitigation Bond Requirements
5. Clean Burning Fireplaces in New Construction
6. Episode Curtailment Program for Wood Smoke
7. Innovative Land Use Planning to Encourage Multimodal Opportunities
8. Integrate Land Use, Transportation, and Air Quality Decision-Making
9. Stabilize or Reduce Speeds on Unpaved Roads
10. Retrofit Municipal Diesel Vehicles and Equipment

A table outlines the final Clean Air Action Plan including action items, responsibilities, and time schedule.

Chapter 5 proposes a structure for a comprehensive educational and outreach program to sustain clean air in the County and presents a plan for implementing the program. A draft logo for the outreach program has been prepared. In addition, a matrix recommending outreach approaches for each of the ten control strategies in the action plan is provided.

Recommended outreach techniques include:

- Identification of a "champion" or "champions" among the stakeholders to lead the effort
- Establishment of a stakeholder database
- Linkage to and coordination with the ADOT AIR AWARE Web site
- Involvement of local schools and Northern Arizona University

The following sample draft elements of the program are provided:

- A set of fact sheets supporting the control measures in the Action Plan
- A slide show script

An outreach implementation plan template is presented that lists the actions needed to implement the program as an aid in assigning responsibilities and milestones.

Presentation of Findings

The findings and recommendations of this study were presented to a Work Session of the Coconino County Board of Supervisors on July 13, 2004.

2. BACKGROUND

The first section of this chapter briefly summarizes area demographics as a basis for understanding the challenges faced in sustaining air quality for Coconino County. The preservation of air quality and visibility in a region is inexorably linked to that area's land use and transportation policies, as well as to the ways in which area growth and development occur. The number of VMT, miles of roads paved, area's commitment to alternative modes of transportation, and area home heating practices all affect the ability to preserve clean and clear air.

Next, this chapter discusses Coconino County air quality data and issues including the sources of air pollution, the location of stationary sources, and the effect of air pollutants on area visibility.

SOCIOECONOMIC CONDITIONS IN COCONINO COUNTY

Based on the US Census, the Year 2000 population of Coconino County was 116,320 residents. Of the total County population, 65.1 percent were White, 29.7 percent were Native American, 10.9 were Hispanic or Latino, 1.4 percent were black or African American, and 1.1 percent were Asian. A total of 8,143 persons, or 7.0 percent of the total County population, were aged 65 years and over. The County had a total of 52,443 housing units. Of these, 40,448 units were occupied and 12,995 units were vacant. A total of 9,155 of the units are for seasonal, recreational, or occasional use. The average household size in the County was 2.80.

The U. S. Census Bureau projects that the total Coconino County population will reach 152,002 by 2012, and increase of almost 31 percent. By 2022, County population is projected to grow another 14 percent to 173,455.

Table 2 profiles several socioeconomic characteristics that have a direct bearing on the improvement of air quality and visibility. While almost seven percent of County households lack automobiles, less than one percent of those commuting to work used transit. However, more than 16 percent of County commuters carpool. These statistics reflect the broad dispersion of persons within the county, but also suggest that a niche for additional local and regional transit services exists. Over 15 percent of homes use wood as a heating fuel, suggesting that adherence to and enforcement of local woodburning stove ordinances are critical components of any air quality improvement effort.

County land use and ownership is as varied as the topography, and much of the land is owned or controlled by public sector agencies including agencies of the federal government and the State of Arizona or by Native American tribes.

While the majority of trips within Coconino County take place by automobile, the County's transportation system includes a variety of modes and methods by which persons and goods travel to, within, or through the County.

TABLE 2. PROFILE OF SELECTED COCONINO COUNTY SOCIOECONOMIC CHARACTERISTICS: 2000 - BY REGION

Subject	Flagstaff Region		Grand Canyon Region		Page		Sedona		Tuba City Region		Williams Region		Remainder of County		County Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Employment Status																
Population 16 years and over	45,750	100.00%	1,623	100.00%	4,973	100.00%	8,990	100.00%	5,588	100.00%	3,047	100.00%	25,996	100.00%	86,977	100.00%
In labor force	33,743	73.76%	1,486	91.56%	3,617	72.73%	5,167	57.47%	3,404	60.92%	2,043	67.05%	15,395	59.22%	59,688	68.63%
Armed Forces	25	0.05%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	16	0.53%	0	0.00%	41	0.05%
Civilian labor force	33,718	73.70%	1,486	91.56%	3,617	72.73%	5,167	57.47%	3,404	60.92%	2,027	66.52%	15,395	59.22%	59,647	68.58%
Employed	32,044	70.04%	1,438	88.60%	3,396	68.29%	4,917	54.69%	2,911	52.09%	1,913	62.78%	13,808	53.12%	55,510	63.82%
Unemployed	1,674	3.66%	48	2.96%	221	4.44%	250	2.78%	493	8.82%	114	3.74%	1,587	6.10%	4,137	4.76%
Not in labor force	12,007	26.24%	137	8.44%	1,356	27.27%	3,823	42.53%	2,184	39.08%	1,004	32.95%	10,601	40.78%	27,289	31.37%
Commuting to Work																
Workers 16 years and over	31,231	100.00%	1,421	100.00%	3,352	100.00%	4,825	100.00%	2,876	100.00%	1,903	100.00%	13,500	100.00%	54,283	100.00%
Car, truck, or van - - drove alone	21,917	70.18%	618	43.49%	2,443	72.88%	3,339	69.20%	1,615	56.15%	1,186	62.32%	9,163	67.87%	36,942	68.05%
Car, truck, or van - - carpooled	4,675	14.97%	141	9.92%	572	17.06%	426	8.83%	763	26.53%	334	17.55%	2,493	18.47%	8,978	16.54%
Public transportation (including taxicab)	185	0.59%	41	2.89%	29	0.87%		0.00%	4	0.14%	16	0.84%	101	0.75%	376	0.69%
Walked	2,060	6.60%	531	37.37%	147	4.39%	232	4.81%	390	13.56%	210	11.04%	779	5.77%	4,117	7.58%
Other means	1,276	4.09%	77	5.42%	103	3.07%	154	3.19%	45	1.56%	46	2.42%	245	1.81%	1,792	3.30%
Worked at home	1,118	3.58%	13	0.91%	58	1.73%	674	13.97%	59	2.05%	111	5.83%	719	5.33%	2,078	3.83%
Mean travel time to work (minutes)1	84	-	-		10		14		-		-		-		19	(X)
Vehicles Available per Household																
Occupied housing units	21,416	100.00%	864	100.00%	2,342	100.00%	4,937	100.00%	2,231	100.00%	1,535	100.00%	12,060	100.00%	40,448	100.00%
None	1,274	5.95%	103	11.92%	114	4.87%	161	3.26%	206	9.23%	114	7.43%	979	8.12%	2,790	6.90%
1	7,428	34.68%	395	45.72%	794	33.90%	1,811	36.68%	1,027	46.03%	463	30.16%	3,742	31.03%	13,849	34.20%
2	8,762	40.91%	289	33.45%	947	40.44%	2,183	44.22%	672	30.12%	546	35.57%	4,587	38.03%	15,803	39.10%
3 or more	3,902	18.22%	77	8.91%	487	20.79%	782	15.84%	326	14.61%	412	26.84%	2,802	23.23%	8,006	19.80%
House Heating Fuel																
Occupied housing units	21,416	100.00%	864	100.00%	2,342	100.00%	4,937	100.00%	2,231	100.00%	1,535	100.00%	12,060	100.00%	40,448	100.00%
Utility gas	17,440	81.43%	113	13.08%	623	26.60%	3,663	74.19%	210	9.41%	897	58.44%	3,025	25.08%	22,308	55.15%
Bottled, tank, or LP gas	918	4.29%	362	41.90%	170	7.26%	327	6.62%	934	41.86%	320	20.85%	3,529	29.26%	6,233	15.41%
Electricity	2,147	10.03%	254	29.40%	1,118	47.74%	838	16.97%	274	12.28%	127	8.27%	1,123	9.31%	5,043	12.47%
Fuel oil, kerosene, etc	69	0.32%	41	4.75%	-	0.00%		0.00%	11	0.49%	3	0.20%	87	0.72%	211	0.52%
Coal or coke	0	0.00%	0	0.00%	-	0.00%		0.00%	55	2.47%	0	0.00%	6	0.05%	61	0.15%
Wood	799	3.73%	89	10.30%	368	15.71%	7	0.14%	729	32.68%	177	11.53%	4,192	34.76%	6,354	15.71%
Solar energy	14	0.07%	0	0.00%	-	0.00%	8	0.16%	0	0.00%	7	0.46%	29	0.24%	50	0.12%
Other fuel	16	0.07%	5	0.58%	63-	2.69%		0.00%	18	0.81%	2	0.13%	40	0.33%	144	0.36%
No fuel used	13	0.06%	0	0.00%		0.00%	31	0.63%	0	0.00%	2	0.13%	29	0.24%	44	0.11%

Source: U.S. Bureau of the Census, *Census 2000*.

[1]If the denominator of a mean value or per capita value is less than 30, then that value is calculated using a rounded aggregate in the numerator.

- Represents zero or rounds to zero. (X) = Not applicable.

AIR QUALITY IN COCONINO COUNTY

The air in Coconino County is healthy to breathe, according to monitoring data collected by the Arizona Department of Environmental Quality, the National Park Service, and the Salt River Project. Violations of the national ambient air quality standards do not occur in the County. However, on some days regional haze causes perceptible reductions in visibility. This section describes the air quality, meteorology, and sources of emissions in Coconino County.

Sources of Air Pollution

In response to the Clean Air Act of 1977, the EPA established National Ambient Air Quality Standards for six pollutants that can adversely affect human health and welfare. These six, called criteria pollutants, are carbon monoxide, lead, nitrogen dioxide, ozone, particulates, and sulfur dioxide. In general, the sources of emissions contributing to formation of these six criteria pollutants and regional haze can be grouped into five major categories: on-road vehicles, non-road engines, point sources, area sources, and miscellaneous sources.

- On-road vehicles are powered by gasoline and diesel fuel and include automobiles, light duty trucks, heavy-duty trucks, buses, and motorcycles. This category represents a significant source of carbon monoxide, nitrogen oxide, volatile organic compound, and particulate emissions.

- Non-road engines include lawn and garden equipment, construction equipment, farm equipment, off-road vehicles, aircraft, and trains. This source is a smaller, but growing source of carbon monoxide, nitrogen oxides, volatile organic compounds, and particulate emissions.

- Point sources include large industrial operations such as electric utilities, manufacturing plants, metals processing facilities, chemical plants, and mines. Sulfur dioxide and lead are emitted primarily by point sources. Industrial processes can also be a major contributor of volatile organic compounds. Other criteria pollutants or precursors may be emitted by a point source depending upon the type of industrial operation.

- Area sources are emission-producing activities conducted over a broad and variable geographic area, such as painting, dry cleaning, construction activity, and wood combustion. Area sources tend to be a major source of volatile organic compounds and particulates. One or more of the other criteria pollutants or precursors may also be emitted by an area source depending upon the type of activity.

- Miscellaneous sources include forest fires, agricultural fires, and wind blown dust. These three miscellaneous sources emit particulates and also contribute to hazy conditions.

Location of Stationary Sources

Potential stationary sources of air pollutants include electrical power plants, mining operations, and other industrial sites. More than a dozen facilities operate within or adjacent to Coconino County that emit significant amounts of carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOC), sulfur dioxide (SO_2), particulate matter (PM_{10} and $PM_{2.5}$), or ammonia (NH_3). The Environmental Protection Agency monitors the activities of these stationary sources and tracks the tons of pollutants each generates annually.[3] The latest data for these facilities—1999—is presented in Table 3, and the locations of the facilities are shown in Figure 1. The first column of Table 3 is a "Map Key" that lists numbers on Figure 1 that show the location of the facilities.

The site that produces the most emissions is the Navajo Generating Station. This facility emits almost six times as much total tons of emissions as the next largest source. The Navajo Generating Station is also the largest source of each of the pollutants with the exception of VOCs. One of the El Paso Natural Gas facilities east of Flagstaff produces nearly five times the VOCs than the Navajo facility emits.

Monitoring Data

In 2000, there were nine air quality monitors operating in Coconino County: two in Flagstaff, two at the Grand Canyon, two in Sycamore Canyon, and one each at Page, Sedona, and the Tusayan airport.[4] Table 4 identifies the location of each monitor, the operator, and the pollutants measured. Sampling ended in 2000 at the monitor located at Tusayan Airport.

Carbon monoxide is not monitored in Coconino County, because the concentrations are known to be far below the standard. Carbon monoxide levels have declined significantly in all parts of Arizona as a result of catalytic converters and electronic ignition systems in new vehicles.

Lead is monitored in Coconino County, but lead concentrations have fallen dramatically over the last twenty-five years, as a result of the phase-out of leaded gasoline and the implementation of stationary source fuel combustion controls. In general, lead concentrations are a small fraction of the federal standards at all 16 monitors operating in Arizona.

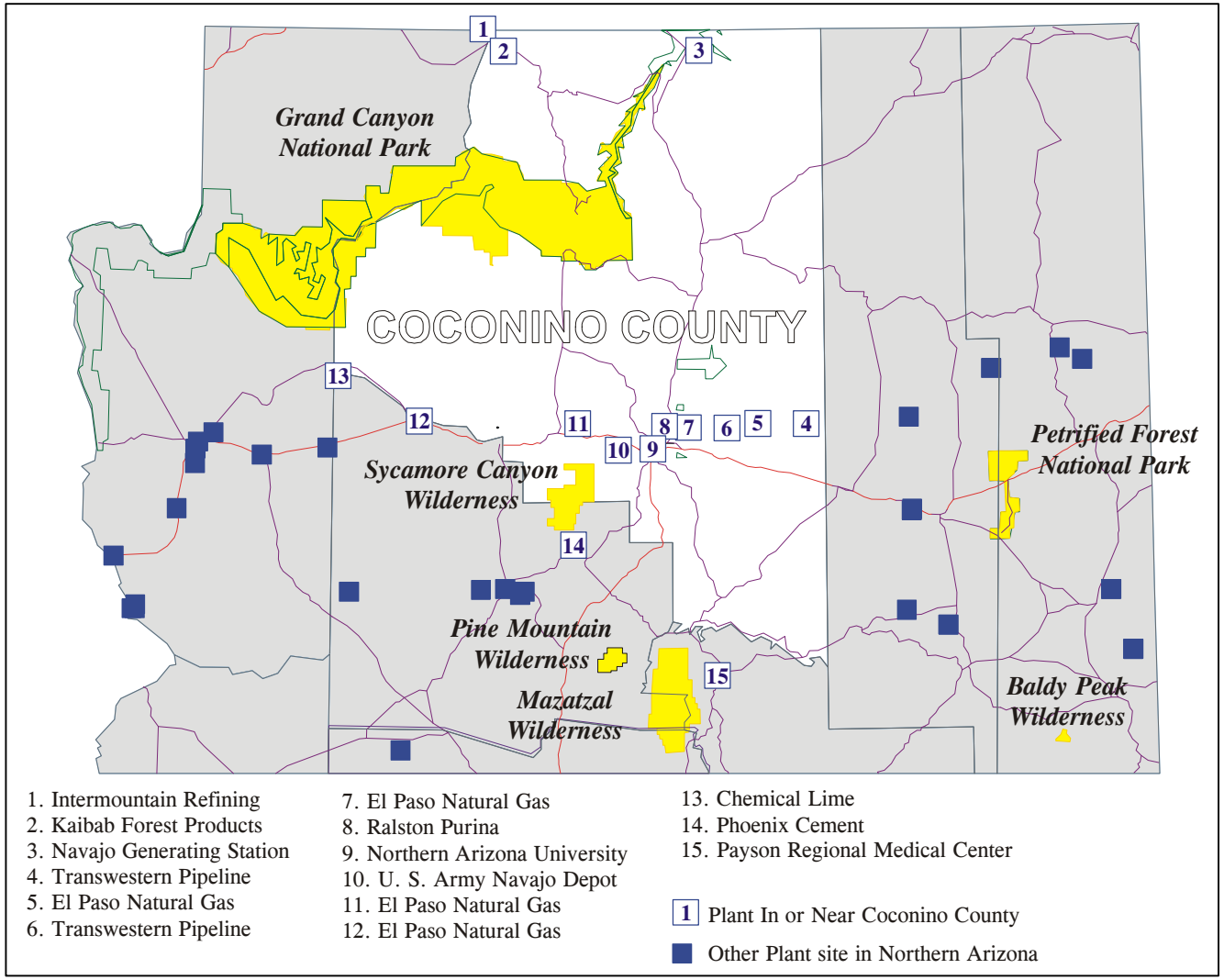
Recent air quality data collected at monitors in Coconino County show no violations of the national ambient air quality standards. Ozone is the only pollutant that approaches the standard on hot summer days. In 1998-2000, the highest eight-hour ozone readings at the South Rim of the Grand Canyon were about 90 percent of the standard. During this same period, peak concentrations in Page were 80 percent of the standard.

TABLE 3. TONS OF AIR POLLUTANTS EMITTED ANNUALLY BY AREA INDUSTRIES (1999)

Map Key	County	Plant Name	SIC Code	Pollutant							Total Emissions
				VOC	NOx	CO	SO_2	PM_{10}	$PM_{2.5}$	NH_3	
1	Coconino	Intermountain Refining	2951	4.68	62.52	2.87	795.08	NA	NA	NA	865.15
2	Coconino	Kaibab Forest Products	2421	NA	NA	NA	NA	31.61	12.06	0.06	31.67
3	Coconino	Navajo Generating Station	4911	232.59	35275.24	1939.23	9162.60	1886.10	855.69	2.66	48498.42
4	Coconino	Transwestern Pipeline	4922	62.29	1377.72	175.05	1.19	2.06	1.45	NA	1618.31
5	Coconino	El Paso Natural Gas Co.	4922	1073.18	2812.01	378.05	0.56	NA	NA	NA	4263.80
6	Coconino	Transwestern Pipeline	4922	14.49	619.53	533.29	0.14	2.29	1.61	NA	1169.74
7	Coconino	El Paso Natural Gas Co.	4922	98.87	2450.12	316.80	0.38	NA	NA	NA	2866.17
8	Coconino	Ralston Purina Company	2048	0.62	29.09	2.45	26.76	6.63	3.71	NA	65.55
9	Coconino	Northern Arizona University	8221	0.41	54.51	5.08	0.08	0.44	0.41	NA	60.52
10	Coconino	U. S. Army Navajo Depot	4911	0.16	2.98	0.65	1.28	0.14	0.05	NA	5.21
11	Coconino	El Paso Natural Gas Co.	4922	161.18	7493.56	955.96	1.79	NA	NA	NA	8612.49
12	Yavapai	El Paso Natural Gas Co.	4922	NA	94.59	NA	0.08	NA	NA	NA	94.67
13	Yavapai	Chemical Lime Company	1499	NA	1196.83	866.95	1404.61	NA	NA	NA	3468.39
14	Yavapai	Phoenix Cement	3241	NA	2648.31	296.85	407.83	157.58	52.9	NA	3510.57
15	Gila	Payson Regional Medical Ctr.	4959	NA	0.17	0.03	NA	0.17	0.17	NA	0.37

Source: U. S. Environmental Protection Agency, National Emission Trends database

FIGURE 1. LOCATIONS OF INDUSTRIES EMITTING CO, NOx, VOC, SO_2, PM_{10}, $PM_{2.5}$, OR NH_3 IN OR NEAR COCONINO COUNTY



Source: U. S. Environmental Protection Agency, National Emission Trends database

TABLE 4. AIR QUALITY MONITORS IN COCONINO COUNTY

Monitor	Location	Operator	Pollutant
Flagstaff, ADOT	5701 E. Railroad Ave	ADEQ	PM_{10}
Flagstaff, Middle School	755 N. Bonito	ADEQ	PM_{10}, $PM_{2.5}$
Grand Canyon, Hance Camp	S. Rim, 2.5 mi W. of Village	NPS	O_3, Pb, Visibility
Grand Canyon, Indian Gardens	4.5 mi from Bright Angel T.H.	NPS	Visibility, Pb
Page, Navajo Generating Station	3 mi E. of Page	SRP	O_3, NO_2, PM_{10}, $PM_{2.5}$, SO_2
Sedona	Post Office	ADEQ	PM_{10}
Sycamore Canyon	Camp Raymond	ADEQ	Light Scattering (PM)
Sycamore Canyon	Camp Raymond	NPS	Visibility
Tusayan	Airport	ADEQ	PM_{10}, $PM_{2.5}$

Source: Arizona Department of Environmental Quality

Other pollutants measured in Coconino County are well below the applicable standards. Nitrogen dioxide at the Page Navajo Generating Station is 96 percent less than the standard. Particulates in the County are one-third of the annual standard or less, while 24-hour concentrations are even lower. The sulfur dioxide levels measured at Page are negligible.

The only pollutant currently measured in Flagstaff is particulate matter. The Middle School monitor collects particle samples that are smaller than 10 microns (PM_{10}) and smaller than 2.5 microns ($PM_{2.5}$). The ADOT monitor measures PM_{10} only. During the mid-1980's, annual concentrations of PM_{10} in Flagstaff averaged nearly 40 µg/m3, or almost 80 percent of the standard. In recent years, annual PM_{10} levels have averaged only 15 µg/m3, representing more than a 60 percent decline since 1985. This reduction can be attributed to the paving of dirt roads, cleaner burning woodstoves and fireplaces, and smoke management programs.

Meteorology

Meteorology plays an important role in the formation, transport, and dispersion of air pollution. In general, the driest years will produce the highest annual PM_{10} concentrations. Dry years with especially windy days can also lead to higher 24-hour PM_{10} concentrations. Cold winters can result in higher $PM_{2.5}$ due to increased use of fireplaces and wood stoves. The photochemical reaction that produces ground-level ozone occurs at ambient temperatures over 90 degrees Fahrenheit; so hotter summers typically produce higher ozone readings.

Relative humidity also plays an important role in the formation of sulfates and nitrates that contribute to regional haze. Higher humidity increases the size of sulfate and nitrate particles, which in turn, increases their ability to scatter light. (Light scattering and absorption are the two phenomena that cause the extinction of light by regional haze.)

Higher humidity is one reason that regional haze is worse in the Eastern U. S. than the West.

The prevailing wind direction at the Flagstaff airport throughout the year is from the South/Southwest. This means that pollutants transported from Phoenix, Yuma, and Southern California may contribute to regional haze hanging over the Colorado Plateau and Coconino County.[5]

The Impact of Emissions on Area Visibility

Figure 2 illustrates the downward trend in annual PM_{10} concentrations in Flagstaff and other locations in Arizona between 1985 and 2000. The PM_{10} data for the Grand Canyon represents the average levels on the 20 percent worst visibility days as measured by the IMPROVE monitors in 1990 through 1999.[6] PM_{10} levels at the Grand Canyon have not exhibited the same downward trend as other locations in Arizona. Figure 3 illustrates the trends in visibility at the Grand Canyon between 1990 and 1999. A change of one deciview is perceptible to the human eye. Unfortunately, visibility on the haziest or clearest days has not improved perceptibly over the ten-year period.

FIGURE 2. ANNUAL PM_{10} TRENDS IN ARIZONA

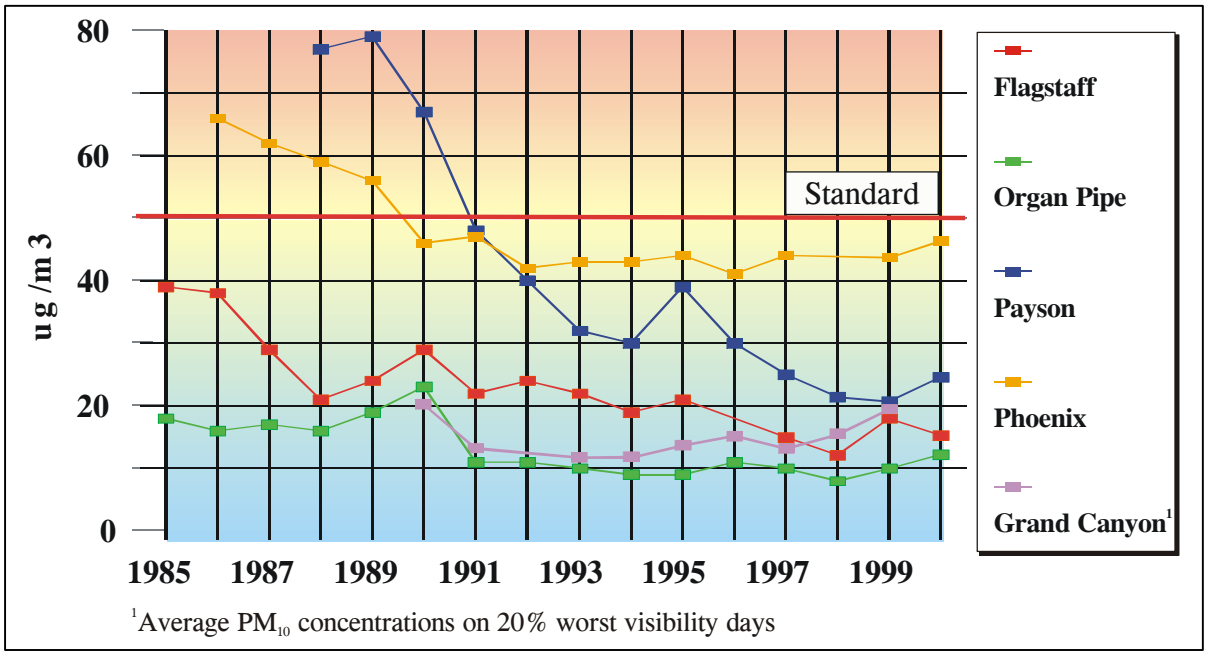
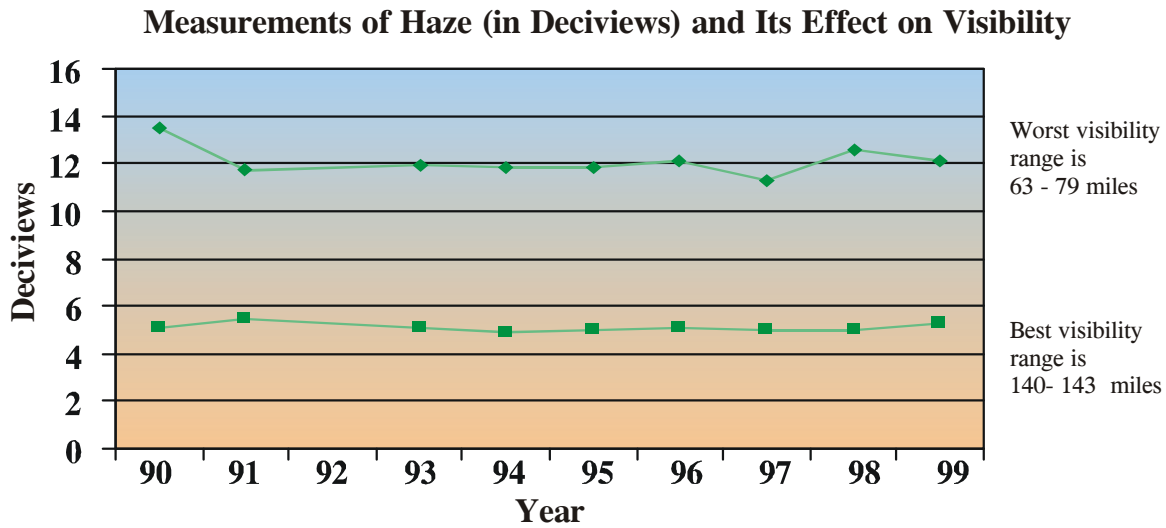


FIGURE 3. TRENDS IN VISIBILITY AT GRAND CANYON NATIONAL PARK



A deciview is a measurement of haze that gauges the impact air pollutants have on visibility. Zero deciviews is an indicator of clear conditions with no visibility impairment. The more deciviews measured, the more visibility impairment that limits the distance that can be seen. Worst and best visibility lines represent averages of the 20% worst and best visibility days, respectively, during a given year.

Source: IMPROVE monitoring data from Colorado State University for the GRCA site

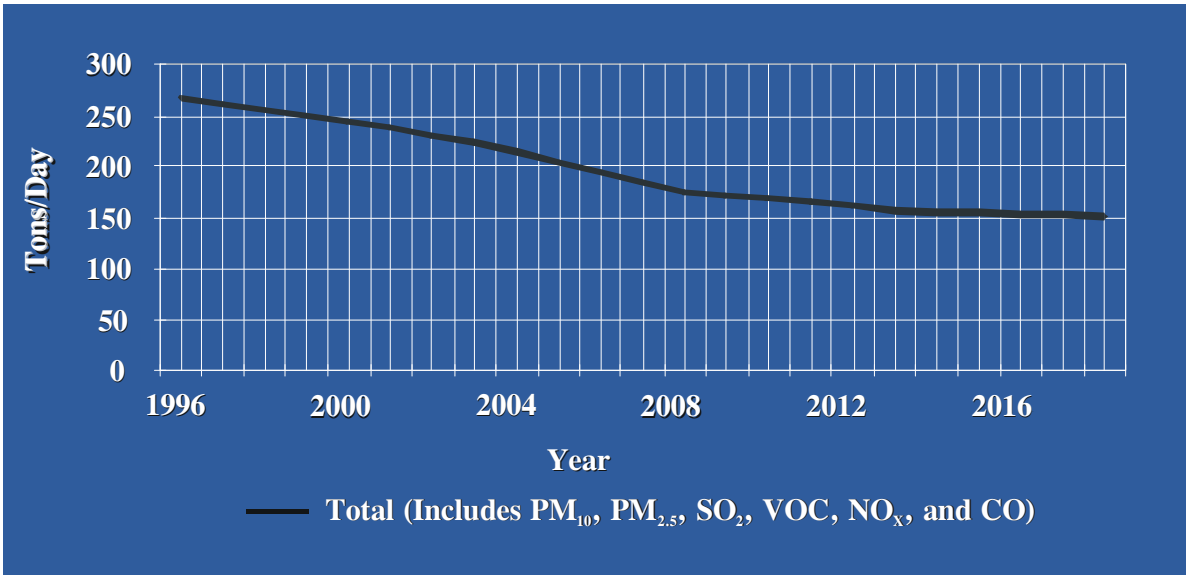
The Western Regional Air Partnership (WRAP) has recently developed emissions data by county for pollutants contributing to regional haze in the western U.S.[7] These data are being used to model current and projected visibility impairment in Class I areas, including the Grand Canyon. The latest mobile source emissions for Coconino County, derived from the WRAP inventories, are shown in Figure 4.

As Figure 4 indicates, total mobile source emissions in Coconino County are expected to decline by more than 40 percent by 2018. This reduction is due primarily to Tier 2 light-duty standards, beginning with the 2004 model year, stricter heavy-duty vehicle and engine controls, beginning with the 2007 model year, and low-sulfur gasoline and diesel fuels, beginning in mid-2006. The magnitude of the decline in mobile source emissions is even more impressive when you consider that the WRAP assumed vehicle-miles of travel in Coconino County would grow by 70 percent between 1996 and 2018.

Visibility Modeling

In mid-2002, WRAP consultants conducted modeling to determine the impact of the Federal Tier 2 and heavy duty vehicle and fuel controls, and other measures implemented since 1996, on visibility in the Grand Canyon, Sycamore Canyon, and other Class I parks and wilderness areas. Visibility on the worst days is expected to improve by .44 deciviews at the Grand Canyon, but deteriorate by .81 deciviews at Sycamore Canyon. [7]

FIGURE 4. 1996-2018 TOTAL COCONINO COUNTY MOBILE SOURCE EMISSIONS

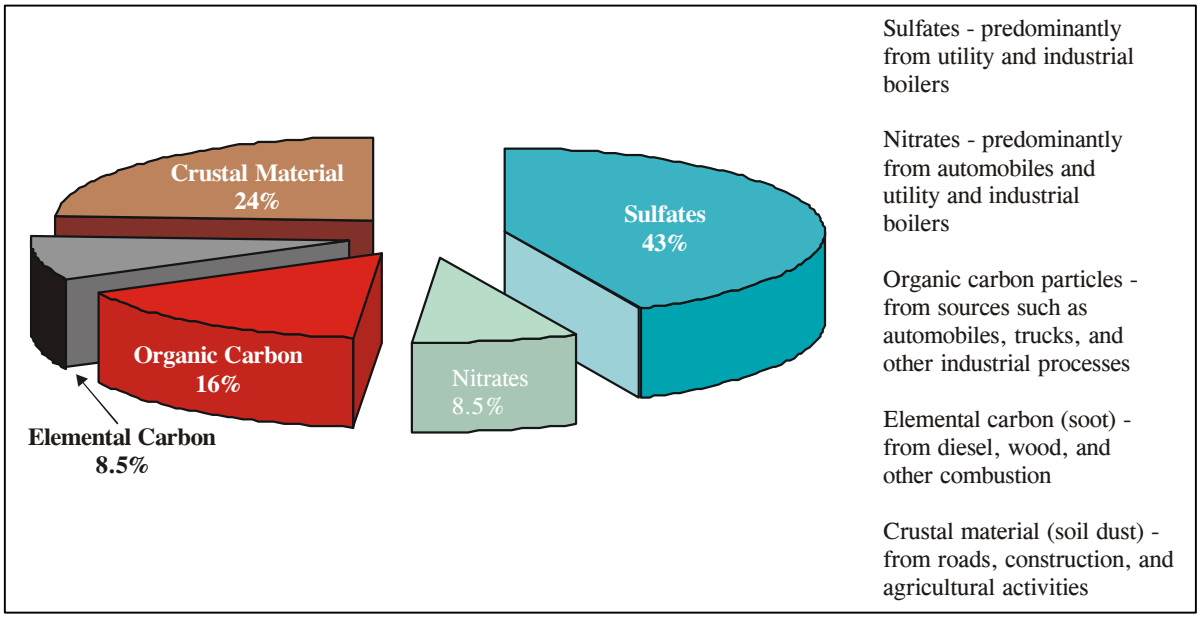


The impact which Coconino County emissions may have on present and future visibility at the Grand Canyon and Sycamore Canyon has not been explicitly modeled by the WRAP. However, some portion of the anthropogenic emissions contributing to regional haze at these sites is produced locally.

One-third to one-half of the haze on the worst days is attributable to natural light particle (Rayleigh) scattering. Figure 5 indicates that sulfates represent 43 percent of the human-caused visibility problems in the Grand Canyon. [8] Sulfates are produced primarily by power plants and industrial boilers. Crustal material from paved and unpaved roads and construction activities contribute another 24 percent. The sources of these emissions are likely to be very close to the Grand Canyon, because coarse particles are relatively heavy and tend to deposit within a small radius of their source. The remaining pieces of the pie—organic carbon, elemental carbon, and the non-industrial portion of the nitrates—are emitted primarily by automobile and truck exhaust and combustion sources. In a worst case scenario, these sources in Coconino County would contribute about 20 percent of the regional haze at the Grand Canyon on a bad visibility day.

While the prevailing wind direction (south/southwest) minimizes the transport of emissions from Flagstaff to the Grand Canyon and Sycamore Canyon, other downwind Class I areas (i.e. Mesa Verde, Canyonlands, Arches, Weminuche) may experience visibility impairment as a result of emissions from Coconino County. In addition, the source attribution pie chart in Figure 5 and the modeling performed by the WRAP represent average meteorological and emission conditions. On any given day, if the wind were blowing from the Northeast or Southeast, Coconino County would contribute a greater portion of the visibility degradation at the Grand Canyon, Sycamore Canyon, and/or other downwind areas.

FIGURE 5. POLLUTANTS THAT CONTRIBUTED TO REDUCED VISIBILITY ON THE WORST DAYS IN 1997 AT GRAND CANYON NATIONAL PARK



Source: Environmental Protection Agency

Summary

In summary, the major pollutants of concern for Coconino County are ozone, $PM_{2.5}$ and PM_{10}. Ozone is a potential problem because recent readings at the Grand Canyon show eight-hour ozone levels to be within 90 percent of the National Ambient Air Quality Standard. $PM_{2.5}$ levels need to be controlled in order to reduce their contribution to formation of regional haze. PM_{10} also contributes to regional haze, although the coarser fraction (greater than $PM_{2.5}$) does not travel as far as the smaller fraction. To be most effective in reducing visibility impairment at the Grand Canyon and Sycamore Canyon, Coconino County efforts to reduce PM_{10} should focus on areas close to these Class I areas.

3. VISIONING SESSION

This chapter describes the elements of the Visioning Session, including the presentations made by the Project Team and by Northern Arizona University Professor Terry Baxter and the feedback obtained from Session participants. Visioning Session attendees are listed in Table 5.

PRESENTATIONS

Background material prepared by the Project Team was E-mailed to Visioning Session attendees in advance for review. Highlights of the background material and three PowerPoint presentations were presented at the Visioning Session.

The background material presented at the Visioning Session included the goal and objectives of this ADOT-funded study; local socioeconomic conditions; national and state air pollutants, standards, sources, and trends; and air quality data, plans, and programs for Coconino County.

Dr. Terry Baxter, Ph.D., P.E., of the Department of Civil and Environmental Engineering at NAU made a 35 mm slide presentation entitled, "We Can't Afford Polluted Air!" Dr. Baxter's presentation emphasized the medical and aesthetic importance of maintaining healthy air and improving visibility in the region.

Dr. Baxter indicated that the overarching goal should be to maintain a high quality of life and healthful environment. He cited three important reasons to sustain good air quality in the area: tourism, telescopes, and toddlers. He indicated that the number one cause of school days missed is asthma and air pollution is one factor causing these attacks. To support this contention, he stated that during the Rodeo-Chedeski fire in the summer of 2002 the Prescott hospital recorded the highest number of admissions in its history.

Dr. Baxter identified two air pollution threats to the community: ozone and $PM_{2.5}$. He expressed concern that high concentrations of ozone may exist in parts of the County that are not being monitored. He indicated that $PM_{2.5}$ is a problem from both a health and visibility perspective and that high concentrations are typically caused by residential wood smoke, controlled and uncontrolled forest fires, and temperature inversions. These inversions trap polluted air near the ground on winter mornings.

Dr. Baxter pointed out that visibility at the Grand Canyon is worst during the summer months. The number of days when visibility is good at the Grand Canyon has declined to only 10 percent of the days in a year. Visibility at the Grand Canyon is also considered to be poor on about 10 percent of the days.

TABLE 5. PERSONS WHO ATTENDED APRIL 30 VISIONING SESSION

Organization	Representative
Arizona Department of Transportation	Pat Cupell, Sr. Transportation Planner
BNSF Railway	Mike McCallister, BNSF Project Engineer
City of Flagstaff	Hon. Libby Silva, Vice Mayor
City of Sedona	Charles Mosley, Engineer
Coconino County	Gene Stanley, County Surveyor
Coconino County	Hon. Paul Babbitt, County Supervisor
Flagstaff Chamber of Commerce	Thomas Vincent, Government Affairs
Flagstaff Metropolitan Planning Organization	David Wessel, Planner
Friends of Flagstaff's Future	Becky Daggett, Executive Director
Grand Canyon Trust	Rick Moore
Mountain Line	Jeff Meilbeck, General Manager
Northern Arizona University	Terry Baxter, Ph.D.
Project Team	Cathy Arthur, Rob Bohannan

Dr. Baxter posed the question, "How can we make a difference at the local and national levels?" He recommends that cost-effective air quality measures be implemented and advocates the placement of additional air quality monitors in the County. In addition, he believes the County or local jurisdictions should track state, regional and national environmental issues. He is especially concerned about the lack of control over federal policies and the potential rollback of initiatives such as the New Source Review Program and "Clear Skies".

After lunch, the Project Team provided an overview of potential air quality improvement strategies that could be implemented by local governments in Coconino County. Measures such as vehicle inspection and maintenance, reformulated fuels, and vapor recovery systems at gas stations were excluded from consideration, because these require State legislation.

Fifty air quality improvement strategies were described, along with the pollutants they reduce, and the most-likely mechanism for implementation (i.e., ordinance, voluntary program, municipal plan, municipal program, or zoning). Examples of municipalities that have already implemented these measures were also identified.

FEEDBACK FROM VISIONING GROUP

Session attendees provided feedback on their collective air quality vision for Coconino County. The feedback provided during four interactive phases of the session, Introductions, Brainstorm Strategic Issues, Formulate the Vision Statement, and Prioritize Air Quality Improvement Strategies, is described below.

Introductions

To kick-off the session, attendees were asked to introduce themselves and describe what they considered to be the most important air quality issues facing Coconino County. The issues mentioned by the group are summarized in Table 6. Most notable about the responses is the breadth of the issues identified. This suggests that the participants represented diverse constituencies and interest groups within their communities and brought considerable knowledge and understanding of air quality issues to the session.

TABLE 6. IMPORTANT AIR QUALITY ISSUES FOR COCONINO COUNTY

1.	Single occupant vehicles (SOVs) [2]
2.	Trucks on I-40 and I-17 [2]
3.	Fireplaces, wood stoves and other wood burning [5]
4.	Transport of pollution from Los Angeles
5.	Navajo Generating Station and other large stationary sources [2]
6.	Construction dust
7.	Other sources of dust
8.	Cinders used to de-ice roads
9.	Transportation sources [2]
10.	National policies
11.	Lake Powell and the Grand Canyon
12.	Tourist traffic
13.	Traffic congestion
14.	Older vehicles
15.	Unpaved roads
16.	Prescribed fires and the drought

[ ] – Number of times mentioned by visioning group

Members of the group identified motor vehicles as an air quality issue nine times (i.e., single occupant vehicles, trucks on I-40 and I-17, transportation sources, tourist traffic, traffic congestion, and older vehicles), while fireplaces, wood stoves and other wood burning were cited five times. Note that dust generating activities were mentioned three times (i.e. construction, unpaved roads, and other dust) and two of large stationary sources such as the Navajo Generating Station in Page.

Brainstorming Strategic Issues

During lunch, the visioning group participated in a brainstorming session to identify strategic issues associated with improving air quality in Coconino County. This type of exercise is called a **S**trengths **W**eaknesses **O**pportunities **T**hreats (**S.W.O.T.)** analysis. Table 7 summarizes the results.

TABLE 7. S.W.O.T. ANALYSIS FOR COCONINO COUNTY

With respect to improving air quality in Coconino County, the following represent				
Strengths	**Weaknesses**	**Opportunities**	**Threats**	**Constraints**
Groups like F3 – Friends of Flagstaff's Future, Keep Sedona Beautiful	Low per-capita income	Persons can benefit from transit financially	Proposed additional power plants on Colorado Plateau	Need Tribal input
Recognition of air quality as valuable natural resource	Rural nature of county leads to auto dependence	broad based support for protecting "golden goose" quality of life visual appeal of area (feds)	Population growth	Large Size of county leads to auto dependence
Large enough to be sophisticated, small enough to be agile	Older vehicle fleets	15% wood use – could reduce	Catastrophic Forest fires	Fed regs (Clear Skies, Pollution Trading)
Good planning tradition	State laws governing subdivisions wildcat subs (dirt roads)	Exchange with Tribes – wood stoves, education County & Flagstaff work with Indian communities on building codes, technology exchange	Lack of regional rule making or consensus (CA)	State laws governing subdivisions
Coop effort between govt. agencies, culture of peer coop	Unpaved Tribal roads – other rural areas	Renewable energy – new sources	Balance air, water, waste	Proximity to California – California power made in Arizona Transport
Low emissions to area ratio	Lack of resources for Renewable energy	Alternatives to campfires in parks and forests		Limited resources for attainment areas
Attractiveness of Visual amenities clear air task force	High use of wood for heat (Census)	Air quality crosses jurisdictional boundaries		
Attainment area		National Parks in close proximity (Federal support)		
WRAP, NAU (information resources)		Small diameter Logs		
Solar potential		Tuba City facility (renewable energy)		

Some key strengths identified for Coconino County are

- Air quality is already recognized as a valuable natural resource
- A strong tradition of planning and cooperation in the region exists
- Groups such as Friends of Flagstaff's Future, Keep Sedona Beautiful, and the Grand Canyon Trust provide strong environmental leadership
- A wealth of information and technical resources such as NAU and the Western Regional Air Partnership (WRAP) are available
- Excellent potential for the generation of solar energy exists;
- Area is large enough to be sophisticated, but small enough to be agile.

Weaknesses cited include low per-capita income, the rural nature of the area leading to auto dependence, and a high use of wood for heating. Examples of opportunities for redressing these weaknesses and improving air quality include exchanging information with the Tribal communities, developing sources of renewable energy, proximity to national parks (attracting Federal resources), and broad-based community support for protecting the quality of life and visual appeal of the area.

Some threats to improving air quality include proposed new power plants on the Colorado Plateau; population growth; catastrophic forest fires; lack of regional rule-making and influence on other states such as California; and balancing the management of air quality, water quality, and solid waste.

Constraints on improving air quality include the need for Tribal input, the large size of the County, federal regulations, state laws allowing wildcat subdivisions, proximity to and producing power for California, and the limited resources available for attainment areas such as Coconino County.

Formulate Vision Statement

After participating in the S.W.O.T. analysis, members of the group were asked to contribute phrases that would be suitable in an air quality vision statement for Coconino County. The following vision statement paragraph and supporting language were developed using concepts provided by the participants:

> In 1958, a TWA pilot who had just flown across America radioed the control tower that "The cleanest air on the continent was in Flagstaff Arizona." Coconino County will preserve and protect this reputation: All levels of government in the County will work together to preserve healthy air, improve visibility, and reduce greenhouse gas emissions. Coconino County will recognize agencies that advocate clean air or help improve air quality and encourage alternatives to single occupancy vehicles such as carpools, buses, bicycles, and walking. The County will also encourage the use of new technologies such as solar energy and telecommuting.

The County will think globally but act locally to enhance our air quality and environment.

To support this vision, concepts presented by participants together with the findings of previous air quality sustainability efforts suggest the following action items:

- Establishment of an Air Quality Steering Committee
- Development and implementation of an Education/Outreach Program
- Identification and implementation of voluntary air quality preservation measures
- Development and implementation of plans, policies, ordinances, and services such as a response system to provide advisories on ambient or predicted air quality conditions

After concepts for inclusion in the Vision Statement and supporting language were recorded, candidate strategies for realizing the concepts were evaluated by the participants as described in the following section.

Prioritize Air Quality Improvement Strategies

After reviewing potential air quality improvement strategies, each member of the visioning group received fifty 3" x 5" index cards. Each index card described an improvement strategy, the pollutants reduced, and the most-likely implementation mechanism. Each of the 50 strategies was assigned to 1 of 10 categories and assigned a number relating it to the category. Hence the ten strategies for controlling fugitive dust, for example, were assigned numbers 1.1 through 1.10. Table 8 identifies the categories used in classifying the strategies by source or type of control.

TABLE 8. CATEGORIES USED IN CLASSIFYING AIR QUALITY IMPROVEMENT STRATEGIES

Category	Strategies	Source or Type of Control
1	1.1-1.10	Fugitive Dust
2	2.1-2.3	Unpaved Roads
3	3.1-3.3	Paved Roads
4	4.1-4.8	Wood Burning Controls
5	5.1-5.3	Heavy-Duty Vehicles and Equipment
6	6.1-6.2	Agriculture (none in Coconino County)
7	7.1-7.3	Vehicles
8	8.1-8.4	Transportation Control Measures
9	9.1-9.3	Land Use and Growth Controls
10	10.1-10.13	Other Controls

First, the group was asked to identify those measures that would *not* be appropriate for implementation in Coconino County. A strategy was discarded only if *everyone* in the group agreed to remove it. During this first phase, seven strategies were eliminated from further consideration.

Each member of the group was then provided with ten adhesive dots and instructed to "vote" for air quality strategies by applying dots to the index cards. More than one dot could be applied to a single card. The cards were then collected and the votes tallied. Table 9 summarizes the results of this prioritization process. A category number is shown next to each strategy in Table 9.

The air quality improvement strategy receiving the most votes was "Encourage Energy Efficiency and Renewable Sources of Energy" (11). The second highest number of votes was cast for "Educational and Outreach Campaign to Sustain Clean Air" (8). The first eight strategies each received four or more votes.

The similar strategies, "Stabilize Unpaved Roads and Alleys" and "Reduce Speed Limits on Unpaved Roads," together received a total of five votes. So "Stabilize or Reduce Speeds on Unpaved Roads" has been included as the ninth strategy in Table 10. To round out the top ten and include a strategy that reduces diesel emissions, "Retrofit Municipal Diesel Vehicles" has also been added to Table 10.

Table 10 identifies how these strategies support the three main goals identified in the vision statement: (1) preserve healthy air (i.e. reduce carbon monoxide, volatile organic compound, nitrogen oxide, or particulate emissions), (2) improve visibility, and (3) reduce greenhouse gases.

The next chapter discusses how each of these air quality improvement strategies might be incorporated into a Clean Air Action Plan for Coconino County.

TABLE 9. VOTING RESULTS FOR AIR QUALITY IMPROVEMENT STRATEGIES

Category #	Air Quality Improvement Strategy	# of Votes
10.11	Encourage Energy Efficiency and Renewable Sources of Energy	11
10.8	Educational and Outreach Campaign to Sustain Clean Air	8
8.1	Alternatives to Single Occupant Vehicle Travel	6
1.1/1.6	Fugitive Dust Control Plans with Mitigation Bond Requirements	5
4.1	Clean Burning Fireplaces in New Construction	5
4.3	Episode Curtailment Program for Wood Smoke	5
9.2	Innovative Land Use Planning to Encourage Multi-modal Opportunities	5
10.13	Integrate Land Use, Transportation and Air Quality Decision-making	4
2.1	Stabilize Unpaved Roads and Alleys	3
4.8	Smoke Management Programs	3
8.3	Retrofit Municipal Diesel Vehicles	3
7.1	Encourage Conversion to Alternative Fuels	3
9.3	Attract "Green" Industries	3
10.5	Voluntary Business Community Emissions Reductions	3
10.10	Ozone Awareness Program	3
1.7	Limitations on Opacity	2
1.10	Control Dust on Public Property	2
2.2	Reduce Speed Limits on Unpaved Roads	2
2.3	Limit Use of Off-Road Vehicles on Public Property	2
3.1	Deploy PM_{10} Efficient Street Sweepers	2
4.2	Retrofit Existing Fireplaces and Wood Stoves	2
5.2	Inventory Diesel Equipment and Upgrade/Replace High Emitters	2
7.3	Voluntary High Emitter Vehicle Repair/Replacement Program	2
8.4	Employer-Based Measures	2
9.1	Growth Boundaries or Other Limitations	2
1.2	Control Bulk Material Transport	1
3.2	Rapid Cleanup of Material Deposits on Paved Roads	1
4.4	Public Information Program on Fireplaces and Wood Smoke	1
4.7	Provide Alternative Heating Options	1
5.1	Limit Heavy-Duty Vehicle Idling	1
8.2	Traffic Flow Measures	1
8.3	Market Based Measures	1
10.1	Restaurant Charbroiler Controls	1
10.7	Apply Maximum Allowable Increases	1
10.12	Expand Air Quality Monitoring	1
	Total	**100**

TABLE 10. HOW STRATEGIES SUPPORT THE AIR QUALITY GOALS

	Strategy	Preserve Healthy air	Improve Visibility	Reduce Greenhouse Gases
1.	Encourage Energy Efficiency and Renewable Sources of Energy	X	X	X
2.	Educational and Outreach Program to Sustain Clean Air	X	X	X
3.	Alternatives to SOV Travel	X	X	X
4.	Fugitive Dust Control Plans with Mitigation Bond Requirements	X	X	
5.	Clean Burning Fireplaces in New Construction	X	X	X
6.	Episode Curtailment Program for Wood Smoke	X	X	X
7	Innovative Land Use Planning to Encourage Multi-modal Opportunities	X	X	X
8.	Integrate Land Use, Transportation, and Air Quality Decision-making	X	X	X
9.	Stabilize or Reduce Speeds on Unpaved Roads	X*	X*	
10.	Retrofit Municipal Diesel Vehicles	X	X	

*Close to the source

4. CLEAN AIR ACTION PLAN

The preferred strategies developed during the visioning session in Flagstaff on April 30, 2003 provide the foundation for a Clean Air Action Plan for Coconino County. The top ten strategies to be implemented as part of the Clean Air Action Plan are described below.

PREFERRED STRATEGIES FOR IMPROVING AIR QUALITY

The strategies are presented in the order they were ranked by the Coconino County Visioning group. Key characteristics of the top ten strategies are summarized in Table 11. A more detailed discussion of each air quality improvement strategy is provided below.

1. Encourage Energy Efficiency and Renewable Sources of Energy

This strategy received the highest number of votes from visioning session participants. More efficient use of energy can be achieved by reducing consumption of electricity. Renewable energy from solar, wind, geothermal, and biomass sources has the potential to reduce the depletion of fossil fuels.

Considerable research on energy efficiency and renewable energy sources has been conducted by the WRAP. The WRAP was formed in 1997 to carry out the recommendations of the Grand Canyon Visibility Transport Commission. The Commission was established by Congress in the early 1990's to determine how to protect and improve visibility in 16 parks and wilderness areas on the Colorado Plateau, including both the Grand Canyon and Sycamore Canyon Wilderness Area in Coconino County.

In 2003 the WRAP recommended policies and programs that could be implemented by states, tribes, and the Federal government to increase efficient use of energy and consumption and generation of power from renewable sources. Many of the WRAP recommendations are also applicable to local communities. For example, some "best practices" to foster energy efficiency at the local level are summarized in Table 12.[9]

Energy Efficiency. The WRAP found that there are a wide range of cost-effective energy efficiency measures in existence, but there are barriers that prevent their widespread penetration. The WRAP supported the implementation of financial incentives and mandatory energy efficiency standards on the part of states and tribes. Other recommended actions to promote reduced energy consumption included consumer information and education, utility and environmental regulatory policies, and utility rate reforms. Additional information on the best practices for energy efficiency can be found at http://www.wrapair.org/forums/ap2/documents/draft/ Best_Efficiency_Measures_for_West.pdf.

TABLE 11. CHARACTERISTICS OF PREFERRED AIR QUALITY IMPROVEMENT STRATEGIES

Air Quality Improvement Strategy	Implementation Mechanism	Pollutants Reduced*	Sources of Pollutants	Groups Affected
1. Encourage Energy Efficiency and Renewable Sources of Energy	Municipal Policies	CO_2, NOx	Power Plants	Utilities, Homeowners, Commercial and Municipal Energy Consumers, Renewable Energy Providers
2. Conduct Education/Outreach Program to Sustain Clean Air	"Air Aware" Program	CO, CO^2,VOC, NOx, $PM_{2.5}$, PM_{10}	Light Duty Vehicles, Wood-burning, Power Plants	Residents, Businesses, Teachers, Students, Utilities, Renewable Energy Providers
3. Encourage Alternatives to Single Occupant Vehicle Travel	Municipal Programs	CO, VOC, NOx, $PM_{2.5}$, PM_{10}	Light Duty Vehicles	Commuters
4. Dust Control Plans with Mitigation Bond Requirements	Ordinances	PM_{10}	Construction and Earthmoving Activities	Construction Industry, Highway Contractors
5. Clean Burning Fireplaces in New Construction	Ordinances	NOx, $PM_{2.5}$, PM_{10}	Wood-burning	Homeowners, Business Owners, Construction Industry
6. Episode Curtailment Program for Wood Smoke	Ordinances	NOx, $PM_{2.5}$, PM_{10}	Wood-burning	Homeowners, Business Owners
7. Innovative Land Use Planning to Encourage Multi-Modal Opportunities	Municipal Planning and Zoning	CO, VOC, NOx, $PM_{2.5}$, PM_{10}	Light Duty Vehicles	Residents, NAU, Businesses
8. Integrate Land Use, Transportation, and Air Quality Decision-Making	Municipal Policies and Planning	CO, VOC, NOx, $PM_{2.5}$, PM_{10}	Light Duty Vehicles	Local Governments, Regional Planning Agencies
9. Stabilize or Reduce Speeds on Unpaved Roads	Municipal Programs	PM_{10}	Vehicles Traveling on Dirt Roads	Residents living on dirt roads, Others who drive on dirt roads
10. Retrofit Municipal Diesel Vehicles and Equipment	Municipal Programs	CO, VOC, NOx, $PM_{2.5}$, PM_{10}	Heavy Duty Diesel Trucks and Equipment	Local governments

*CO – carbon monoxide, CO_2 – carbon dioxide, VOC – volatile organic compounds; NOx – nitrogen oxides, PM_{10} – particulate matter smaller than 10 microns, $PM_{2.5}$ – particulate matter smaller than 2.5 microns

TABLE 12. SELECTED ENERGY EFFICIENCY BEST PRACTICES

Sector	Source Category	Measures
Residential	Efficient Cooling Systems	Evaporative cooling – installation, retention, and renewal of systems
	Appliance Recycling	Removal of older refrigerators and freezers
	Efficient Lighting	Mix of compact fluorescent lamp based measures
	Appliance Standards	Clothes washers – mix of Energy Star vertical axis machines and horizontal axis machines Appliance standby loss – reduce loss to one watt per electronic device
Commercial	Efficient lighting	Mix of better technologies
	Efficient refrigeration	Mix of better technologies
	Efficient cooling systems	Cooling efficiency – mix of better systems Indirect/direct evaporative cooling
	Efficient space heating systems	Ground source heat pump Fuel switching from electric to gas
	Multi-measure strategies for existing building stock	Miscellaneous devices (LED traffic lights and signs, clothes washers, computers, monitors and other office electronics
	Retro-commissioning	Operations and maintenance of existing building stock
	Water heating	Mix of efficiency and fuel switching from electric
	Transformers	Efficiency improvements
Industrial	Transformers	Efficiency improvements
	Motors	Premium motors (including replace rather than rewind) and motor downsizing
	Motor drive systems	System upgrades of fans, air compressors, pumps

Source: Derived from Appendix V of WRAP Air Pollution Prevention Forum, "WRAP Policy - Renewable Energy and Energy Efficiency as Pollution Prevention Strategies for Regional Haze," April 2003.

Renewable Sources of Energy. The WRAP estimated that six percent of the electricity needs of the nine-state Grand Canyon Visibility Transport Region were met by renewable sources in 1999; most of this energy was produced in California. The WRAP recommendations focus on achieving a goal of meeting 10 percent of the region's power needs with renewable sources by 2005 and 20 percent by 2015.

The WRAP concluded that there is considerable potential for generation of renewable energy in the West, but there are major barriers, the largest of which is cost. With the exception of wind resources, generation from renewable sources is generally more expensive than conventional electric technologies. The environmental benefits of renewable energy are not currently considered adequately in evaluating power generation costs.

To overcome this barrier, the WRAP recommended that states provide financial incentives for the production and consumption of renewable energy. In addition, customers who want to purchase renewable-generated electricity should be given the option of purchasing part of their power through a subsidized "green pricing program." To improve the performance of such a program, states, tribes, and local governments could adopt complementary policies that lower transaction costs for renewable electricity products and services.

In 2004, Arizona Public Service (APS) doubled its financial incentives and will now rebate up to half the cost of solar equipment bought by its customers. On March 24, 2004, APS broke ground on a unique solar trough generating station that uses energy from the sun to make steam that turns a turbine generator. These initiatives will help APS meet the Arizona Corporation Commission's requirement that regulated utilities in the state obtain at least one percent of their electricity from renewable sources such as solar, wind, and biomass by 2005.[10]

Another innovative renewable energy program is Nevada GreenPower, which encourages residents and businesses to make tax deductible donations to help subsidize generation of power from renewable sources. Those interested in supporting renewable energy can sign up with their power company to add a few extra dollars to their monthly electricity bill. The program is a joint venture of Nevada Power, Sierra Pacific, and the Desert Research Institute Foundation. The donations are used to fund solar, wind, geothermal, and biomass power generation projects and educational programs in Southern Nevada. In 2002, GreenPower installed solar and wind electricity-generation systems at Hyde Park Middle School in Las Vegas. Twelve solar panels and a wind turbine with a 4-foot wing span were mounted on the roof of the school. The power produced by these sources is saving the school about $500 a year in energy costs. GreenPower also sponsored renewable energy training for science teachers at Hyde Park Middle School and they have subsequently modified their lesson plans to include more emphasis on natural resources, energy conservation and alternative energy sources. The students are also given an opportunity to collect and analyze data produced by the solar array. The equipment used in the Hyde Park project was installed by Las Vegas Solar Electric which donated a

significant part of the costs as a learning experience to fine-tune the process for future GreenPower sites.

The WRAP concluded that tribal lands in the West have great potential for the development and delivery of electricity generated from renewable resources. Many tribes are interested in producing, selling, and using such power. However, additional barriers exist for many tribes, including lack of an energy authority or policy; local demand for basic, reliable electric service; and limited capital to finance expensive power generation facilities. [7]

Implementation Mechanism: This strategy involves implementing a public information program and incentives to encourage more efficient use of petroleum products, and, where feasible, substitution of renewable sources of energy, such as solar and wind power. Since Coconino County has an abundance of annual sunshine (an average of 264 days per year are either clear or partly cloudy), solar-powered options should be fully explored via research and demonstration projects. Individuals might be encouraged to use solar energy in their homes and businesses if they were shown they can realize monetary savings (i.e., tax incentives, lower annual energy costs).

Municipal and county codes should be examined to determine if there are current impediments to—or opportunities for—conserving energy or substituting renewable power. To be most effective, there should be research, outreach, and financial incentive components to this program. The program might be most effectively coordinated and implemented as a joint venture involving Northern Arizona University, energy providers, Indian communities, and local governments in Coconino County.

Municipal policies could be developed by local governments and tribes in Coconino County to provide financial incentives for generating, selling, and using electricity from "green" sources. Table 12 provides some guidance on local policies that might be formulated to promote energy efficiency. Local governments should also coordinate with the Indian communities in Coconino County to develop complementary policies on energy efficiency and renewable sources. Local governments and citizen groups should also be encouraged to write letters in support of Federal and state policies and regulations embodied in the WRAP's recommendations.

In addition, the Coconino County "Air Aware" Program to be implemented as part of the education and outreach component of the Clean Air Action Plan should educate consumers, businesses, and students on how to reduce consumption of electricity, and encourage use of power from renewable sources (i.e., solar or wind). Via "Air Aware," Coconino County can also communicate the importance of reducing dependency on petroleum products used in automobiles (i.e. driving cars with high fuel economy).

Sources and Pollutants Reduced: The WRAP forecasted that the recommended energy efficiency and renewable energy measures will reduce nitrogen oxides by 1-2 percent and carbon dioxide by 10-14 percent by 2018 in the nine-state Grand Canyon Visibility Transport Region. Reductions in particulate matter and sulfur oxides were estimated to be

negligible. These estimates are based on reductions in emissions from power plants fueled with non-renewable resources.

Costs of Implementation: The WRAP estimated that the renewable energy measures in the Region would cost $300 to $900 million by 2018, while the energy efficiency efforts would reduce costs by $1 billion. The net benefit would be between $100 and $700 million.

The cost of implementing policies in Coconino County to support the WRAP recommendations is estimated to be about $75,000 per year, which represents the cost of hiring a policy analyst to evaluate WRAP recommendations and other potential measures, develop local government policies, oversee their adoption, and monitor their implementation. The additional cost of implementing the "Air Aware" campaign, which would include the promotion of energy efficiency and renewable sources, is discussed below.

2. Conduct Education/Outreach Program to Sustain Clean Air

This strategy received the second-highest number of votes from participants in the Coconino County visioning session. It would involve a comprehensive "Air Aware" campaign which would address measures that individuals, employers and students can take to reduce air pollution. The campaign would promote alternative transportation modes, including carpooling, vanpooling, riding the bus, bicycling and walking; compressed work schedules and telecommuting; alternatives to wood burning in the winter; and refueling vehicles after dark in the summer. Businesses could be encouraged to meet trip reduction targets. During the winter, the campaign would educate homeowners on reducing emissions from wood smoke and discourage use of wood burning during temperature inversions and bad visibility days. The campaign could also arrange for dust control training (to be offered by the Arizona Department of Transportation) for construction, demolition, hauling and landscaping workers and managers.

"Air Aware" should be a multi-media campaign, utilizing one or more of the following: web page, television, radio, newspaper, bus advertisements. Businesses could be targeted through direct mail, management-level briefings and/or advertising in business publications. Information could be provided to residents at community events. The campaign could also promote energy efficiency and renewable sources of energy. Brochures could be provided to employers to distribute to their employees and to utility companies to distribute to their customers. Lesson plans could be distributed to primary and secondary schools and educational events hosted on local campuses. A special effort should be made to disseminate information to NAU students and faculty.

Implementation Mechanism: The agency that assumes the leadership role in implementing the Clean Air Action Plan (Coconino County, NACOG or FMPO) would also be responsible for conducting the "Air Aware" education and outreach program. The lead agency would obtain co-sponsors (Chambers of Commerce, cities and towns, Indian

communities, environmental groups, utilities, and renewable energy companies) to provide in-kind resources and promote the campaign.

Sources and Pollutants Reduced: This campaign will reduce pollutants emitted by power plants, light duty vehicles, and wood burning sources. These pollutants include carbon dioxide, carbon monoxide, volatile organic compounds, nitrogen oxides, and particulate matter (both PM_{10} and $PM_{2.5}$). Based on the FY 2003 Congestion Mitigation and Air Quality Improvement (CMAQ) Annual Report for Maricopa County, it is estimated that the "Air Aware" campaign in Coconino County would reduce CO emissions by 51 tons/year, VOCs by 7 tons/year, and PM_{10} by 11 tons/year. The emission reductions for Coconino County were derived by applying 3.75 percent to the Maricopa County emission reduction estimates for air quality education and outreach programs in the CMAQ report. This is the ratio of the population of Coconino County to the population of Maricopa County, as reported in the 2000 Census.

Costs of Implementation: A year-round "Air Aware" campaign for Coconino County would cost an estimated $75,000 per annum. This includes a part-time campaign coordinator, as well as costs of materials and advertising. For comparison purposes, Valley Metro in Maricopa County spent about $2.15 million in FY 2003 on air quality education and outreach programs, including the ozone education program, telework outreach program, and trip reduction program.

3. Encourage Alternatives to Single Occupant Vehicle Travel

This strategy supports new programs and capital and operating expenditures for bus system improvements, bicycle and pedestrian facilities, regional ridesharing programs, and park and ride lots. The objective of these programs and expenditures is to increase the attractiveness and level of service of these alternative modes, so that the public will reduce their single occupant vehicle (SOV) travel.

Implementation Mechanism: Local governments in Coconino County would be responsible for planning and implementing transportation programs and improvements that improve the competitiveness of alternative modes. The lead agency for the Clean Air Action Plan would be responsible for regional programs, such as ridesharing, and would ensure that interfaces among alternative modes are coordinated throughout the County.

Sources and Pollutants Reduced: This strategy will reduce pollutants emitted by light duty vehicles. These pollutants include carbon monoxide, volatile organic compounds, nitrogen oxides, and particulate matter (both PM_{10} and $PM_{2.5}$). Based on the FY 2003 CMAQ Annual Report for Maricopa County, it is estimated that the regional rideshare program in Coconino County would reduce CO emissions by 57 tons/year, VOCs by 8 metric tons/year, and PM_{10} by 12 tons/year. The emission reductions for Coconino County were derived by applying 3.75 percent to the Maricopa County emission reduction estimates for

the regional rideshare program in the CMAQ report. This is the ratio of the population of Coconino County to the population of Maricopa County, as reported in the 2000 Census.

Costs of Implementation: A regional ridesharing program for Coconino County would cost an estimated $50,000 per year. This includes a part-time program coordinator, as well as costs of materials and advertising. For comparison purposes, Maricopa County spent about $660,000 in FY 2003 on the regional ridesharing program. Costs to improve the infrastructure or service of alternative modes could quickly escalate this cost into the millions of dollars.

4. Dust Control Plans with Mitigation Bond Requirements

The objective of a dust control plan is to minimize emissions from construction and earthmoving activities. This strategy requires land-clearing and construction operators to develop a plan to control dust before, during, and after the dust-generating activities occur. The dust control plan would have to be approved by a government entity before the operator can proceed with grading and drainage work.

Activities of this type are temporary yet important sources of PM_{10} pollution in urban areas. The activities requiring dust control on the work site include drilling and blasting, excavation, cut-and-fill, material storage and handling, and vehicles traveling on unpaved surfaces. In addition, mud and dirt tracked out onto paved public roadways can be a major source of PM_{10}.

A typical dust control plan for a work site would identify the potential sources of dust, the location of delivery, transport, and storage areas, the types of material to be stored, and the size of piles. In addition, the plan would describe measures to be applied at the site during periods of dust generation, including the frequency and duration of watering or other suppressant application. The plan would also address control of material track-out where unpaved access points join paved surfaces and handling of loads during transport to and from the work site (i.e., all truck loads covered with no less than 3 inches of freeboard).

The dust control plan could include a variety of work practices such as frequent watering of disturbed surfaces and storage piles and use of wind fences for control of windblown dust. Other site-specific prevention and mitigation measures could include paving of roads and access points early in the project, compaction or stabilization (chemical or vegetative) of disturbed soil, phasing of earthmoving activities, reduction of mud and dirt tracked onto paved streets, installation of truck wash or devices to remove dirt from vehicles and tires prior to exiting the site, and periodic cleaning of the street near work site entrances.

Under the mitigation bond requirement, a company seeking a grading and drainage permit would provide a letter of credit or surety bond to cover the cost of mitigation measures contained in the dust control plan. The full amount posted plus interest would be refunded

at the completion of the project, if the company followed the dust control plan and the municipality incurred no costs in controlling dust at the project site. Mitigation bond requirements have been implemented in Clark County, Nevada, and Rancho Mirage, California. Typical surety bonds posted in Clark County are in the $500-$20,000 range, depending upon the size of the construction project.

Implementation Mechanism: Arizona law provides local governments with the authority to suppress environmental nuisances. Under this authority, the cities and towns in Coconino County could adopt ordinances to require dust control plans in order to avert public nuisances. Building inspectors could inspect construction sites to ensure that the dust control plan is being implemented. Enforcement personnel would have to be hired to respond to complaints. Due to the potential increase in resources required to implement and enforce this ordinance, the requirement for a dust control plan and mitigation bond might be most appropriately applied to large construction projects (i.e., greater than 50 acres) in Coconino County. Fees (per acre) are typically charged to cover the costs of administration and enforcement.

Sources and Pollutants Reduced: This strategy will reduce particulate matter (PM_{10}) produced by disturbing soils during construction and earthmoving activities. Based on Sierra Research estimates, the PM_{10} reductions associated with watering a 50 acre residential construction site in accordance with a Dust Control Plan would be 27 tons over the six-month life of the project, a 61 percent reduction in PM_{10} emissions. [11]

Costs of Implementation: Sierra Research also estimates that the contractor's cost to water a 50-acre site adequately for six months would be about $54,000. Costs of the permits and mitigation bonds would depend upon fees and rates set by the implementing jurisdiction. The administrative cost to develop a dust control ordinance with a mitigation bond requirement would be about $15,000. At least one full time staff person would be required to review the dust control plans, conduct periodic inspections of 50 acre or larger projects, and respond to citizen complaints. Employment of this additional staff person would cost about $60,000.

5. Clean Burning Fireplaces in New Construction

This strategy reduces emissions from new residential and commercial fireplaces and wood stoves. The Arizona Department of Environmental Quality has estimated that wood burning may cause up to 40 percent of the pollution in neighborhoods during winter temperature inversions.

Flagstaff already has an ordinance (No. 1664, June 5, 1990) that prohibits the sale or installation of wood heaters or fireplace insets that do not meet Phase II EPA Standards. The existing ordinance requires that a permit be obtained before installing a wood burning heater or fireplace. It also outlaws the burning of coal within the city limits.

A clean burning fireplace ordinance would go further, prohibiting the installation or construction of a fireplace or wood stove, unless it is one of the following:

- A fireplace that has a permanently installed gas or electric log insert,
- A fireplace or wood stove or any other solid fuel burning appliance that is certified as conforming to Phase II EPA Standards of Performance for Wood Heaters in 40 CFR Part 60, Subpart AAA, as amended through July 1, 1998, or
- A fireplace that has a permanently installed wood stove insert that complies with Phase II EPA standards.

The ordinance would prohibit the subsequent conversion or alteration of an approved fireplace or wood stove to an unapproved use. The ordinance typically provides exemptions for home heating, industrial equipment, cooking devices, and outdoor fireplaces.

The advantage of this air quality improvement strategy is that it helps to offset the increase in emissions due to population growth. In the Phoenix area, Maricopa County and all local jurisdictions within it were required by the Arizona Legislature (S.B. 1427) to adopt, implement, and enforce clean burning fireplace ordinances by December 31, 1998.

Implementation Mechanism: Local governments in Coconino County have the authority to adopt ordinances governing construction and installation of woodstoves and fireplaces.

Sources and Pollutants Reduced: This strategy will reduce particulate matter (PM_{10} and $PM_{2.5}$) and NOx emitted in wood smoke. Certified woodstove efficiency is estimated to be 68 percent. Emission reductions from certified wood burning devices would be 0.16 lbs of PM_{10} per new residence per heating day, 0.13 lbs of $PM_{2.5}$ per new residence per heating day and 0.01 lbs of NOx per new residence per heating day.

Costs of Implementation: The administrative cost to develop a clean burning fireplace ordinance would be about $10,000. The cost to the consumer could vary from $100-$500, depending upon the certified woodstove or fireplace product installed. However, operating efficiencies and reduced fuel costs may result in overall customer savings, as well as air quality improvements.

6. Episode Curtailment Program for Wood Smoke

This strategy restricts the use of wood stoves and fireplaces during episodes when monitored concentrations of air pollutants exceed predetermined thresholds. Unless additional monitors are activated, a wood smoke curtailment program in Coconino County would be based upon PM_{10} concentrations at the Flagstaff monitors or degraded visibility readings at the Grand Canyon monitor. When one of these monitors reached certain threshold levels and other environmental conditions such as calm winds were evident, a no-

burn alert would be announced. Alerts would be communicated to the public through the broadcast media (radio, TV) and to employers via fax notification.

Maricopa County adopted an ordinance establishing a residential wood burning restriction program in 1994. The annual period during which restrictions on burning can be called is October 1 through February 29. The County Air Pollution Control Officer can call a restricted burn period on the basis of an assessment of meteorological data, atmospheric conditions, ambient temperatures, and monitored carbon monoxide or PM_{10} concentrations. When a restriction is called, all fireplaces and wood heating devices must be shut down within three hours. Exemptions include those that are the sole source of heat in a residence and those that qualify as an approved wood burning device (i.e. gas logs, EPA Phase II certified wood heaters, pellet stoves, and masonry heaters). Wood-fired barbeques and commercial cooking devices are also exempt. Any person who violates this ordinance within a 1-year period, after being issued a warning notice, is guilty of a civil offense and subject to a $100 fine. In addition to Maricopa County, this strategy has been implemented in Missoula, Montana; Mammoth Lakes, California; and Clark and Washoe counties in Nevada.

Implementation Mechanism: Jurisdictions in Coconino County have the authority to adopt ordinances establishing a wood smoke curtailment program and setting criteria for no-burn advisories. The local governments would need to work cooperatively with the Arizona Department of Environmental Quality (ADEQ) to set up a real-time forecasting system using meteorology and the PM_{10} and visibility monitoring data available for Coconino County. The ADEQ can assist in determining whether additional monitors (i.e. carbon monoxide) would be needed to augment the forecasting system.

Sources and Pollutants Reduced: Assuming 15 curtailment days per year, this strategy would reduce PM_{10} by 165 lbs per wood heated residence, $PM_{2.5}$ by 135 lbs per wood heated residence, and NOx by 15 lbs per wood heated residence.

Costs of Implementation: The administrative cost to develop a wood smoke curtailment ordinance would be about $15,000. The administrative cost to set up and maintain a real-time monitoring system, publicize high pollution advisories, and enforce no-burn restrictions could cost as much as $70,000 per year.

7. Innovative Land Use Planning to Encourage Multi-Modal Opportunities

This strategy would promote land use plans and policies that will increase the use of modes other than the single occupant vehicle. The urban growth boundary implemented in Flagstaff will have the eventual effect of increasing both residential and employment densities, which, in turn, will promote the use of alternative modes. Limited parking exists in downtown Flagstaff; rather than providing more parking, the fees for the existing spaces could be increased. These measures are also typical of land use policies that encourage transit-oriented development.

Like many university towns, Flagstaff has taken the initiative to develop an extensive network of bike paths, the Flagstaff Urban Trail System, to encourage bicycling in lieu of driving. Similarly, land use planning that creates convenient access for pedestrians will increase walking, improve public health, and reduce vehicle trips. Other design techniques such as traffic calming, roundabouts, and auto-free zones have been applied elsewhere in the country to discourage vehicular traffic. Although these planning and design innovations are important in increasing the attractiveness of alternative modes, another element in their success has been the parallel, and often major, investment in improved service and infrastructure for alternative modes such as late night and weekend bus service, coordinated networks of bicycle and pedestrian paths, and pedestrian-friendly street redesign.

This strategy would be implemented as part of the comprehensive planning processes at all levels of government in Coconino County. In order to be effective in reducing SOV travel, policies that promote increased residential and commercial densities, restrict parking supply, and impose higher parking fees need to be paired with increased capital investments in transit, bike, and pedestrian facilities. Because public funding is limited especially at this time, financing for these capital investments may require considerable political will. Strong public support will also be needed to increase parking rates as this action, although effective in encouraging use of alternative modes, has proven to be politically unacceptable in many parts of the country.

Implementation Mechanism: Local governments in Coconino County have the authority to prepare land use and zoning plans that incorporate one or more innovative planning and design features. The Growing Smarter legislation requires governments to update their general plans on a periodic basis. Innovative land uses that encourage higher density developments and use of alternative transportation modes can be integrated into the next general plan update.

A potential source of funding for innovative land use planning to support transportation and environmental goals is federal grants. There is considerable interest at the federal level in funding projects that demonstrate the impacts of land use planning on transportation and air quality. These impacts are intuitively suspected, but have not been quantified to any great extent. Local governments might consider teaming with Northern Arizona University to apply for a grant from EPA or U.S. DOT to show how innovative land use policies can result in increased use of alternative transportation modes.

Sources and Pollutants Reduced: If innovative land use planning reduces vehicle travel in Coconino County by one percent in 2015, the reduction in vehicle emissions would be about 676 kg/day for carbon monoxide, 38 kg/day for nitrogen oxides, 35 kg/day for volatile organic compounds, and 38 kg/day for particulate matter (PM_{10}). Reducing VMT will also decrease greenhouse gases, gasoline consumption, and the County's reliance on fossil fuels.

Costs of Implementation: There would be negligible cost to incorporate multi-modal land use planning and design concepts into the required general plan updates. However, there

could be considerable costs associated with capital investments in infrastructure and services to improve the attractiveness of alternative modes.

8. Integrate Land Use, Transportation, and Air Quality Decision-Making

This strategy would involve a review of development and transportation plans, programs, and policies at all levels of government in Coconino County to determine if land use, transportation and the environment, including air quality, are adequately coordinated. Typically, long-range plans include land use, transportation, and environmental goals and objectives. However, these may not be translated into integrated programs and policies. Day-to-day decisions of local government officials may not reflect the same level of integration as is contained in these plans. If not, then better coordination needs to take place within agencies. This is complicated by the fact that land use, transportation, and environmental issues are typically handled by different departments and reviewing work of other departments may not be the highest priority.

To ensure that land use, transportation and air quality decisions are integrated across Coconino County, coordination also needs to take place at all levels of government. For example, County staff should be familiar with the plans, programs, policies, and decisions being made by the City of Flagstaff and the Flagstaff MPO, and vice versa. Coordination with other large land owners and policy-makers, such as the Indian tribes, state, and federal government, is also important.

To make informed decisions, elected officials and municipal/county managers need to obtain staff recommendations that reflect an understanding of the land use, transportation and environmental implications of proposed actions. One way to ensure that coordination has occurred is to require a formal review of major proposals by appropriate departments within the agency. Another approach would be to assign a staff person as an integrator; that is, someone who understands the issues and impacts of proposed actions across all functions. As an initial step, decision-makers could direct their staffs to consider the land use, transportation and environmental implications of each proposed action and point out significant problems or discontinuities with internal programs and policies or those at other levels of government. The Arizona Department of Transportation is currently conducting a land use, transportation, and air quality integration study. When completed, this study may be useful in providing guidelines for more integrated policies and decision-making throughout Arizona.

Implementation Mechanism: Elected and appointed local government leaders in Coconino County have the authority to internally reorganize and reprioritize to ensure that the integration of land use, transportation, and air quality policies and decisions takes place.

Sources and Pollutants Reduced: If improved integration in land use, transportation, and air quality decision-making reduces vehicle travel in Coconino County by one percent in 2015, the reduction in vehicle emissions would be about 676 kg/day for carbon monoxide,

38 kg/day for nitrogen oxides, 35 kg/day for volatile organic compounds, and 38 kg/day for particulate matter (PM_{10}). Reducing VMT will also decrease greenhouse gases, gasoline consumption, and the County's reliance on fossil fuels.

Costs of Implementation: There would be minimal cost to reorganize or reprioritize to emphasize integration, rather than compartmentalization, in local government agencies.

9. Stabilize Surface or Reduce Speeds on Unpaved Roads

This strategy involves actions to mitigate the dust and PM_{10} pollution generated by vehicles traveling on dirt roads in Coconino County. Potential measures include paving, covering the surface with gravel, chemical stabilization, watering, or reducing speeds of vehicle traffic. Speeds could be reduced by posting lower speed limits or building speed bumps. The cities, towns, and County could implement these measures on public unpaved roads under their jurisdiction. Since there are a large number of unpaved roads in Coconino County, controlling dust on all of them would not be practical. Given the large size of the County and the limited resources available, it might be appropriate to target the unpaved roads with the highest average daily traffic (ADT) or those closest to the Grand Canyon or Sycamore Canyon Wilderness Area first. In Maricopa County, public dirt roads that carry more than 150 ADT must be stabilized by June 10, 2004.

Implementation Mechanism: Stabilization of public unpaved roads or a reduction in speeds on those roads could be undertaken by the local governments in Coconino County that currently maintain these facilities. The legislature has authorized local governments to lower speeds on public dirt roads if doing so will reduce air pollution.

Sources and Pollutants Reduced: This strategy reduces PM_{10} emissions from vehicles traveling on dirt roads. Sierra Research has recently reported that reducing average speeds from 25.9 to 25.0 miles per hour on dirt roads in San Joaquin Valley with an annual average daily traffic count (ADT) of 15 vehicles per day reduces PM_{10} emissions by 29.9 pounds per day per centerline mile or 5.45 tons per year. Sierra also estimated that the reduction in PM_{10} emissions due to paving a dirt road having 20 to 65 ADT per day would be 7.45 to 20.45 tons per year per centerline mile.[11]

Costs of Implementation: Sierra Research has also estimated that it will cost $400 per centerline mile of dirt road to install one speed limit sign in each direction. The average cost of paving a road in San Joaquin Valley is $400,000 per mile, including roadway excavation, aggregate base, striping, and traffic control.

10. Retrofit Municipal Diesel Vehicles and Equipment

Although this strategy only received three votes from the visioning group (versus the four or more votes received by each of the others), it was added to the list of top ten preferred

strategies because it is the only one that mitigates the impact of diesel emissions on public health and visibility. In 2001, EPA mandated stricter standards for heavy duty diesel vehicles that will begin phasing in with model year 2007. The catalytic converters that will be installed in the cleaner diesel vehicles are quickly rendered inoperative by the high sulfur content of the diesel fuel currently sold in America (except California). To address this problem, EPA is also requiring that low sulfur diesel fuel be sold nationwide by mid-2006. In May 2003, EPA also proposed stricter standards for diesel equipment that operates off-road, such as that used for construction and agricultural purposes, which may begin to phase-in as early as 2007.

These new federal standards will reduce emissions from new diesel vehicles and engines. However, due to the longevity of this equipment and its high cost, it will be many years before older "dirty" vehicles are retired and diesel fleets are entirely "clean". In the meantime, local governments are taking actions to accelerate the conversion to cleaner diesel fuels and reduce diesel tailpipe emissions. For example, in 2002 the State of Arizona inaugurated a Diesel Conversion Grant Program that provides up to $30,000 of the cost of converting a diesel vehicle over 19,500 pounds GVW to alternative fuels. To qualify for the grant, the vehicle must travel 50 percent or more of the time in the Phoenix or Tucson metropolitan areas. Alternative fuels are defined as compressed natural gas (CNG), liquefied natural gas (LNG), propane, electric, solar, or hydrogen.

The Environmental Protection Agency is promoting a number of new initiatives as part of its Diesel Emission Reduction Program. EPA is encouraging public/private partnerships to reduce idling and retrofit or replace older engines of diesel vehicles. One such initiative is Clean School Bus USA, which has established a goal of modernizing the entire public school bus fleet by 2010. See www.epa.gov/cleanschoolbus. Under this program, EPA is providing grants to school districts for demonstration projects. Paradise Valley School District in Maricopa County was awarded a grant in FY 2004 to use ultra low sulfur (15 ppm) diesel fuel in their school buses and install particulate traps on 20 buses. Federal funding for Clean School Bus USA was $5 million in FY 2003 and FY 2004, but may increase to as much as $65 million in FY 2005. In addition, as part of a federal settlement with Toyota, an additional $20 million will become available in the spring of 2004. School districts and others interested in diesel emission reduction programs may be eligible for funds from this settlement.

Retrofitting municipal diesel vehicles and equipment to reduce emissions in Coconino County could take many forms, including conversion to alternative fuels (i.e., biodiesel), installation of oxidation catalysts and particulate filters, and application of idling reduction technology (i.e., electrification kits). Professor William Auberle of Northern Arizona University received a grant from EPA in 2001 to conduct workshops on technologies that are available to reduce vehicle idling at truck stops and other locations. He would be an excellent resource for additional information on diesel technologies that could be applied to municipal vehicles and equipment.

It is envisioned that these retrofit technologies could be applied to garbage trucks, street sweepers, school buses, or off-road diesel equipment (i.e., construction) owned by city or

county governments. The cities of Mesa and Tempe are jointly planning to retrofit 45 municipal vehicles with oxidation catalysts and particulate filters and run them on low sulfur diesel fuel. The estimated cost of this FY 2007 demonstration project will be $350,000.

The City of Flagstaff has issued a request for bids to supply the City's vehicle fleet with biodiesel. The product will be used in over 100 city vehicles including fire trucks, refuse trucks, and roadway maintenance vehicles.

Other local governments in Coconino County could team with Northern Arizona University to request a grant from EPA to conduct a demonstration project to retrofit municipal diesel vehicles and equipment. Although ultra low sulfur diesel fuel will be available in mid-2006 and stricter federal standards for new model diesel vehicles will begin in 2007, older diesel engines will still be emitting high levels of pollution for many years. (Diesel engines typically last 20-35 years). To reduce emissions from these older engines, local governments need to institute programs to reduce idling and retrofit or replace older diesel vehicles and equipment. Diesel exhaust emissions contribute to the degradation of visibility and may even be carcinogenic. It is especially troubling that children are being exposed to toxic fumes when they ride diesel buses to school.

Implementation Mechanism: Local governments in Coconino County have the authority to retrofit municipal diesel vehicles, such as garbage trucks, street sweepers, school buses and off-road equipment, to reduce air pollution. They can also conduct voluntary programs that encourage reductions in idling of diesel vehicles and equipment.

Sources and Pollutants Reduced: This strategy reduces carbon monoxide, volatile organic compounds, nitrogen oxides, and particulate emissions (PM_{10} and $PM_{2.5}$) that are emitted by diesel trucks and equipment. In the case of the 45 municipal diesel vehicles that are to be retrofitted with 3-way catalysts and particulate traps by Mesa and Tempe in FY 2007, the estimated emission reductions are 12.8 kg/day for CO, 1.3 kg/day for VOCs, 27.4 kg/day for NOx, and 1.0 kg/day for PM_{10}.

Costs of Implementation: The cost to implement the pilot retrofit program for the 45 Mesa/Tempe municipal vehicles is estimated to be $350,000. Funding for diesel emission reduction programs in Coconino County is potentially available from EPA and the imminent Toyota settlement. The Mobile Sources Forum of the Western Regional Air Partnership (WRAP) may also have $40-70K available in FY 2005 to fund diesel retrofit projects. Since improving visibility in the Grand Canyon (and other 15 Colorado Plateau Class I areas) is a primary goal of the WRAP, Coconino County should be a competitive candidate for these funds. The Air Quality Steering Committee could take the lead in identifying worthy diesel retrofit projects and applying for WRAP funding, EPA grants, and a portion of the Toyota settlement.

CLEAN AIR ACTION PLAN

Table 13 summarizes the tasks that need to be implemented to achieve the desired improvements in Coconino County air quality. The first step in implementing the Clean Air Action Plan will be to set up an Air Quality Steering Committee. It is envisioned that the Northern Arizona Council of Governments (NACOG), the FMPO, or Coconino County would assume a leadership role in implementing the Clean Air Action Plan, since air quality is a regional issue that transcends city and town boundaries. The agency selected to play the lead role in implementing the Plan will also be responsible for identifying specific resource requirements and funding sources for each task.

The third task in Table 13, the strategy receiving the second-highest number of votes during the visioning process, is the air quality education and outreach program. A website, fact sheets, and other collateral materials are being provided as part of this ADOT contract to "jump-start" this Plan. Early implementation of this task should create the momentum, enthusiasm, and support necessary to fund and implement the remainder of the Plan.

Conclusion

The residents of Coconino County desire to improve their air quality. Specifically, they want to reduce air pollutants that are unhealthy to breathe, impair visibility, and contribute to global warming. Through a visioning process, local stakeholders have identified the issues of greatest concern, contributed to a vision statement, and prioritized potential air quality improvement strategies. A Clean Air Action Plan has been developed to ensure that the "vision" becomes a reality. Air quality can be improved and the quality of life can be sustained in Coconino County through a coordinated regional effort with a clear "vision" and the direction provided by the Clean Air Action Plan.

TABLE 13. CLEAN AIR ACTION PLAN FOR COCONINO COUNTY

Task	Responsibility	Time Frame
1. Set up Air Quality Steering Committee	NACOG, FMPO, or Coconino County lead; Committee membership – elected, staff, and ADOT	1-3 months
2. Encourage Energy Efficiency and Renewable Sources of Energy	NACOG, FMPO, or Coconino County lead w/input from Air Quality Steering Committee	1 year
3. Conduct Education/Outreach Program to Sustain Clean Air	NACOG, FMPO, or Coconino County lead w/input from Air Quality Steering Committee	3-6 months
4. Encourage Alternatives to Single Occupant Vehicle Travel	NACOG, FMPO, or Coconino County lead w/input from Air Quality Steering Committee	1 year
5. Dust Control Plans with Mitigation Bond Requirements	Local Governments	1-3 years
6. Clean Burning Fireplaces in New Construction	Local Governments	1-3 years
7. Episode Curtailment Program for Wood Smoke	Local Governments	1-3 years
8. Innovative Land Use Planning to Encourage Multi-Modal Opportunities	NACOG, FMPO, or Coconino County lead w/input from Air Quality Steering Committee	1-3 years
9. Integrate Land Use, Transportation and Air Quality Decision-Making	NACOG, FMPO, or Coconino County lead w/input from Air Quality Steering Committee	1-3 years
10. Stabilize or Reduce Speeds on Unpaved Roads	Local Governments	1-3 years
11. Retrofit Municipal Diesel Vehicles and Equipment	Local Governments	1-3 years

5. IMPLEMENTATION OF THE OUTREACH PROGRAM

This chapter presents candidate elements for the educational outreach program and recommends elements for selection in implementing the program. The first portion of the chapter presents the goals, theme, target audiences, and potential program sponsors.

In February 2001, this Project Team completed the development of a similar implementation program for an Air Quality Outreach Program for Central Yavapai County.[12] Program elements were developed with input from that project's technical advisory committee as well as a Steering Committee comprised of area stakeholders. The second part of the chapter identifies recommended outreach techniques for implementation in Coconino County.

GOALS AND OBJECTIVES FOR THE PROGRAM

The overall goal of the outreach program is summarized by the Vision Statement presented in Chapter 3. As mentioned in Chapter 3, "Development and implementation of an Education/Outreach Program" is one of the action items recommended for adoption in support of the Vision Statement.

THEME OF THE OUTREACH PROGRAM

As a first step in developing the Outreach Program, a graphical representation was developed together with the Steering Committee. A logo was developed incorporating:

- Geography, nature, and landscape of Coconino County
- Characteristics of the environment
- Focus on preserving and improving air quality
- Appealing slogan
- Kinship with other air quality outreach programs sponsored by the Arizona Department of Transportation

Figure 6 introduces a proposed logo for the outreach effort. The graphic identifies the jurisdictions spearheading the effort without restricting the geographical extent to particular jurisdictional boundaries. Additionally, the logo stylizes the familiar profile of the San Francisco Peaks north of Flagstaff. Through the chosen slogan of AIR AWARE, focus is directed to the need to improve air quality in the County. The choice of AIR AWARE, which has been adopted by Central Yavapai County in a similar effort and is used on the ADOT Air Quality Web site, links the new Coconino program to the growing success and acceptance of these previously conducted efforts.

FIGURE 6. PROPOSED LOGO FOR THE AIR AWARE OUTREACH EFFORT

Source: Lima & Associates

TARGET AUDIENCES

Air quality affects everyone, and local residents and visitors alike will benefit from sustained air quality or suffer from increased air pollution. Therefore, the Outreach Program should target the general public, and special attention should be paid to ensure that all segments of the population are reached. Moreover, it is important that outreach activities strive to provide information in regard to the most effective strategies for improving air quality. Table 14 lists the air quality improvement strategies identified during the Visioning Session. Each strategy is paired with the potential target group affected by the strategy. Additionally, possible mechanisms for reaching the specific groups are identified.

Based on the control strategies, several segments of the population have been identified as being essential to the effectiveness of the Outreach Program. A database should be developed to manage this information. As the Outreach Program evolves, the database could be used to facilitate mailings and specifically indicate interested groups and individuals.

Stakeholder Database

A database application should be developed to track contacts in the identified target groups and other potentially interested stakeholders in the process. Figure 7 presents a possible form layout for such an application.

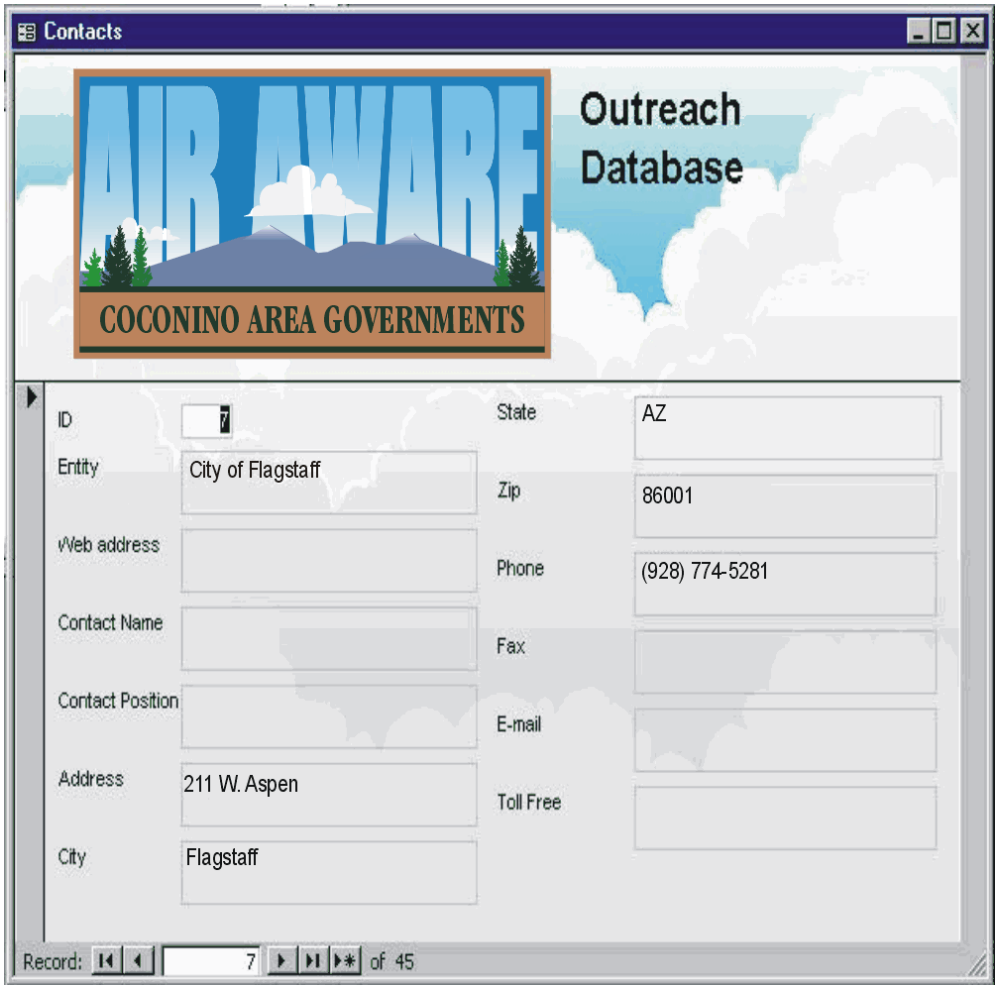
TABLE 14. MATRIX OF STRATEGIES FOR IMPROVING AIR QUALITY IN COCONINO COUNTY

Strategy	Possible Measure	What's Already Being Done	Target Groups	Outreach Measures
Encourage energy efficiency and renewable sources of energy	Municipal policy	• Greater Flagstaff Economic Council Renewable Energy Fair, August 2003 • Green building code • Arizona Regional Haze State Implementation Plan	• General public • Construction industry • Public agencies • Chambers of commerce	• Newsletter • Public service announcements • Information materials for booths
Educational and Outreach Program to sustain clean air	Voluntary program	• Arizona Public Service company policies • Arizona Regional Haze State Implementation Plan	• General public • Schools	• Fact sheets • Public service announcements • Educational programs
Alternatives to SOV travel	Municipal program	• Mountain Line and VanGo transit and paratransit services in the Flagstaff area • Pedestrian and bicycle lane construction guide • Transportation Demand Management program	• General public • Motor vehicle operators • Employers • Public agencies • Winter ski industry	• Deep discount passes • Educational materials • Bike and pedestrian trails map • Information on forming carpools and vanpools
Fugitive dust control plans with mitigation bond requirements	Ordinance	• Including county-wide road paving in Capital Improvement Program – as fiscally feasible • All-terrain vehicle restrictions	• Construction industry • Small timber logging • Building inspectors	• Provide informational materials through permitting process and on a local website
Clean burning fireplaces in new construction	Ordinance	• City of Flagstaff restricts sale of non-EPA certified devices	• General public • Contractors • Homeowners with wood-burning fireplaces	• News media • Provide information material through the permitting process and on a local website
Episode Curtailment Program for wood smoke	Municipal program	• Air curtain destructors available for $200,000 each can contain smoke from controlled burning • ADEQ open-burning rule	• Individuals and agencies Involved in open burning	• Public service announcements

TABLE 14. MATRIX OF CONTROL STRATEGIES FOR SUSTAINING AIR QUALITY IN COCONINO COUNTY (Continued)

Strategy	Possible Approach	What's Already Being Done	Target Groups	Outreach Measures
Innovative land use planning to encourage multi-modal opportunities	Municipal plans Zoning ordinances	• City of Flagstaff has established urban growth boundary; design review guidelines • County Comprehensive Plan, encouraging higher densities, is pending Board approval • Transit-oriented design in the Regional Transportation Plan	• Elected officials • Municipal planning agencies	• Internal directives from top management • Intergovernmental coordination and cooperation
Integrate land use, transportation, and air quality decision-making	Municipal policy	• Transit-oriented design in the Regional Transportation Plan	• State Legislature (eliminate wildcat subdivisions) • Elected officials • Municipal agencies	• Internal directives from top management • Intergovernmental coordination and cooperation
Stabilize unpaved roads Reduce speeds on unpaved roads	Municipal program	• "No Dust Area" signs posted • County CIP Promotes Improvement Districts • Flagstaff has a paving program; all dirt roads to be paved as resources permit • Neighborhood speed watches	• Elected officials • Municipal agencies • Neighborhoods	• Intergovernmental coordination and cooperation • Public service announcements
Retrofit Municipal diesel vehicles	Municipal program	• City of Flagstaff is using biodiesel in 100 municipal vehicles • Coconino County is evaluating the Flagstaff program	• Municipal agencies	• Publish success stories (Flagstaff experience) on local website • Source of information on other efforts to retrofit diesel vehicles and use alternative fuels is ictc@gladstein.org

FIGURE 7. AIR AWARE OUTREACH DATABASE FORM



Source: Lima & Associates

OUTREACH SPONSORS

Based on the database, efforts should be undertaken to identify potential outreach sponsors, who should be contacted to solicit their participation in the program. There are several ways in which stakeholders can participate:

- Jurisdictional buy-in, representation of AIR AWARE as a motto in civic functions.
- Jurisdictions and utilities could assist in funding the design and creation of collateral materials. Such materials can be included in monthly utility billings to residents, or AIR AWARE announcements can be included in newsletters, which are often included in such billings. At a minimum, these newsletters could display the AIR AWARE logo signifying the endorsement and participation of the jurisdiction or utility.

- School districts could develop AIR AWARE "units" for classroom use, and begin by ensuring that faculty members themselves are informed on clean air issues. Science classes could include segments on solar energy and alternative fuels, stressing the importance of future clean air to today's youth.
- Chambers of Commerce, service clubs, and other civic organizations could be asked to participate by assisting with funding, including the logo and information in their mailings, and/or recruiting volunteers to aid in making presentations to other groups.

Chambers of Commerce might incorporate the Air Quality Outreach Program into other Outreach Programs that the Chambers conduct. Other civic organizations and local jurisdictions should also be encouraged to become sponsors of the Outreach Program.

PROGRAM COMPONENTS

To enable the Outreach Program to effectively target the general public, a series of measures could be implemented to support the AIR AWARE program. Table 15 lists these possible mechanisms. Emphasis should be given to materials for community media including the following:

- Informational and educational fact sheets
- Public service advertisements for newspapers (area newspapers themselves should be encouraged to become sponsors of the campaign by running such ads, as well as announcements of AIR AWARE activities, free of charge)
- Public service announcement scripts for radio and television
- Press releases
- Graphical presentations
- Mass mailings

RECOMMENDED OUTREACH TECHNIQUES

This section presents the outreach techniques recommended for this project, including the use of "portal" links to ADOT's AIR AWARE Web site, fact sheets, and a slide presentation.

Air Aware Web Site

Following the recommendations of the Central Yavapai Study, ADOT developed an AIR AWARE Web site.[13] Over time, the site has been continually revised and expanded, and contains a section on the Coconino Project including the two previous working papers and the preliminary recommendations of the Visioning Session. The current home page of the site is shown in Figure 8. The current Web address for the site is http://tpd.az.gov/air/.

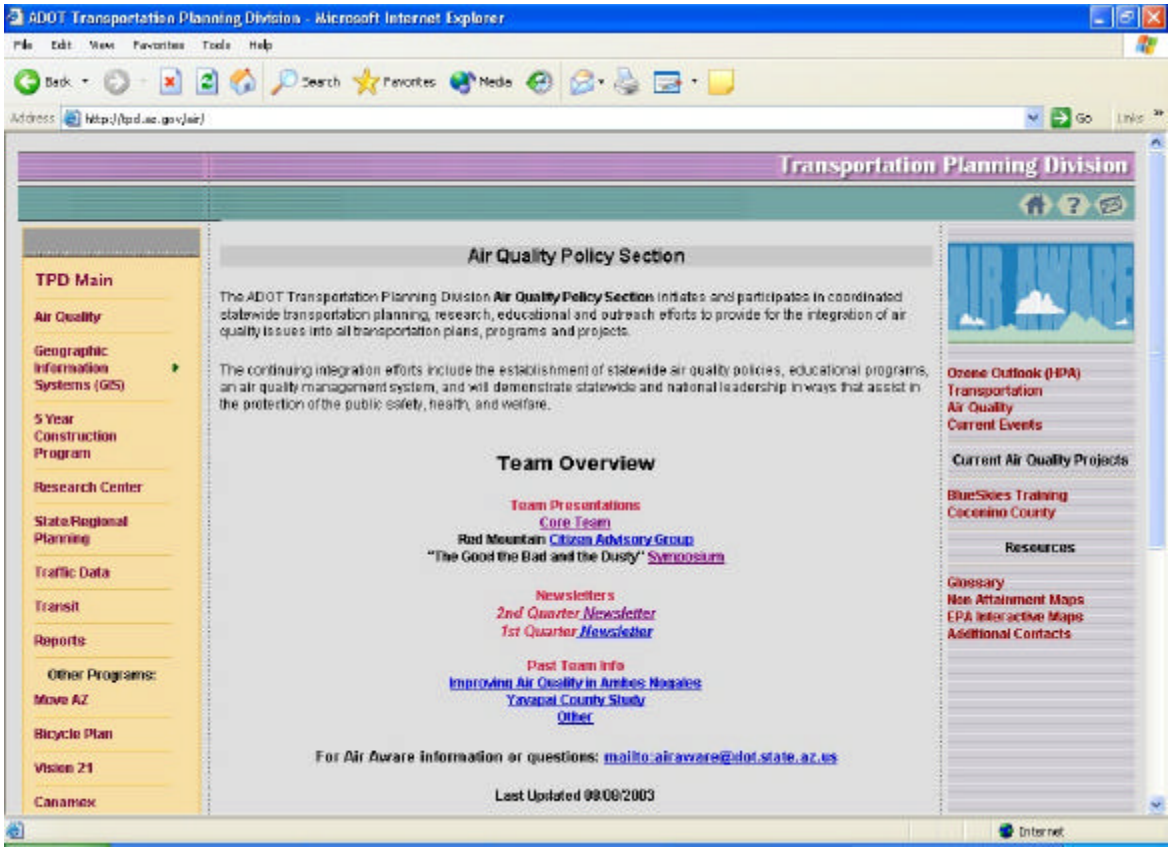
TABLE 15. POTENTIAL AIR QUALITY OUTREACH COMPONENTS

Potential Component
• Informational fact sheets – problem definition, description of current activities, key contact persons
• Educational fact sheets– description of air pollutants and strategies
• Scripts for radio and television public service announcements
• Feature articles for newspapers
• Poster boards
• Displays for open houses
• Speakers bureau
• Off-the-shelf videos
• Neighborhood meetings
• Business group meetings
• Structure for workshops
• Material for public area display
• Structure for telephone hot line
• Content for opinion polls
• Community access television program material
• Suggested briefings with decision makers
• Structure for public panel discussions
• Structure for press briefings
• Collateral material for mailings to target groups
• Syllabi for elementary, middle school, and high school air quality preservation units and accompanying classroom materials and handouts
• Content for Web site

ADOT personnel have been able to post updates to the site fairly promptly, responding to one of the principal concerns regarding informational Web sites. However, by its very nature, the ADOT site will always be statewide in scope. As additional areas and jurisdictions develop air quality-related outreach efforts involving ADOT affiliation or sponsorship, the ADOT site will become more complex. The "Coconino AIR AWARE" effort should consider implementing one or more "portal" sites of its own that could be linked directly to Coconino pages on the ADOT site. For simplicity of site maintenance, program updates should be forwarded to ADOT for uploading to the Coconino pages of their site. Candidate portals for the Coconino AIR AWARE effort include:

- Coconino County http://co.coconino.az.us/
- City of Flagstaff http://www.flagstaff.az.gov/
- Flagstaff Metropolitan Planning Organization http://www.flagstaff.az.gov/
- Flagstaff, Arizona Online http://www.flagstaff.az.us/

FIGURE 8. ADOT AIR AWARE WEB SITE HOME PAGE

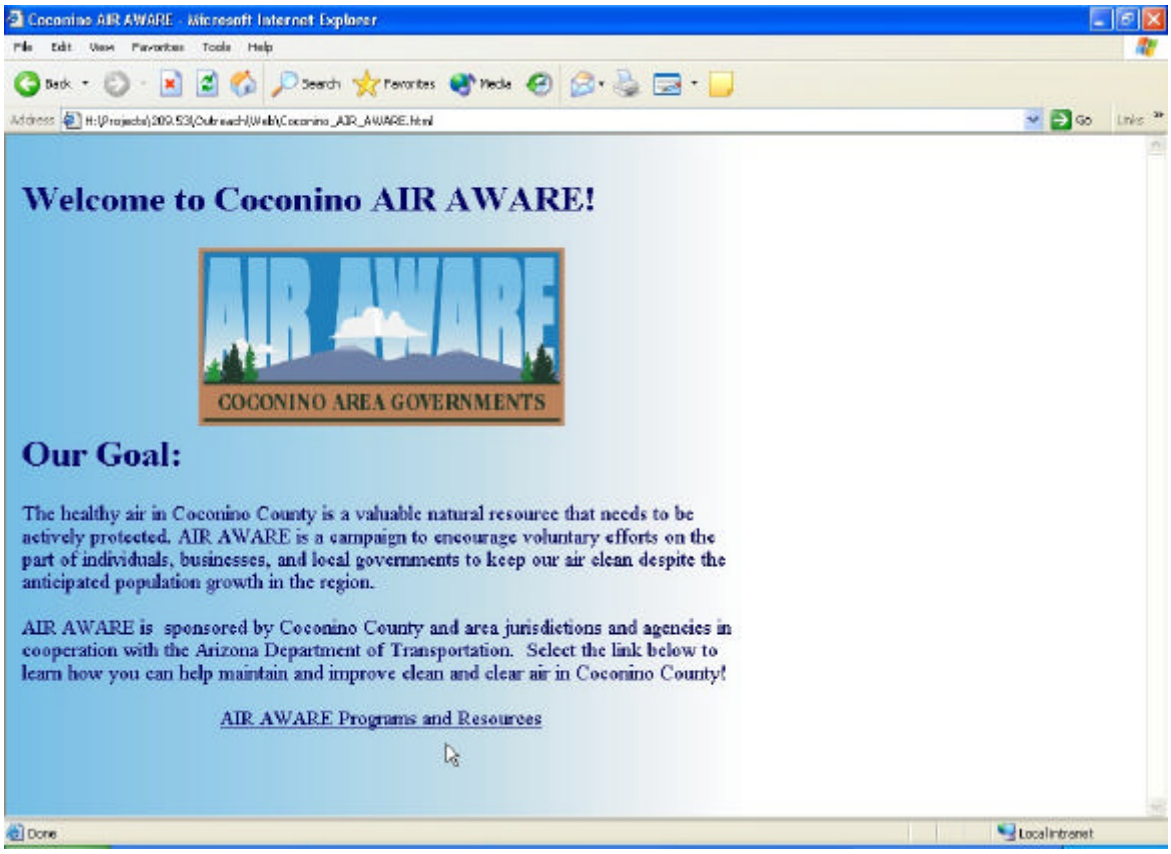


Source: Arizona Department of Transportation, Transportation Planning Division, Air Quality Policy Section

- Flagstaff Chamber of Commerce http://www.flagstaffchamber.org/
- GRAND CANYON Explorer http://www.kaibab.org/home.htm
- City of Williams http://www.ci.williams.az.us/
- City of Page and Lake Powell http://www.page-lakepowell.com/
- Williams–Grand Canyon Chamber of Commerce http://www.williamschamber.com/
- Navajo Nation http://www.navajo.org/

One concept would be to encourage any or all of these agencies to include the AIR AWARE logo on their Web site home pages. The AIR AWARE logo would be linked so that clicking on it would take the user directly to a portal page such as that depicted in Figure 9. Such a page could be part of the Coconino section of the ADOT site, or could be an independent site linked to the ADOT site. Ideally, this page could also be reached directly by entering an easy-to-remember Web address such as www.coconinoairquality.org or www.coconinoairaware.org.

FIGURE 9. EXAMPLE WEB PORTAL PAGE



Source: Lima & Associates

The expense of reserving and maintaining such a Web domain name would represent a small amount of the campaign's overall budget. This Web address and/or a toll-free air quality hotline number would be included in all literature published on behalf of the outreach campaign and would also be imprinted on promotional giveaways such as pens, T-shirts, and coffee mugs.

Fact Sheets

Fact sheets provide both general information and discussion of specific air quality strategies. The following fact sheets have been prepared as examples to be used as part of the educational outreach program.

- Energy Efficiency and Renewable Sources of Energy
- Improving Air Quality in Coconino County
- WoodBurning and Air Quality
- Land Use Planning, Transportation, and Air Quality

- Alternatives to Single Occupant Vehicle Travel
- Controlling Construction Dust
- Diesel Vehicles and Equipment

Drafts of these Fact Sheets are contained in Appendix A.

Slide Presentation Script

A draft slide presentation script has been prepared for the Outreach Program and is included in Appendix B. This presentation has been designed for the general public and summarizes the visioning process, presents control strategies, and provides suggestions regarding how the viewer can aid in improving air quality.

EDUCATIONAL OUTREACH

The Project Team identified schools as a key target group for the Outreach Program. In addition, chambers of commerce in Coconino County could incorporate elements of the Air Quality Outreach Program into their annual programs of work and assist in obtaining private sector participation and sponsorship. The chamber in each community could introduce the program to grade schools, high schools, and community colleges.

Elementary, Middle, and High School Programs

Educational programs could be developed internally through the curricula of local schools and can also be obtained from commercially available sources. Materials that could be developed locally include:

- AIR AWARE lesson plans and fact sheets for administrators and teachers
- AIR AWARE educational materials such as posters and workbooks for students
- Coloring books, games, and puzzles for younger students

The EPA Web site has an EPA Student Center at http://www.epa.gov/students/ that includes an air quality section. Sites linked to the Air Quality page include a "Plain English Guide to the Clean Air Act", an environmental atlas, and a site discussing air quality issues related to National Parks.

Local and regional agencies have also developed educational programs. For example, the Puget Sound Clean Air Agency (PSCAA) has developed "Clean Air Express", an air quality resource manual for K-12 teachers that can be downloaded from the PSCAA Web site at http://www.pscleanair.org/news/cleanairexpress.

Northern Arizona University Involvement

As was discussed in Chapter 3, Dr. Terry Baxter, Ph.D., P.E., of the Department of Civil and Environmental Engineering at NAU participated in the Visioning Session and provided background support by presenting a slide show entitled "We Can't Afford Polluted Air!" that had previously been developed by the Department. The University has played a key role in guiding and supporting the environmental concerns and goals of the region—NAU's involvement in the air quality outreach program will be no less important.

As the effort to sustain and improve the quality of County air progresses, the University can provide technical expertise and oversight and can serve as a supporting reference for techniques and strategies that are adopted and recommended by the program.

OVERVIEW OF OUTREACH IMPLEMENTATION

The implementation of the outreach program consists of three major components:

- Establish Institutional Framework
- Finalize and Publish Collateral Material
- Initiate Outreach Campaign

For each component, the project team has developed a list of actions needed to implement the outreach program. The specific actions for implementing the program are listed in chronological order in Table 16, which is structured as a template to be used in assigning responsibilities and milestones for each of the program components.

Once the institutional framework has been established, the program coordinator and the coordination team or Technical Advisory Committee can oversee and assign the action items included in the other components. When milestones and responsibilities for each of the action items in Table 16 have been identified, a Gantt chart can then be developed to highlight the interdependency of the various components and track the progress of program implementation.

TABLE 16. AIR QUALITY SUSTAINABILITY OUTREACH IMPLEMENTATION PLAN TEMPLATE

Action	Responsibility	Schedule
Establish Program Framework		
Identify Sponsoring Agency or Agencies ….		
Establish Outreach Coordinator……		
Establish Coordination Team……		
Finalize and Publish Collateral Material		
Promotional Brochure ……		
Clean Air Action Plan ……		
Web site ……		
Fact Sheets……		
Presentation……		
Lesson Plans……		
Workbooks and other educational collateral .		
Initiate Campaign		
Get Buy-in from Cites, County, FMPO……		
Get Buy-in from business community ……..		
Issue Press Release (Media Blitz) ……		
Hold Press Conference ……		
Present Overview of Outreach Program……		
Conduct Speaking Engagements and Stakeholder visits ……		
• Chambers of Commerce ……		
• Community Colleges……		
• Environmental organizations ……		
• Major Employers ……		
• Northern Arizona University……		
• Public Works Directors ……		
• School Districts ……		
• Service clubs ……		
Establish On-going Campaign Elements		
Fundraising and budget……		
Outreach product update procedures……		
Printing and distribution procedures ……		
Program oversight and monitoring ……		
Speakers' Bureau and scheduling procedures		
Staffing and volunteers ……		

APPENDIX A. SAMPLE OUTREACH FACT SHEETS

FACT SHEET

ENERGY EFFICIENCY AND RENEWABLE SOURCES OF ENERGY

Reducing electricity use saves energy. Moreover, dependence on and use of fossil fuels could be reduced if more electricity were generated from renewal sources such as solar, wind, geothermal, and biomass. Increasing energy efficiency and use of renewable sources reduces the combustion of petroleum products to produce electricity which, in turn, reduces carbon dioxide and nitrogen oxides emitted by power plants.

Energy Efficiency. A wide range of cost-effective energy efficiency measures exist, but there are barriers that prevent their widespread adoption. Financial incentives and mandatory energy efficiency standards could be implemented by states and tribes. Other recommended actions to reduce energy consumption include consumer information and education, utility and environmental regulatory policies, and utility rate reforms.

Renewable Sources of Energy. With the exception of wind resources, generation of electricity from renewable sources is generally more expensive per kilowatt-hour than generation of electricity from conventional power plants fired by coal, oil, or natural gas. To realize the considerable potential that exists in the western states for generating power from renewable resources, states could provide financial incentives for the production and consumption of renewable energy. In addition, customers who want to purchase renewable-generated electricity should be given the option of purchasing part of their power through a subsidized "green pricing program". To improve the performance of such a program, states, tribes, and local governments could adopt complementary policies that lower transaction costs for renewable electricity products and services.

In 2004, Arizona Public Service (APS) doubled its financial incentives and now rebates up to half the cost of solar equipment bought by its customers. On March 24, 2004, APS broke ground on a unique solar trough generating station that uses energy from the sun to make steam that turns a turbine generator. These initiatives will help APS meet the Arizona Corporation Commission's requirement that regulated utilities in the state obtain at least one percent of their electricity from renewable sources such as solar, wind, and biomass by 2005.

WHAT YOU CAN DO:

1. Use energy efficient "Energy Star" appliances.
2. Minimize personal consumption of electricity and petroleum products.
3. Participate in "green power" initiatives sponsored by local energy providers.
4. Purchase solar equipment for your home/business, if feasible.

FACT SHEET

IMPROVING AIR QUALITY IN COCONINO COUNTY

Coconino County is one of the fastest growing areas in Arizona. Although the region does not currently violate the national standards for any air pollutants, the dramatic growth in population, jobs, and vehicle travel expected during the next twenty years poses a potential threat to maintaining clear and healthy air. In order to prevent the degradation of air quality, elected officials, local government representatives, and others with environmental interests in Coconino County participated in an air quality visioning session sponsored by the Arizona Department of Transportation (ADOT) in April 2003. The purpose of the session was to:

- Develop an air quality "vision" reflecting consensus of stakeholders from Coconino County
- Evaluate current trends and identify key pollutants that pose the greatest threats to healthy and clear air
- Select and document the best strategies for controlling air pollution as the population continues to grow

Central to the "vision" of participants was preserving Coconino County's reputation as having some of the cleanest air in America. To achieve this vision, citizens and all levels of government need to work together to preserve healthy air, improve visibility, and reduce greenhouse gases.

Visioning participants evaluated 50 potential air quality improvement strategies and selected ten for further consideration. The top ten strategies included encouraging energy efficiency and use of renewable energy sources, conducting educational and outreach programs, alternatives to driving alone, construction dust control plans, banning decorative wood-burning fireplaces in new homes, programs to control wood smoke, improved coordination among planning agencies and decision-makers, reducing dust from unpaved roads, and controlling emissions from older diesel vehicles and equipment.

WHAT YOU CAN DO:

1. Reduce your consumption of electricity and petroleum products.
2. Walk, bike, take the bus, or form a carpool instead of driving your car.
3. Do not burn wood in your fireplace when the winds are calm.
4. Drive slowly (less than 15 mph) on unpaved roads.
5. Support your local agencies and elected officials in their quest to improve air quality.

FACT SHEET

ALTERNATIVES TO SINGLE OCCUPANT VEHICLE TRAVEL

Despite advances in recent years by both foreign and domestic automobile manufacturers, cars and trucks are still significant sources of air pollution. State, Tribal, and local governments and businesses can all take steps to limit the number of vehicle miles traveled by encouraging travelers to use alternatives to driving alone. These steps include new programs and capital and operating expenditures for bus system improvements, bicycle and pedestrian facilities, regional ridesharing programs, and park and ride lots. The objective of these programs and improvements is to make alternative modes of travel more attractive and convenient, so that people will reduce their number of single occupant vehicle trips.

Local governments in Coconino County could take the lead in planning and implementing transportation programs and improvements that improve the competitiveness of alternative modes. The Clean Air Action Plan lead agency would be responsible for regional programs, such as ridesharing, and would encourage coordination among alternative modes throughout the County.

WHAT YOU CAN DO:

1. Encourage your community to develop an extensive network of bike paths, as Flagstaff has done.
2. Residents of Flagstaff and the surrounding area should encourage and support the expansion of the Urban Trail System to keep pace with area growth and development.
3. Support the use of “traffic calming” devices such as speed bumps and roundabouts where needed in your neighborhood.
4. Support local initiatives to implement or expand transit service, such as adding a downtown circulator or service on evenings and weekends.
5. Urge decision-makers to implement or improve accessible sidewalks and pedestrian-friendly street redesign.
6. Take advantage of a ride-sharing program offered by your community or employer, or encourage them to implement such a program. Your Clean Air Action Plan coordinator can provide you with the details.

FACT SHEET

CONTROLLING CONSTRUCTION DUST

Dust is actually made up of particles of many different sizes. The largest particles that are readily visible to the naked eye settle back to the ground fairly quickly. Smaller particles stay airborne and can be inhaled deep into the lungs where they interfere with breathing and contribute to respiratory illnesses. Even smaller particles contribute to the haze that degrades views at places such as Grand Canyon. The small, invisible particles (less than 10 microns) that remain in the air are called particulate air pollution (PM_{10} or $PM_{2.5}$).

The objective of a dust control plan is to limit dust generated by construction and earthmoving activities. These activities can be major sources of particulate air pollution in urban areas. The plan must show how dust will be controlled before, during, and after the construction/earthmoving activities occur. The dust control plan would be approved by a government agency before grading and drainage could proceed.

The activities requiring dust control on the work site include drilling and blasting, excavation, cut-and-fill, material storage and handling, and vehicles traveling on unpaved surfaces. In addition, mud and dirt tracked out onto paved public roadways need to be controlled.

A typical dust control plan for a work site would identify the potential sources of dust, the location of delivery, transport, and storage areas, the types of material to be stored, and the size of storage piles. In addition, the plan would describe measures to be applied at the site during periods of dust generation, including the frequency and duration of watering or other suppressant application. The plan would also address control of material track-out where unpaved access points join paved surfaces and handling of loads during transport to and from the work site (i.e., all truck loads covered with no less than 3 inches of freeboard).

The dust control plan could include a variety of work practices such as frequent watering of disturbed surfaces and storage piles and use of wind fences for control of windblown dust. Other site-specific prevention and mitigation measures could include paving of roads and access points early in the project, compaction or stabilization (chemical or vegetative) of disturbed soil, phasing of earthmoving activities, reduction of mud and dirt tracked onto paved streets, installation of truck wash or devices to remove dirt from vehicles and tires prior to exiting the site, and periodic cleaning of the street near work site entrances.

FACT SHEET
WOODBURNING AND AIR QUALITY

Wood burning contributes to carbon monoxide and particulate air pollution. Carbon monoxide and particulates are unhealthy to breathe at high concentrations, especially for the young, the elderly and those with lung or cardiovascular disease. Although Coconino County does not currently violate the national air quality standards for these pollutants, significant increases in population, jobs, and vehicle travel over the next twenty years could degrade the air quality. Reducing wood burning is one way to offset the negative effects of future growth.

The incomplete burning of wood causes tiny particles and gases, including carbon monoxide, to be released into the air. Because wood burning typically occurs in the winter, higher amounts of carbon monoxide and particulate pollution can also occur then. To make matters worse, temperature inversions often take place on winter evenings, sandwiching a layer of warmer polluted air between a cooler upper air mass and the ground. This "traps" air pollution until the next morning, when traffic and wood burning add more emissions, resulting in even higher concentrations. The Arizona Department of Environmental Quality has estimated that wood burning may cause as much as 40 percent of the pollution in neighborhoods during temperature inversions. So it is especially important to limit wood burning activities during winter inversion conditions.

Arizona taxpayers can deduct up to $500 from state income for the cost of converting an existing wood-burning fireplace to natural gas or electric logs or a permanent EPA-certified wood stove insert or replacing an existing wood stove with an EPA-certified one.

WHAT YOU CAN DO:

1. Take advantage of the Arizona tax deduction and convert your wood burning fireplace to natural gas or electric logs, or an EPA-certified low-emission device.
2. Use properly seasoned (dried at least 6-8 months) firewood to provide the cleanest, cheapest and safest fire.
3. Do not use anything (i.e. organic material, rubbish, or chemically treated wood) but paper to start the fire.
4. Avoid recreational use of wood burning fireplaces on winter evenings and mornings when winds are light and the temperature is less than 40 degrees.
5. If smoke is visible from your chimney, open the damper to provide more air.
6. Allowing a wood fire to smolder produces the most pollution and greatly increases creosote buildup in the chimney.
7. Support local ordinances requiring clean burning fireplaces and wood stoves in new construction.

FACT SHEET

LAND USE PLANNING, TRANSPORTATION, AND AIR QUALITY

As urban areas of Coconino County increase in population, improving the air quality will depend on careful planning by local governments with informed citizen input to limit the increase in vehicle miles traveled within the area to the extent possible. Limiting VMT will also reduce greenhouse gases, gasoline consumption, and reliance on imported oil.

When plans, programs and policies at all levels of government in Coconino County are updated, these should be reviewed to determine if land use, transportation, and environmental issues are properly coordinated. Once these are adopted, day-to-day decisions of local government officials need to reflect the coordination of these issues. Such coordination may not be easy because land use issues such as zoning, transportation and traffic issues, and environmental impacts are often handled by different departments or individuals within each agency.

To ensure that land use, transportation and air quality decisions are integrated across Coconino County, coordination also needs to take place between levels of government. For example, County staff should be familiar with the plans, programs, policies and decisions being made by the City of Flagstaff and the Flagstaff MPO, and vice versa. Coordination with other large land owners and policy-makers, such as the Tribal, state, and federal governments, is also important.

The Arizona Department of Transportation is currently conducting a land use, transportation, and air quality integration study. When completed, this study may be useful in providing guidelines for more integrated policies and decision-making throughout Arizona.

WHAT YOU CAN DO:

- Encourage your elected officials to maintain an understanding of the land use, transportation, and environmental implications of actions they propose.
- Suggest that local government staffs consider the land use, transportation, and environmental implications of each proposed action and point out significant problems or discontinuities with internal programs and policies or those at other levels of government.
- Promote land use plans and policies that will increase the use of modes other than the single occupant vehicle.

FACT SHEET

DIESEL VEHICLES AND EQUIPMENT

New federal standards that will soon go into effect will reduce carbon monoxide, volatile organic compounds, nitrogen oxides, and particulate emissions (PM_{10} and $PM_{2.5}$) from new diesel vehicles and engines. Ultra low sulfur diesel fuel will be available in mid-2006 and stricter emission standards for new diesel vehicles and engines will begin in 2007. However, older diesel engines will still be emitting high levels of pollution for many years, because these engines typically last 20-35 years. To reduce emissions from these older engines, local governments need to institute programs to reduce idling and retrofit or replace older diesel vehicles and equipment. Diesel exhaust emissions contribute to the degradation of visibility and may also be carcinogenic.

Retrofitting municipal diesel vehicles and equipment to reduce emissions in Coconino County could take many forms, including conversion to alternative fuels (i.e., biodiesel), installation of oxidation catalysts and particulate filters, and application of idling reduction technology (i.e., electrification kits). These retrofit technologies could be applied to garbage trucks, street sweepers, school buses, or off-road diesel equipment owned by city or county governments. Local governments could also conduct voluntary programs that encourage reductions in idling of diesel vehicles and equipment.

The City of Flagstaff has issued a request for bids to supply the City's vehicle fleet with biodiesel. The product will be used in over 100 city vehicles including fire trucks, refuse trucks, and roadway maintenance vehicles. Other local governments in Coconino County could team with Northern Arizona University to request a grant from EPA to conduct a demonstration project to retrofit municipal diesel vehicles and equipment.

WHAT YOU CAN DO:

Support local government efforts to retrofit municipal diesel vehicles to reduce air pollution.

APPENDIX B. SAMPLE SLIDE SHOW SCRIPT

IMPROVING AIR QUALITY IN COCONINO COUNTY

Slide No.	Script
1	Coconino County is renowned for its sweeping vistas, mountains, forests, parks, and canyons. Residents of Coconino County want to preserve their beautiful and healthy outdoor environment. Local actions to reduce air pollution, improve visibility, and control greenhouse gases will help preserve this high quality of life for future generations.
2	A visioning process was conducted in Flagstaff on April 30, 2003, to establish a framework for improving air quality in Coconino County. Representatives from local governments, chambers of commerce, transportation providers, NAU, and environmental groups participated in the process.
3	During the morning session, the visioning group received background information on air quality. During and after lunch, participants conducted a strategic analysis, formulated a vision statement, and identified actions that might be taken to improve air quality.
4	Visioning participants identified a large number of potential sources of air pollution in Coconino County, including: single occupant vehicles, trucks traveling on the Interstates, fireplaces, transport of pollution from other areas such as Los Angeles, power plants, construction dust, cinders used to de-ice roads, tourist traffic and traffic congestion, in general, older vehicles, unpaved roads, prescribed fires, and droughts.
5	During a lunchtime brainstorming session, participants analyzed potential strengths, weaknesses, opportunities, threats and constraints that might impact the County's ability to improve air quality. Some strengths that were identified include: (1) active groups such as Friends of Flagstaff's Future and Keep Sedona Beautiful, (2) a spirit of cooperation among local governments, (3) the area does not violate federal air quality standards, (4) the availability of local expertise at NAU, and (5) potential use of solar energy.
6	Some potential weaknesses were: (1) high use of wood for heat, (2) rural nature of the county leads to automobile dependence, (3) prevalence of dirt roads on Indian lands and remote areas, (4) low per capita income leads to use of older vehicles, and (5) state laws protecting wildcat subdivisions.
7	In the afternoon, participants were asked to contribute ideas that would be suitable in crafting an air quality vision statement for Coconino County. The vision statement shown on this slide incorporates the key phrases and concepts provided by participants.
8	As the final step in the visioning process, participants reviewed fifty air quality improvement strategies that might be implemented in Coconino County. The group then prioritized the most promising strategies; the ten highest ranking strategies and the air quality goals they support are shown on this slide. The preferred strategies address a broad array of sources and concerns. The "top ten" support actions to increase energy efficiency and reduce dependence on non-renewable sources; conduct a clean air educational/outreach

Slide No.	Script
8 (Continued)	program; encourage alternatives to single occupant vehicles; control dust created by construction and unpaved roads; reduce wood smoke; address air quality in local planning and decision-making, and reduce emissions from diesel vehicles.
9	The air quality vision statement and preferred strategies establish a framework for a Clean Air Action Plan for Coconino County. This slide identifies major tasks, responsibilities and timeframes to ensure that the vision for improving air quality becomes a reality in Coconino County. Since air quality is a regional issue that transcends jurisdictional boundaries, it is envisioned that Coconino County, the Flagstaff MPO, or the Northern Arizona COG would assume the lead role in implementing the Clean Air Action Plan.
10	One of the "top ten" strategies identified by the visioning group is an educational and outreach campaign to improve air quality. Sample materials to support such a campaign, including a prototype web page and fact sheets, have been developed for Coconino County.
11	Some things that you as individuals can do to improve air quality are: • Keep your vehicles well-tuned • Replace air filters regularly and keep tires properly inflated • Carpool, take the bus, ride a bike or walk to work or school • Avoid driving during rush hours
12	• Drive newer, lower-emission vehicles whenever you have a choice • Refuel your vehicle after 5 p.m. in the summer • Don't "top off" or spill fuel during refueling • Drive 15 mph or less on unpaved roads • Limit use of off-road vehicles • Don't park on unpaved parking lots or vacant lots • Telecommute, if possible
13	• Mow the lawn and use other gasoline-powered equipment after 5 p.m. • Avoid using leaf-blowers • Limit use of your wood-burning fireplace and use dry wood • Upgrade to a clean-burning stove or fireplace • Encourage your community to provide natural gas service for heating and cooking • Encourage "clean" industries
14	The next step is for Coconino County to identify a lead agency to oversee implementation of the Clean Air Action Plan and top ten strategies developed as part of the local visioning process. For more information on the "Air Aware" campaigns being conducted in Coconino County and elsewhere in Arizona, check out the ADOT website at http://tpd.az.gov/air/index.htm.

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