Utah FOUNDATION Research Report

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THE AIR WE BREATHE

A BROAD ANALYSIS OF UTAH'S AIR QUALITY AND POLICY SOLUTIONS

HIGHLIGHTS

- Utah has some of the highest levels of short-term air pollution in the United States; Utah's periodic summer ozone issues are not as dire, although several areas are nearly out of federal compliance.
- Analysis of the past 15 years of Utah's air pollution shows no discernible increases or decreases in days with poor air quality.
- In terms of fine particulate matter reduction, the EPA forecasts that the seven U.S. counties which will benefit the most from proposed Tier 3 automobile and fuel standards are all in Utah: Box Elder, Cache, Weber, Davis, Tooele, Salt Lake and Utah counties.
- Wood smoke may be a larger contributor to winter air pollution than previously thought, accounting for approximately 10% of Utah's fine particulate matter.
- In addition to vehicle emission reduction, if there is one thing that average Utahns can do to reduce winter pollution it is refrain from burning wood and other solid fuels before and during periods of bad air quality.
- The Uinta Basin is on the cusp of being out of compliance with federal ozone standards; the Utah Department of Air Quality will likely propose numerous measures in the coming months to clamp down on the biggest emitters.

Air quality has become a major concern for Utahns and Utah policy makers, particularly with regard to high ozone levels and periodic winter inversions. The Wasatch Front and Cache County are known to have some of the worst short-term fine particulate matter pollution in the country.[1] While Utah cities do not top the list for ozone, numerous areas of the state do have disconcertingly high levels.[2] Studies show that ozone and inversion-type particulate exposure can shorten life expectancy, exacerbate cardiovascular and respiratory issues, and increase infant mortality rates.[3] Poor air quality may also affect the state's highly-valued economic development and tourism. These concerns led to a flurry of pollution-related legislation that was proposed during Utah's 2013 General Session, and even more is proposed for 2014.

Previous work by Utah Foundation has shown that air quality is a priority for Utahns. In the 2013 Utah Foundation Quality of Life Index, survey respondents ranked "the quality of the environment, such as air and water quality" as the fifth most important of 20 factors. Air quality was first in response to the open-ended question about the most important thing that could be improved to increase the quality of life of Utahns.[4] Additionally, in the 2012 Utah Priorities Project survey, 53% of Utahns were concerned or very concerned with environmental issues in general, while 64% of Utahns were concerned or very concerned with air quality specifically.[5] A 2013 survey produced by Envision Utah indicated that almost all Utahns (99%) are willing to act to clean their air.[6]

This report analyzes the trends, science, health concerns, and policy solutions related to the two primary pollutants contributing to Utah's air-pollution issues – ozone and fine particulate matter. There are many policy options to help clean up the air that Utahns breathe. Most of them are very small, incremental measures that many Utahns will follow with a little coaxing and education. The Envision Utah survey showed that 79% of Utahns are willing to chain trips during bad-air days, 65% will avoid idling their cars, 62%

Figure 1: Air Pollution Mitigation Strategies

Individual Actions
Increase transit usage
Drive zero-emission vehicles
Drive newer vehicles
Maintain vehicle emissions systems
Carpool
Reduce idling
Chain trips (to reduce vehicle cold starts)
Telecommute on bad air days
Do not use wood (and solid fuel) on no-burn days
Buy low-VOC consumer products
Install solar power and hot water systems
Lower thermostats
Update home heating systems
Business Actions
Encourage alternative to single occupant commuting
Empower telecommuting on bad air days
Implement reduced iding and driving policies
Update commercial heating systems
Install commercial cooking catalysts
Install solar power systems
Improve oil and gas exploration practices
Regulatory Actions
Implement Tier 3 emissions standards
Increase fuel economy standards
Adopt California emissions standards
Strengthen industrial standards
Ensure wood (and solid fuel) no-burn compliance

will avoid errands, and 56% will turn down their thermostats by two degrees.[7] This report touches on many of these, but focuses on larger steps that individuals, businesses, and the state can take to clean Utah's air.

Since vehicles are responsible for a majority of the ozone and fine particulate matter in the state, many of the policy measures in this report target ways to decrease automobile pollution, with particular emphasis on Tier 3 automotive and fuel standards. Utah is facing rapid population growth and may find it difficult to reduce these levels as much as needed. However, new federal automotive fuel standards – some recently implemented and some only proposed – should improve air quality in Utah counties more than any other counties in the nation.

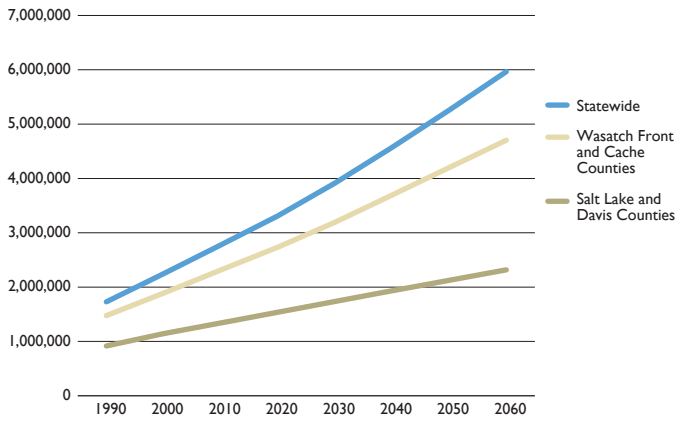
This report also deals with wood smoke issues in depth; Utah has banned cigarettes in public spaces, but smoke from wood and other hard fuels play a significant part in the state's clean air and may be much more harmful to Utahns than cigarettes. Wood smoke regulations are quickly topping the list of action items in the state because if there is one way individual Utahns negatively affect air quality during inversion periods more than almost anything, it is lighting wood fires in their fireplaces and stoves. Interestingly, the Utah Clean Air Action Team – a coalition of air quality experts – independently determined to also focus its early efforts on Tier 3 automotive and fuel standards and wood smoke.

AIR QUALITY OUTLOOK

Six Utah counties are among the fastest-growing counties in the nation, including Wasatch, Grand, Washington, Cache, Box Elder, Utah, and Uintah.[8] In terms of total population growth, Utah is expected to double in size by 2040; this equates to an additional 2,000,000 along the Wasatch Front (see Figure 2).[9] Numerous groups are planning for this growth because of its effects on many facets of Utah life, including housing, water, transportation, and air quality.

The number of miles that Utahns are traveling per capita has remained fairly steady in recent years.[10] However, the total vehicle miles traveled by Utahns (VMT) have trended upwards because of population growth. Transportation experts predict that VMT will double by 2040.[11]

Figure 2: Utah Population Growth, Actual and Projected, 1990-2060



Note: Area population trends are shown; Wasatch Front and Cache County have higher fine particulate matter levels and Salt Lake and Davis Counties have higher ozone levels.

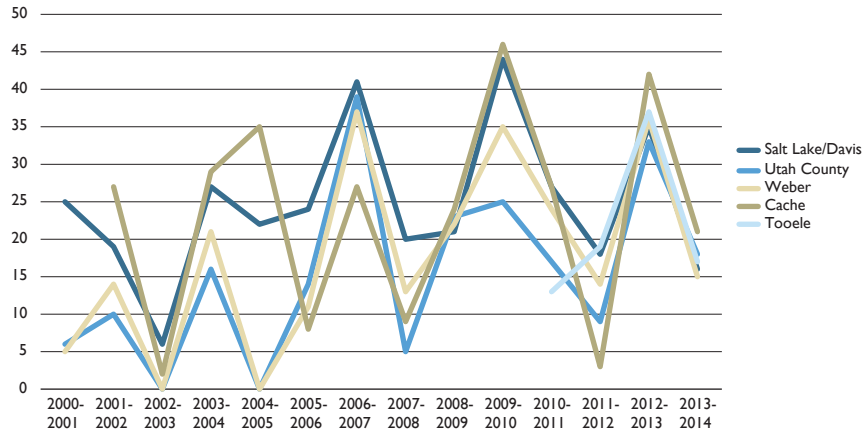
Source: Utah Governor's Office of Management and Budget 2012 Baseline Projections.

Even with the increase in VMT, vehicle emissions are expected to continue decreasing to approximately half of the 2013 level by 2030, after which emissions are expected to gradually increase.[12]

Most Utahns believe that air quality has worsened in the past 20 years.[13] However, annual emissions from all pollutants are estimated to have decreased across the state; for example, in Salt Lake County emissions are estimated to have decreased by approximately 47% between 2002 and 2011.[14] These estimated decreases have not necessarily translated into fewer high pollution days (see Figures 3 and 4). Further, several areas across the state have more recently landed above federal pollution standards which have become more stringent over the years.

Utah Foundation's analysis of ozone and fine particulate matter shows no discernible overall trends between the late 1990's and mid-2013 other than the obvious seasonal trends. While some years have higher spikes in pollution than others, air quality does not appear to be getting statistically better or worse at any individual monitoring station.[15]

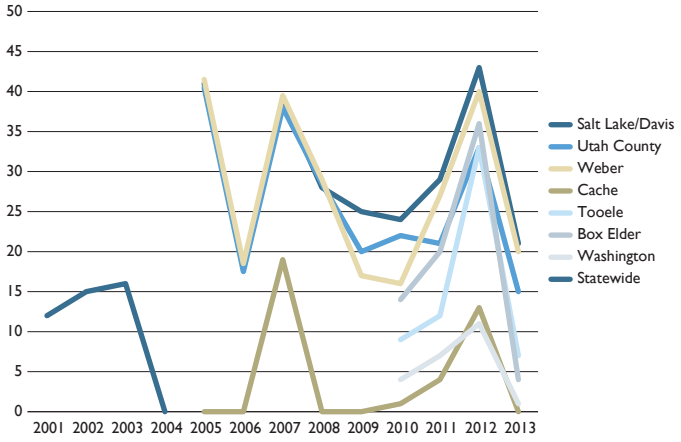
Figure 3: Winter Days with High Levels of Fine Particulate Matter (PM 2.5) by County, 2001-2014



Note: Winter 2013-2014 include mandatory days thorugh January 10; current manditory action is 25 micrograms and above; data before and including 2011-2012 include both "yellow" and "red" days of 25.5 micrograms and above.

Source: Utah DAQ.

Figure 4: Summer Days with High Ozone Levels by County (Statewide until 2004), 2001-2013



Note: Data are for ozone levels greater than 0.068 parts per million.

Source: Utah DAQ.

HISTORY OF CRITERIA POLLUTANTS

Public health professionals' attention was directed toward the dangers of air quality and pollution beginning in the 1930s as localized smog caused illness and death. One of the first of these events was in the Meuse Valley, an area in Belgium that was considered one of the "most industrialized areas of continental Europe."[16] During the first week in December 1930, a fog of pollution covered the valley which resulted in 60 deaths and many illnesses.[17] Another large-scale incident occurred in Donora, Pennsylvania. For six days in October 1948, intense air pollution fell over the town of 14,000 people where "7,000 people were hospitalized or became ill" and 20 died from asphyxiation.[18] Lastly, London's "Great Smog of 1952" caused as many as 12,000 deaths and over 100,000 hospital admissions due to five days of thick pollution.[19]

Utah has been monitoring its air pollution since 1958, and Utah's Air Conservation Act was first adopted by the Utah State Legislature in 1968 during the decade of Utah's worst air pollution.[20] More than 100 other metropolitan areas operated air pollution control agencies before adoption of the U.S. Clean Air Act Extension of 1970 (Clean Air Act), often measuring sulfur oxides and large particulate matter.[21]

The federal government passed its first air pollution legislation in 1955 with the Air Pollution Control Act. It was designed to fund air pollution research. President Richard Nixon created the Environmental Protection Agency (EPA) by executive order in 1970.[22] This set the stage for the creation of a plethora of environmental legislation, rules, and regulations, including the Clean Air Act. Through the Clean Air Act and its amendments in 1977 and 1990, the EPA regulates emissions of stationary and mobile source "pollutants considered harmful to public health and the environment," also known as "criteria pollutants."[23]

The EPA requires Utah's Division of Air Quality (DAQ) to ensure the state's compliance with the EPA's air quality standards for the criteria pollutants. The National Ambient Air Quality Standards (NAAQS or "nacks") outline the maximum acceptable levels of the pollutants for each area of the United States. When an area falls within these acceptable levels it is considered in "attainment." If the area fails to comply with the pollutant standards it becomes a "nonattainment" area. The standards for all of the criteria pollutants (except carbon monoxide) are split into two categories: the primary standards and the secondary standards. The first provides "public health protection, including protecting the health of 'sensitive' populations such as asthmatics, children, and the elderly;" and second provides "public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings."[24] The DAQ operates over two dozen primary monitoring stations across the state to measure the six criteria pollutants. While this report focuses primarily on ozone and particulate matter in Utah, the other criteria pollutants are briefly described below.

Carbon Monoxide

Carbon monoxide is an odorless and colorless gas from the combustion of carbon-based fuel like oil, gas, coal, and wood. When breathed, the gas temporarily takes the place of oxygen in the bloodstream, thus reducing the amount of oxygen to organs.[25] The EPA set the first NAAQS for carbon monoxide in 1971. Downtown areas of Ogden, Salt Lake City, and Provo are considered "maintenance" areas because they were previous considered nonattainment areas by the EPA. However, with the efficiency of newer vehicles the state has become compliant with the NAAQS.

Lead

Lead is a heavy metal that accumulates in the bones to adversely affect organs and decrease the blood's oxygen carrying capacity. The EPA set lead standards in the mid-1970s. The phase out of lead from fuel by 1995 decreased air-borne lead dramatically.[26] Between 1980 and 1999, lead from vehicles and total lead in Utah's air decreased by approximately 95%.[27] Accordingly, Utah is compliant with air-borne lead NAAQS. Nonetheless, extraction and processing of metallic ores and other smaller sources continue to emit air-borne lead.

Sulfur Dioxide

Sulfur Dioxide (SO_2) is a colorless gas with a pungent odor. It is mainly emitted from power plants, oil refineries, and ore processing, but also from diesel engines and to a lesser extent gasoline engines. It has adverse respiratory effects and reacts with other chemicals to form fine particulate matter.[28] The standard for SO_2 was first set by the EPA in 1971. Salt Lake County and higher elevations of Tooele County (above 5,600 feet) are considered to have nonattainment levels of SO_2.[29] Nonetheless, the state has had better levels of compliance than in the past due in large part to technology upgrades at Utah's ore processors in the early 1980s and mid-1990s.[30] This report further details SO_2 only as it applies to the creation of fine particulate matter.

Nitrogen Oxides

Nitrogen dioxide (NO_2) is the indicator pollutant under the NAAQS for levels of nitrogen oxides (NO_X). It is a reddish-brown gas with a sharp odor. It has numerous adverse respiratory effects.[31] It also combines with volatile organic compounds (VOCs) to form ozone in the summer and combines with ammonia to form fine particulate matter during winter inversion periods. The NO_2 standard was first set by the EPA in 1971; Utah's emission levels are within compliance. This report further details NO_2 only as it applies to the creation of ozone and fine particulate matter.

Green House Gases

In 2007, the U.S. Supreme Court ruled that greenhouse gases are an air pollutant that the EPA can, and must, regulate under the Clean Air Act if it is found that such gases are harmful.[32] Since then the EPA has been acting to reduce greenhouse gases. In June 2012, the U.S. Court of Appeals for the District of Columbia found that CO_2 is one such greenhouse gas, and that regulating the emissions from vehicle tailpipes and large industrial emitters is neither "arbitrary nor capricious." The basis for the ruling was that CO_2 – which accounts for the lion's share of greenhouse gases – is altering the environment.[33] While CO_2 is naturally present in the atmosphere, the amount being created is too great to be produced by natural means.[34] In the last 20 years the issue of greenhouse gases has become a partisan touchstone, especially concerning the question of whether human-created greenhouse gases cause climate change. Regardless of these political issues, the regulation of greenhouse gases will have an impact on energy creation, transportation, and industry (which account for 40%, 31%, and 14% respectively of CO_2 emissions).[35] In 2009, two organizations petitioned the EPA to add CO_2 and six additional greenhouse gases to the list of NAAQS criteria pollutants.[36]

OZONE AND PARTICULATE MATTER IN UTAH

Ozone

Ozone is simply three oxygen atoms combined together. However, unlike the oxygen that animals breathe (diatomic oxygen or O_2), ozone is a powerful oxidizing agent that reacts with other gases and with plant and animal cells. It is a pale blue gas with a pungent smell, and it is the main component in smog.

Ozone is "good up high, bad nearby."[37] A protective layer of ozone is produced naturally in the stratosphere, some 15 miles above the Earth's surface. This layer reflects away some of the ultraviolet (UV) radiation which can cause cancer, cataracts, and can harm immune systems. The ozone layer can be depleted by certain human-made chemicals, though there has been a concerted effort around the world to reduce the use of these chemicals.

Ozone is not directly emitted into the air. Instead, it is typically created from fossil-fuel combustion exhaust which can then be altered by high temperatures and sunlight. Specifically, NO_X and VOCs react under high temperature and high radiation levels to reconfigure into ozone and other gases. Peak ozone levels in Utah tend to occur temporarily during the hottest times of the day during the hottest days of the year. While vegetation can reduce ozone levels by cooling the surrounding areas and removing pollution, vegetation can also increase ozone levels; some plants emit VOCs which then react with human-produced NO_X to create ozone.[38]

Smog was first observed in the 1940s in Los Angeles, which had the highest ozone concentrations in the world between the 1950s and 1970s. The EPA initially set an ozone standard in 1971. In 2008 the standard for ozone was reduced from 84 parts per billion (ppb) to 75 ppb. The measurement is based upon the fourth highest daily eight-hour average concentration, meaning that the EPA does not calculate the three highest ozone levels of the year ensuring that a few days of unusually high ozone levels do not result in an unnecessary review by the EPA.[39] Davis and Salt Lake counties are currently just below the ozone standards and are considered "maintenance" areas by the EPA.

Between 2010 and 2012, the Utah DAQ set up 27 additional ozone measurement sites in non-metropolitan areas. The results of this ozone study may indicate a potential nonattainment of the current NAAQS in Tooele, Summit, Wasatch, and Washington counties. Areas of the "Wasatch Back" mountain valleys had particularly high ozone levels during this study. Of the nine testing stations in the area, several had higher levels than along the Wasatch Front, with Parley's Summit experiencing more high-ozone days during the testing than Salt Lake City. Ozone can be carried hundreds and even thousands of miles from its original source by the wind, evidenced by the timing of the ozone peaks at ozone testing stations in the Wasatch Back; the farther east the stations from the Salt Lake valley, the later in the day the ozone peaks occurred.

High rural ozone levels may be the result of other conditions as well. The state's high mountain valleys have over 50% more solar radiation than the Wasatch Front; this, as noted, can contribute to the creation of ozone. Also, regional transportation along Utah's interstate highways adds to ozone production. Wildfires also elevate ozone levels. Even the Great Salt Lake has an effect; the highly reflective properties of the lake and the lake's wind patterns contribute to increased ozone levels in adjacent areas. Lastly, stratospheric ozone intrusion can cause localized ozone spikes.[40] During violent storms the "good up high" ozone in the stratosphere can mix with the surface air of the troposphere – typically in high mountain areas – resulting in particularly high levels of ozone.

One of the state's rural areas that is of particular interest to regulators and scientists is the Uinta Basin in eastern Utah. Even though ozone is generally formed in the summer due to sunlight and higher temperatures, the Basin has unusually high levels of winter ozone and is on the cusp of becoming a nonattainment area due primarily to oil and gas exploration activities in the area. The Utah DAQ is looking at potential rule-making options for the Uinta Basin. Importantly, the Utah DAQ's director indicated "there are a lot of low-hanging fruit" that could help bring the Basin into EPA compliance.[41]

In 2011 it was expected that the EPA would reduce the ozone standard from 75 ppb to between 60 and 70 ppb.[42] However, President Barack Obama halted the EPA's reduction request of the new standard due to "regulatory burdens and regulatory uncertainty," opting to wait until the completion of an EPA review that was to have been completed in 2013.[43] A reduction in the standard would put many areas in Utah and the western United State into nonattainment, in part due to ozone emissions from China that drift across the Pacific Ocean. A reduction to 70 ppb would put Tooele, Summit, Wasatch, Washington, Morgan, eastern Weber, Millard, and Juab counties at risk of nonattainment. The World Health Organization recommends an even lower ozone standard of 50 ppb.[44] Regardless of the standard, future ozone levels might be adversely affected by warmer temperatures. A report from the Union of Concerned Scientists analyzed the link between climate change and ozone levels. The organization estimated an increase of 1.2 ppb ozone in the United States resulting from each one degree Fahrenheit increase in average annual temperature.[45]

Particulate Matter

Unlike the other five criteria pollutants, particulate matter does not have a specific chemical compound. Instead, it is defined by its size. Particulates are small solid or semi-solid particles and tiny liquid

droplets suspended in the air that create haze.[46] They are formed from both chemical and mechanical processes. The chemical process is generally from fossil fuel combustion combined with other gases. Mechanical sources include fuel combustion, dust, fireplace and forest fires, mining, construction, vehicle wear (brakes, tires), and plant matter. The EPA uses the microgram, or one-millionth of a gram, to measure particulate matter. This is a very small amount; one ounce is equal to 28,349,523 micrograms.

"Inhalable coarse particles" are regulated by the EPA as PM_{10}.[47] The EPA began measuring coarse particulate matter in the 1980s.[48] PM_{10} is between 2.5 and 10 microns in diameter, about the size of dust, pollen, and mold.[49] These are generally large enough to be filtered by nose hair and lung cilia and then coughed out. Fine beach sand is about 90 microns in diameter. Human hair is between 50 and 70 microns in diameter.

The 24-hour air quality standard for PM_{10} has been 150 micrograms per square meter since 1987. It is "not to be exceeded more than once per year on average over 3 years," or must not be exceeded four times in three years.[50] Ogden has been in attainment for PM_{10} since January 2013. Salt Lake and Utah counties are nonattainment for coarse particulates due to "exceptional events" like dust and wildfires; Utah is currently seeking an exemption from the EPA due to these events.

This report primarily focuses on "fine particles" which are regulated by the EPA as $PM_{2.5}$.[51] $PM_{2.5}$ is directly emitted but is also formed by gases which are converted to particles. These gases are referred to as "precursors." About 95% of emissions from transportation, commercial sources, agriculture, residential sources, and industry are precursors while about 5% are particles. Ultimately, about 30% of Utah's $PM_{2.5}$ during winter inversions are directly emitted particles while about 70% begin as precursors but are formed into secondary particulates.[53] In Utah, $PM_{2.5}$ is made up mostly of ammonium nitrate.

Monitoring of fine particulate matter began in 1997 as measuring abilities improved and more precise instruments were widely available. This is particulate matter that is less than two and one half microns in diameter, or about one-twentieth the diameter of a human hair. $PM_{2.5}$ particles are most often combustion particles, organic compounds, and metals.[52] The maximum annual average level of $PM_{2.5}$ was 15 micrograms per cubic meter of air and reduced to 12 micrograms in 2012. All areas in Utah have been compliant with the annual level $PM_{2.5}$ since the Utah DAQ began monitoring in 2000. The change in 2012 will likely not put any areas in Utah into nonattainment with the annual average standards.

In addition to annual average levels, the EPA also has a standard for daily levels of $PM_{2.5}$. The EPA's standard for daily or 24-hour fine particulate matter is a bit more complicated that its annual average. The EPA calculates the 98th percentile of the 24-hour data which is averaged over three years. This ensures that a few days of unusually high pollution levels do not result in an unnecessary review by the EPA.[54] The NAAQS standard for $PM_{2.5}$ was initially set at 65 micrograms per cubic meter in 1997. It was lowered to 35 micrograms in 2006.

Due to the change of the 24-hour $PM_{2.5}$ standard in 2006, portions of Cache, Weber, Box Elder, Tooele, and Utah counties and all of Salt Lake and Davis counties have failed to meet the EPA's 24-hour standard for $PM_{2.5}$. Accordingly, since 2009 these counties have been categorized as nonattainment areas. There are numerous episodes throughout the year when Utah's cities have high levels of $PM_{2.5}$. The ones that cause the greatest concern are those during the winter inversion periods.

Figure 5: Particulate Matter Standards By Year of Inception and Change, Measured in Micrograms per Cubic Meter of Air

	1987	1997	2006	2012
Annual PM_{10}	150	150	150	150
Annual $PM_{2.5}$	n/a	15	15	12
24-Hour $PM_{2.5}$	n/a	65	35	35

Source: EPA.

Usually, Utah's valleys hold the warmest air, benches are cooler, and mountains are the coolest. While warm air rises, it cools off because the air pressure is lower at higher altitudes. Certain areas in Utah – like the Wasatch Front and Cache County – experience inverted temperatures at times during winter months. These inversions mean that lower temperatures remain below higher temperatures. Inversions begin when snow covers the ground. The snow reflects away the warming sunlight which decreases the normal mixing of warm air with colder air at higher elevations. If the air in the valleys is also stagnant because of stable weather and high pressure systems, particulate matter pollution begins to builds up. This layer of pollution further reflects away warming sunlight, additionally exacerbating the problem. Fog can also occur during inversion periods and increase pollutant concentrations. Because of Utah's geography and atmospheric phenomena, the only solution to the state's particulate pollution problem is to emit fewer particles into the air.

COSTS AND BENEFITS OF AIR QUALITY IMPROVEMENT

There are numerous reasons to improve air quality, though these improvements come at financial costs. This section reviews several of the air quality costs and benefits related to health, economic development, and federal highway funds.

Health

Studies related to pollution typically come to the same conclusion: it is bad. The trick is figuring out how bad it is. $PM_{2.5}$ and ozone have some similar health effects, and some that are specific to each pollutant. Many of these effects are detailed below

The average adult breathes over 3,000 gallons of air each day.[55] Studies show that ozone and short-term, high-level, inversion-type particulate in this air can shorten life expectancy, exacerbate cardiovascular and respiratory issues, and increase infant mortality rates.[56] There are also recent links to the incidence of autism in both $PM_{2.5}$ and ozone. [57]

One of the preeminent researchers on the health effects of air pollution is Dr. C. Arden Pope from Brigham Young University. A study by Dr. Pope in the early 1990s looked at respiratory hospital admissions from 1985 to 1989 from Utah, Salt Lake, and Cache counties. During this period, Utah County experienced a unique natural occurrence: a steel mill that emitted an estimated 60% of the valley's particulate matter closed operations on August of 1986 and reopened on September of 1987. Dr. Pope's statistical analysis

of the valley demonstrated that "average hospital admissions in Utah Valley for bronchitis and asthma were substantially higher when the steel mill was open than when it was closed," particularly among preschool-aged children, where admissions were twice as high during the mill's operations.[58]

Since this publication, there have been hundreds of reports demonstrating the correlation between health impacts and changes in levels of particulate matter and ozone. While both pollutants can have an effect on everyone, certain groups are more sensitive. Children, the elderly, and people with existing cardiovascular or respiratory diseases are more likely to be affected by increases in particulate matter and ozone, making them more susceptible to pneumonia, bronchitis, and asthma.[59] Increases in ozone levels can also impact otherwise healthy adults who are active outside and others with ozone sensitivity.

In addition to respiratory diseases, studies show that $PM_{2.5}$ going deep into the lungs increases the risk of heart attacks, arrhythmias and strokes, or may cause chest pain, palpitations, shortness of breath, and fatigue. [60] Individuals with preexisting or undiagnosed heart or lung disease can see their symptoms exacerbated by particulate matter. Similarly, ozone is "associated with adverse health effects, including decreased pulmonary function, asthma exacerbations, increased hospital and emergency department visits, and increased mortality.[61] Many of these deaths come from the increased risk of heart attack.[62]

On a broader scale, particulate matter and ozone can impact overall life expectancy and infant health and mortality. Recently, Dr. Pope's evaluation of 545 U.S. counties showed that each decrease of 10 micrograms of $PM_{2.5}$ increased average life expectancy by 0.35 years.[63] Reductions in $PM_{2.5}$ were shown to be associated with greater gains in life expectancy with women than men.[64] "New studies suggest that exposure to high particle levels may also be associated with low birth weight in infants, pre-term deliveries, and possibly fetal and infant deaths." [65]

A 2012 fine particulate matter study analyzing 2005-2007 data determined that reaching the EPA's 15 microgram annual standard and 35 microgram 24-hour standard would prevent 5,000 to 15,000 mortalities per year in the U.S.[66] The same study determined that if the EPA implemented and all communities reached 11 microgram annual standards and 25 microgram daily standards, between 22,000 and 83,000 mortalities would be prevented per year. Most of these decreases would be from heart disease and lung cancer. Meeting the current stands would also decrease five million respiratory symptoms and one million lost days of work. A similarly constructed ozone study showed that reaching the current standard of average annual 75 ppb standard would decrease premature deaths by 1,410 to 2,480 nationwide. Implementing and reaching the standard recommended by the EPA Clean Air Scientific Advisory Committee of between 60 and 70 ppb would reduce premature deaths by between 2,450 and 7,990. Acute (sudden or new) respiratory symptoms would be reduced by three million cases and there would be a decrease of one million lost school days if 75 ppb were achieved, and up to over 10 million fewer acute respiratory symptoms and over three and one half million fewer lost school days if 60 ppb were implemented and achieved. [67]

While some pollution reduction measures are costly to both individuals and local economies, the EPA predicts that the reduction in health care costs and pollution-related premature deaths outweigh such costs by a wide margin.[68] An analysis of the 1990 amendments to the Clean Air Act looked at costs and benefits to 2010 and 2020. The total cost over 30 years is expected to reach $65 billion while the benefits are expected to reach nearly $2 trillion. Nearly half of the costs are from vehicle improvements and about one-third is from electricity generation improvements. These costs result in a more than 50% decrease in VOCs, a nearly 70% decrease in NO_X and SO_2, and a nearly 20% decrease in direct particulate matter. Reductions translate mostly into benefits from a decrease in mortality, though the improvement in health and visibility alone are more than twice the total cost.

Figure 6: Health Cost Reduction between 1990 and 2010 from the 1990 Clean Air Act Amendments, United States.

Health Cost	Reduction
Premature deaths – adults ($PM_{2.5}$)	160,000
Premature deaths – infants ($PM_{2.5}$)	230
Premature deaths (ozone)	4,300
Chronic bronchitis ($PM_{2.5}$)	54,000
Acute myocardial infarction ($PM_{2.5}$)	130,000
Asthma exacerbation ($PM_{2.5}$)	1,700,000
Hospital Admissions (PM and ozone)	86,000
Emergency room visits (PM and ozone)	86,000
Restricted activity days (PM and ozone)	84,000,000
Lost school days (ozone)	3,200,000
Lost work days ($PM_{2.5}$)	13,000,000

Source: EPA.

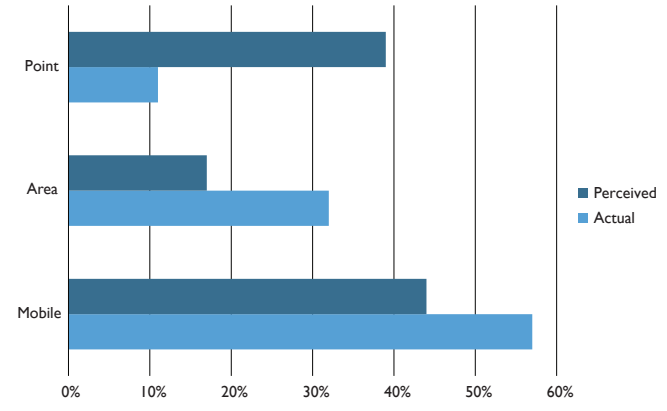
Economic Development

As noted above, there are various costs that come with higher air quality. Point source improvements can cost well over $20,000 per ton of pollution reduction, which costs are then typically passed on to consumers. Further, automobile manufacturers incur costs to produce more efficient cars, which result in higher sticker prices (though relatively lower costs at the fuel pump). However, there are also economic costs that come with not improving the air.

The director of the Utah Governor's Office of Economic Development has stated that – whether or not Utahns believe that the health effects of pollution are real or imagined – "from an economic development standpoint air quality is an important issue."[69] This issue is acknowledged by the Utah Legislature's 2013 Economic Development Task Force which, under its formation legislation, was directed to look at the link between economic development and air quality. The task force found that "poor air quality is a threat to the state's economic development and continued growth… accordingly, improving air quality should be a priority for state and local government, Utah's businesses, and Utah's citizens." The Task Force suggested eight recommendations for legislative action to help improve air quality.[70] Utah's Governor Herbert, too, has stated that air quality "has a lot of ramifications to our economy," when on May 2, 2013, he proclaimed May as Clean Air Month.

Utah state government is certainly concerned about air quality, but so is the business community. The Salt Lake Chamber of Commerce hosts an annual Business Case for Clean Air event that brings together nearly "100 business leaders" to discuss the issue. The Chamber also hosts a monthly Clean Air Task Force and runs a Clean Air Champions group of over 50 organizations "engaging the business community in an innovative program to save fuel, reduce vehicle emissions, and improve business attraction and retention in Salt Lake City." The Utah Valley Chamber of Commerce and the Davis County Chamber also have such discussions.

Figure 7: Percentage of Pollutants by Source, Perceived and Actual



Source: Heart+Mind Strategies; Utah DAQ.

Highway Funds

In addition to the economic development concerns, air quality could have a direct financial cost on Utah's coffers. The state's failure to meet the standards could result in sanctions under the Clean Air Act that impact federal highway funding.[71] Funding would continue for activities such on-going transit operations, planning, intersection work, interchange upgrades, and safety, including resurfacing, shoulders, and guardrails. The sanction would end expansion funding for freeways, major arterials, light rail, and commuter rail.[72]

AIR QUALITY EFFORTS

There are two questions to consider when analyzing Utah's air quality efforts: 1) What are we doing now? and 2) What can we do? This report answers each of these questions, first by analyzing air quality efforts in general, and then by categorizing pollution reduction efforts by their source. Air pollution is typically divided into three source categories: mobile (transportation related, both on and non-road), point (large industrial sources), and area (smaller, localized sources like small businesses, homes, and consumer goods). Utah's DAQ creates an inventory of pollutants from each of these sources. For instance, it estimates that 57% of the fine particulate matter in the air comes from mobile sources, 11% from point sources, and 32% from area sources. A recent poll shows that Utahns underestimate the pollution caused by mobile and area sources while overestimating point sources (see Figure 7).[73]

Figure 8: Utah Division of Air Quality Health Index

Health Legend	Health Forecast	$PM_{2.5}$ in micrograms	Ozone in parts per million
Good	Air quality is considered satisfactory, and air pollution poses little or no risk.	0 - 12.0	0 - 0.059
Moderate	Highly-sensitive people should consider reducing prolonged or heavy outdoor exertion.	12.1 - 35.4	0.06 - 0.075
Unhealthy for Sensitive Groups	The following groups should reduce prolonged or heavy outdoor exertion: • People with lung disease, such as asthma • Children and older adults • People who are active outdoors	35.5 - 55.4	0.076 - 0.095
Unhealthy	Same as "Unhealthy for Sensitive Groups" Everyone else should limit prolonged outdoor exertion.	55.5 - 150.4	0.096 - 0.115
Very Unhealthy	Same as "Unhealthy for Sensitive Groups" Everyone else should limit outdoor exertion.	150.5 - 210.4	0.116 - 0.374
Hazardous	This would trigger health warnings of emergency conditions. The entire population will most likely be affected.	Above 210.5	Above 0.375

Source: Utah DAQ.

Figure 9: Utah Division of Air Quality Air Action System

Action Legend	Action Forecast	$PM_{2.5}$ in micrograms
Unrestricted	Can burn but visible emissions must meet air quality regulations	Below 15
Voluntary	Utahns are asked to voluntarily not use solid fuel devices, like wood and coal burning stoves and fireplaces. Also, people should consolidate trips. Industry should minimize air pollution.	Between 15 and 25
Mandatory	Solid fuel devices must not be used, and open burning in fire pits, etc. is prohibited. Again, people should consolidate trips. Industry should minimize air pollution.	At or forecasted to be at or above 25

Source: Utah DAQ.

Utah DAQ

The Utah DAQ plays an integral role in air pollution mitigation, from planning and permitting to compliance. While the federal government mainly affects mobile source pollution, the Utah DAQ has been primarily focused on point source pollutants, though it has also taken measures toward mobile and area source reductions.

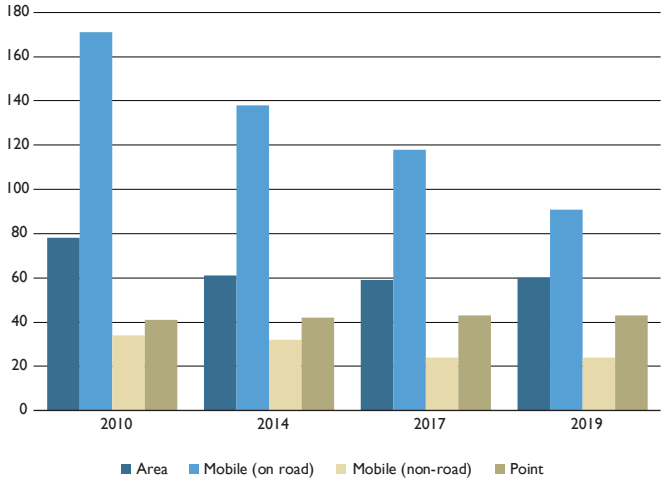
One important role the Utah DAQ plays is that it is the main source of health and action information when pollution readings are high. Its Health Index – as detailed in Figure 8 – is based upon the EPA's Air Quality Index. It indicates when pollution is a threat to certain groups. The Utah DAQ's Air Action system – as detailed in Figure 9 – indicates when Utahns are expected to react to high pollution levels. The "Mandatory Action" bans wood, pellet, coal burning stoves or fireplaces, but simply advises industry to reduce emissions and vehicle drivers to reduce trips. The action targets Box Elder, Cache, Davis, Salt Lake, Tooele, Utah and Weber counties based upon Utah Administrative Code for solid fuel burning devices, as well as Washington, Duchesne, and Uintah counties.[74] The "Choose-Clean-Air" program is Utah DAQ's summer control program which recommends action for ozone levels.

In its planning role, the Utah DAQ is required to complete a State Implementation Plan (SIP), which is a narrative that describes how the state will attain and maintain the NAAQS. The document – which is based upon an inventory of mobile, point, and area sources – is updated as needed to comply with federal standards in areas of nonattainment.

The EPA tightened the NAAQS $PM_{2.5}$ standard in December of 2009. This led to the Wasatch Front and Cache County falling into a level of nonattainment as the result of three years of pollution at levels above the NAAQS. The DAQ had one year to submit new additions to the SIP that outline how the state intends to reduce fine particulate pollution. The SIP describes measures to decrease emissions from higher-polluting products and businesses in order to reach attainment by December 14, 2019.

The SIP details very specific reductions in each of the nonattainment counties. Salt Lake County is expected to reduce its daily tonnage of pollution in the winter from 366 in 2008 to 243 by 2019. Utah County is expected to decrease from approximately 83 tons to 54 tons, and Cache County would decrease from 27 to 21 tons. The new SIP requirements focus on area sources and

Figure 10: Current and Projected Contributions to $PM_{2.5}$ by Source



Source: Utah DAQ.

some specific point source requirements. The mobile reductions under the SIP are related to federal automobile standards which are currently in effect. Mobile emissions take up the lion's share of the decrease, reducing emissions by approximately 50%. Area sources are expected to decrease by approximately 20% while point sources (mostly industrial facilities) will increase by about 12% due to economic expansion. Utah's recent SIP will need to be amended following comments from the EPA.

The Utah DAQ is constrained from enacting regulations which are stricter than current federal standards without proceeding through a lengthy review process. During the 2013 General Session, Representative Rebecca Chavez-Houck sponsored House Bill 346 – Air Quality Amendments – that would have allowed the Utah DAQ to bypass a portion of this process. When the bill was heard in committee, a legislator asked the Utah DAQ whether this legislation was needed. The director responded that developing air quality regulations and ensuring compliance with such regulations requires funding, and the Utah DAQ does not "have the personnel or the budget to do this."[75]

Other Reduction Efforts

Removing this air pollution at the source begins with research. The federal government has been funding research since the 1930s, which culminated in the Air Pollution Control Act of 1955 "to provide research and technical assistance relating to air pollution control."[76] Much of the State of Utah's directly funded research has come out of the Utah DAQ. Most recently Utah Governor Gary Herbert recommended an additional amount for the fiscal year 2015 state budget of $1.8 million for air quality research.[77] A portion of this new funding would likely go toward the University of Utah's recently developed Program for Air Quality, Health and Society which aims to be a multi-disciplinary, credible source of all facets of air pollution information.

The Utah Legislature also delved into the issue during the 2013 General Session when it passed House Bill 168 – Air Quality Mitigation by Government Entities. This bill provides a framework for the state government as a whole and for school districts in nine northern-Utah counties to produce reports detailing which methods they are currently using and which they will implement to reduce the emission of air pollutants, both on a "regular basis" and particularly on days the Utah DAQ issues air quality action alerts. Most of the reported items were related to mobile source pollutants and include flexible work hours, anti-idling programs, telecommuting, and transit. However, they also included several area source reduction ideas like energy efficiency programs and "turn-it-off" campaigns.

Research and action do not only originate from Utah's universities and from state government. There are numerous non-profit organizations which focus on clean air. Utah Moms for Clean Air is an advocacy organization focusing on all facets of air pollution with chapters along the Wasatch Front and Cache County. HEAL Utah is an advocacy organization that works on numerous environmental issues, including air quality. Breathe Utah focuses on educational outreach, multi-stakeholder collaboration, and policy change for solutions to air quality problems. UCAIR is a non-profit that was launched by Governor Herbert to develop a statewide public awareness campaign. It received a $50,000 allocation from the Utah Legislature in the 2013 General Session. Further, the Governor's 2015 budget recommends that UCAIR receive a $1.3 million grant to help small businesses upgrade their emissions reduction equipment and help them comply with new air quality standards. Of that amount, $350,000 is to be used for an "air quality campaign."[78] Other non-profit organizations that focus on specific air pollutant emission sources are detailed in their respective source sections, below.

In a recent effort to combat air pollution, Envision Utah – in partnership with Governor Herbert – formed the Utah Clean Air Action Team (UCAAT) to recommend practical and effective strategies to improve Utah's air quality. As noted previously, UCAAT arrived at many of the same conclusions as this report, including the determination to focus on two of the main mobile and area source pollution solutions detailed below: 1) Tier 3 automotive and fuel standards and 2) wood smoke reduction. While Utah Foundation's research was performed independently of UCAAT, several of UCAAT's members directly and indirectly informed this report.

MOBILE SOURCE POLLUTION

The largest portion of air pollution in the state originates from mobile source pollution. This pollution comes from both road and non-road sources. Road sources include:

- Cars and light duty trucks
- Heavy duty trucks
- Buses
- Motorcycles

The non-road source category is more varied, emitting on land, in the air, on water, and in the garden. These sources include:

- Aircraft
- Motorboats
- Trains
- Heavy equipment that can be moved from place to place
- Lawn mowers and other gardening equipment

Utahns – like all Americans – own and drive a lot of automobiles. There are fewer licensed drivers than the 2,140,968 registered vehicles in the state.[79] A vast majority are passenger cars and "light trucks"

(which are vehicles under 8,500 pounds including payload, which includes most pickup trucks and sport utility vehicles). The remainder is 68,188 heavy trucks and 74,324 motorcycles.[80] There are also 5,414 buses in operation in Utah.[81]

Mobile sources are the highest contributor of NO_X, which lead to ozone and $PM_{2.5}$ formation. Mobile sources are also a high contributor of VOCs, which lead to $PM_{2.5}$ formation.

Numerous organizations work on transportation and its resultant air quality implications in Utah. One such organization is the Wasatch Front Regional Council, which is a metropolitan planning organization (MPO) that represents local governments from Box Elder, Weber, Morgan, Davis, and Salt Lake counties. The Mountainland Association of Governments and the Cache MPO represent the remaining counties that make up the Wasatch Front and the "Wasatch Back," which are generally those counties in the state most affected by mobile source pollution. Loosely working together, the MPOs, the Utah Department of Transportation, the Utah DAQ, and several federal partners make technical and policy recommendations regarding the conformity of air quality planning and transportation planning. Highway planning and air pollution are linked because road congestion leads to higher pollution (though expansion of highway capacity could also encourage more driving). These groups also help ensure that the transportation inventory complies with what is allowable under the NAAQS. Separately, Travelwise is an organization developed by the Department of Transportation to encourage Utahns to use transportation methods other than traveling alone, like carpooling, transit, and other sources. Travelwise seeks to improve air quality as well as reduce fuel consumption and the number of vehicles on the road for congestion purposes.

Business has also been playing its part. The Salt Lake Chamber of Commerce's Clean Air Champions program boasts numerous mobile source emission reduction successes.[82] As part of the group, Rio Tinto saves $1.65 million annually with a no-idling policy for trucks (which installed idle monitors on over 430 vehicles), Architectural Nexus saves $72,000 annually by replacing meetings that required travel with video conferencing system, Hale Center Theatre saves $5,000 per vehicle since converting its fleet to compressed natural gas, UPS has saved 10 million gallons of fuel since 2004 with smarter vehicle-route planning, and ADP has reduced commuting as well as decreased office space by 40,000 square feet since implementing a teleworking policy for 250 employees. Additionally, Overstock.com subsidizes carpooling and transit, and L-3 Communications funds campus transport buses, bike share, and electric vehicle incentives. The Chamber has also recently launched "An Emergency, Business, Air Quality Initiative" regarding inversion mitigation. This initiative focuses primarily on mobile source pollution with trip reduction plans, incentivizing alternative transportation, carpooling assistance, flextime travel, and more.

Transit

Transit has long been seen as an important player in the quest for higher air quality. The Utah Transit Authority (UTA) is the largest transit organization in Utah, with a commuter train, light rail, bus service, a trolley line, paratransit, and/or vanpools operating in Box Elder, Weber, Davis, Tooele, Salt Lake and Utah counties. System-wide ridership was over 42 million in 2012.[83] UTA takes nearly 120,000 cars off the road daily, saving a UTA-estimated 750,000 vehicle miles per day. UTA's passenger miles topped 300 million.

Figure 11: Transportation to Work in Utah

Method of Transportation	2006	2007	2008	2009	2010	2011	2012
Drove alone	75.2%	74.9%	75.0%	76.1%	77.6%	76.5%	75.7%
Carpooled	13.1%	13.0%	13.1%	11.7%	11.2%	12.0%	12.2%
Public transportation (excluding taxicab)	2.6%	2.4%	2.4%	2.4%	2.1%	2.4%	2.5%
Walked	2.8%	2.6%	3.0%	2.9%	2.9%	2.4%	2.6%
Bicycle	0.6%	0.8%	0.7%	0.8%	0.7%	0.8%	1.0%
Taxicab, motorcycle, or other means	1.1%	1.0%	1.2%	1.2%	1.1%	1.1%	1.3%
Worked at home	4.6%	5.3%	4.6%	4.8%	4.4%	4.6%	4.8%

Source: American Community Survey.

Now that UTA has completed its "Frontline 2015" expansion, it is seeking increased ridership through expansion of regular bus service and Bus Rapid Transit. UTA's plan is to double ridership by 2040 through the full funding of the Unified Transportation Plan. [84] Currently, approximately 2.5% of Utahns use public transportation to work (see Figure 11). The highest transit usage in the state is in Salt Lake County which is at 4%.[85]

In 2013, two transit-related bills failed to pass the Utah Legislature. One was HB405 – Clean Air Public Transit Pilot Program – which would have created free monthly passes for the months of January and July in UTA service areas. The hope was that a free pass program would increase ridership, thereby decreasing mobile source pollution during the top inversion and ozone months. The other failed bill was HB411 – Public Transit Funding Amendments – which aimed to allow for local sales tax increases and Utah Transportation Investment Fund dollars to be directed to a public transportation with oversight by a newly created board.

UTA is often trying new programs on its own to increase ridership. For example, it is currently in partnership with Salt Lake City to offer discount passes to city residents. Further, in an effort to combat ozone pollution in July 2013, UTA offered a Ride Clean transit pass, which was a free week of transit with a $75,000 Zion's Bank sponsorship for four thousand riders. The program resulted in over 20,000 boardings using the passes.[86] UTA is planning a similar program for February 2014. A recent survey showed that 60% of Utahns would be more likely to use public transportation if it was free during poor air quality weeks.[87]

Increasing ridership does get cars off the road, though the replacement is not one-to-one. The American Public Transportation Association shows that without access to rail, 61% of riders would use automobiles – 40% would drive, 14% would ride with someone, and 7% would use a taxi. The number of bus riders that would use automobiles is somewhat lower (53%).[88] Another way of decreasing mobile source air pollution is through driving cleaner vehicles.

Zero-Emission Vehicles

Electric automobiles – and even electric/gasoline hybrids – have been in operation for over 100 years. Today there are many options for consumers. Some are fully electric, like the Nissan Leaf. Others are "partially electric vehicles," like the Chevrolet Volt. These two cars lead the way in sales of the 16 available zero-emissions vehicles

from eight manufacturers, though their sales have been about half of what was estimated by the manufacturers.[89]

Zero-emissions vehicles are vehicles that can operate with no tailpipe pollutants. They include electric, hydrogen fuel cell (including the Honda FCX Clarity available for lease in Southern California), and plug-in hybrid electric vehicles. Nationwide there are expected to be 200,000 zero-emissions vehicles on the road by 2015, and governors from eight states (not including Utah) signed a cooperative agreement to utilize state incentives and combined efforts to put a total of 3.3 million zero-emissions cars on the road by 2025.[90]

There are currently two hindrances to the proliferation of zero-emission vehicles. One is cost. Another is that they do not have the range or refueling infrastructure that gasoline and diesel vehicles enjoy. Mass expansion of electric vehicles will require a "charging" infrastructure. A new Utah rule should encourage more charging availability; on June 20, 2013, the Utah Public Service Commission adopted a rule that allows for the "re-sale" of electricity to electric vehicles.[91] This means that non-utilities, like gas stations and other businesses, will be able to install charging stations and sell the electricity to users.

Electric vehicles are clean, but they still get their fuel from somewhere. Instead of emissions out of the tailpipe, their emissions are at power plants, which in Utah are mostly coal-fired. However, these plants do have certain efficiencies that most vehicles do not, and the plant locations – which while they may lead to increased rural ozone levels – certainly do not have as great an effect on winter inversion $PM_{2.5}$ levels as do gasoline vehicles.

Like transit, alternative fuel vehicles are not a silver bullet to cleaner air, at least in the short term. While there may not be a silver bullet available, mandating cleaner gasoline vehicles has had and will continue to have a large effect on air pollution mitigation.

Fuel Economy Standards

The biggest reductions to mobile source pollution have come from federal automobile standards. A portion of this improvement is simply due to increased fuel economy. The first fuel economy standard of 18 miles per gallon (mpg) was introduced in 1978 for passenger cars. Requirements were incorporated for light trucks the following year. The Corporate Average Fuel Economy (CAFE) standard is the required average fuel economy for vehicle manufacturers.[92] It remained steady for passenger cars at 27.5 mpg between 1990 and 2010. During this time, the CAFE standard for light trucks increased from 20.0 mpg to 23.5 mpg.

In 2011, President Obama reached an agreement with 13 automakers to increase the CAFE standards by 2025 to 54.5 miles per gallon.[93] The standard is divided into the specific size of passenger car and light truck. Manufacturers that do not meet the standard must pay $5.50 per 0.1 mile per gallon below the standard per vehicle sold in the U.S. market.

Additionally, manufactures of new passenger cars that have a fuel economy of less than 22.5 miles per gallon must pay a Gas Guzzler Tax to the Internal Revenue Agency of between $1,000 and $7,700 for each vehicle sold in the U.S.[94] The 81 model-year 2013 vehicles subject to this tax are sports cars like Chevrolet Camaros and Dodge Vipers, as well as high-end vehicles like numerous models of Cadillac, BMW, Mercedes, and Ferrari.

Vehicle Emissions Standards and Tier 3

Some emissions controls have been on vehicles since 1968. In 1991 the EPA passed a regulation to clean up mobile source pollution apart from fuel economy improvements. The Tier 1 standards were phased in from 1994 to 1997 to require that new vehicles emit less than 910 milligrams of VOC and NO_X per mile. It also required that diesel vehicles emit less than 100 milligrams of direct particulate matter per mile.

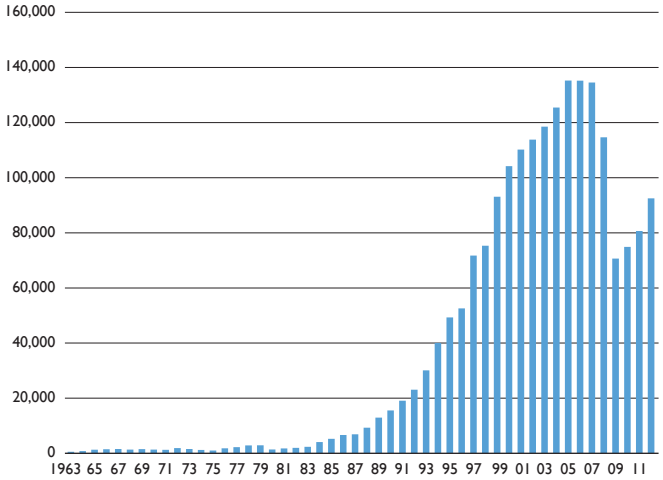
Tier 2 standards were adopted in 1999 and phased in from 2004 to 2009. This second step treated vehicles and fuels as one system: decreasing emissions and reducing sulfur in gasoline. It required that the combined VOC and NO_X emissions be reduced to 160 milligrams per mile, an 82% decrease from Tier 1. Further, direct particulate matter requirements were set at 10 milligrams per mile for gasoline and diesel vehicles. These improvements are responsible for large decreases in emissions of VOC and NO_X between 2010 and 2019 that are included in Utah's SIP, even when accounting for the increase in vehicle miles traveled over that time period.

Tier 2 also required that fuel contain lower sulfur levels. The reduction of sulfur is important for two reasons. First, it instantly decreases the emission of SO_2 and the resultant ozone and $PM_{2.5}$ formulation. Second, sulfur dirties the vehicle emissions system, which decreases the ability of the catalytic converter to remove other pollutants before combustion exhaust exits the tailpipe. According to the EPA, "the Tier 2 program was a success and resulted in gasoline sulfur reductions of up to 90 percent and enabled the use of new emission control technologies in cars and trucks with no serious negative impacts on the refining industry."[95]

About 85% of Utah's registered vehicles comport with the Tier 1 standards, meaning that they are model year 1997 or newer. Currently only about 20% of the vehicles on the road meet the final Tier 2 standards, meaning that they are model year 2009 and newer (see Figure 12).

The proposed Tier 3 standards also treat the "vehicle and its fuel as an integrated system."[96] This would require vehicles to emit

Figure 12: Current Number of Vehicles Registered in Utah by Model Year



Note: Data include passenger vehicles and light trucks only; not included in the graph are approximately 7,000 registered vehicles which are older than 1963.

Source: Utah State Tax Commission.

less pollution using a variety of technologies that are very similar to the currently available partial zero-emission vehicles (PZEV), including better catalytic converters and measures which reduce the evaporation of gasoline from the fuel systems. Numerous PZEV vehicles are being manufactured as a result of the Low-Emission Vehicle III (LEV III) requirements adopted by the California Air Resources Board and slated to begin in 2015. In addition, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, Vermont and Washington will follow this standard.[97] The goal of Tier 3 "is to create a coordinated ''national program'' in which California would accept compliance with Tier 3 standards as sufficient to also satisfy LEV III requirements, thus allowing manufacturers to comply nationwide by marketing a single vehicle fleet."[98]

The Tier 3 program, if approved, would be phased in between 2017 and 2025. At 2025, all vehicle improvements would need to have been implemented. The benefits would continue long past 2025 as the new Tier 3 vehicles replace older vehicles. The Tier 3 standard vehicles will show a 70% reduction on the primary particulate emissions along with an 80% reduction in emissions of VOCs and NO_X over Tier 2 standard vehicles. In addition, Tier 3 aims to improve emissions from medium-duty passenger vehicles (which are between 8,500 and 10,000 lbs) and other heavy-duty vehicles (over 8,500 lbs) which were not included in Tier 2 emission reductions.

In 2017, approximately 90% of emissions reductions would be due to Tier 3 fuel. [99] The fuel requirement would lower the acceptable level of sulfur in gasoline from 30 ppm to 10 ppm. The sulfur-reduced fuel would have an immediate effect of reducing emissions of all vehicles on the road.

Cost estimates of implementing Tier 3 vary. The Utah DAQ contends that the refining cost to reduce sulfur to 10ppm is less than one cent per gallon of gasoline at the pump; additional manufacturing costs are estimated to add about $134 to the cost of each new vehicle, or less than one-half percent of the cost of a new car.[100] However, a report prepared for the American Petroleum Institute indicated that in the U.S. "four to seven refiners could shut down rather than make the investments required to meet the standards" of decreasing sulfur content in fuel.[101] Additionally, the report indicates the cost to comply with the sulfur reduction is estimated at "$0.12 to $0.25 per gallon on an annualized basis." [102]

The Tier 3 proposal includes measures to mitigate the costs to refineries, including a three-year delay for small refiners and small volume refineries processing 75,000 barrels of crude oil per day or less (including Utah's five refineries), and allows for hardship provisions and a company-wide averaging of sulfur content.[103] These measures could negate some or all of Utah's reduced sulfur benefit from Tier 3, unless Utah regulators demand Tier 3 standard fuel.

In 2013, Utah's Air Quality Board sent a letter to the EPA supporting the implementation of Tier 3 standards, stating that the program would be a "crucial tool to assist in attaining and maintaining the [NAAQS], in order to protect public health." The board stated that "recognizing the benefits of Tier 3 Gasoline on mobile sources, we also encourage the final rule to allow minor increases of emissions from the production of Tier 3 Gasoline to be offset by the reduction from mobile source fleet-wide emissions within the nonattainment areas" [104] Governor Herbert has also extended his support of the improved standards. A bill garnering support of Utah's Legislators for Tier 3 will likely be heard during the 2014 General Session.

The EPA estimates that the seven counties in the nation that have the most to gain from Tier 3 in terms of $PM_{2.5}$ (by 2030) are all in Utah: Box Elder, Cache, Weber, Davis, Tooele, Salt Lake and Utah counties.[105] The Utah DAQ was not able to include Tier 3 improvement estimates in its recent SIP adjustments since the Tier 3 rule has not been finalized. Accordingly, the passage of Tier 3 would likely help residents along the Wasatch Front realize cleaner air, but there are factors that will mitigate some of the benefits. A major, remaining mobile source issue is with older, more polluting vehicles.

New Vehicles and Existing Inventory Improvements

The replacement of older vehicles for newer ones is one avenue toward cleaner air. One step toward this goal (and toward economic stimulation) was the Consumer Assistance Recycle and Save Act of 2009, or "Cash for Clunkers."[106] This program removed 5,605 lower fuel economy cars off the road in Utah by subsidizing the trade-in value toward a more fuel efficient car. Under the program, if the fuel economy difference between the old car and the new car improved by between four and nine miles per gallon, the purchaser received a $3,500 credit towards the new vehicle. If the economy increased by ten miles per gallon, the driver received a $4,500 credit towards the new vehicle. The program cost $23,781,500 in Utah. Nationally, the average miles per gallon of the trade-in were 15.8 and on the new vehicles were 24.9, a 58% increase.

There are less expensive air quality related programs than simply helping pay for new vehicles. One is making sure that the existing vehicles are operating as efficiently as possible. Utah's Wasatch Front counties saw their first vehicle inspection/maintenance (IM) programs in 1980, originally just measuring ozone and carbon monoxide. The most recent addition was in 2013 with the Cache County IM program as needed for the SIP. IM programs require that vehicles pass fairly loose emissions tests. Heavy trucks do not need to pass the tests, and diesel vehicles are simply "opacity inspected," determining how much light is obscured by smoke. Older gasoline-powered vehicles made before 1967 and diesel-powered vehicles made before 1997 are exempt altogether.

Not all vehicles are created equal in terms of pollution. Older, less fuel-efficient, pre-Tier 1 automobiles are, of course, bigger polluters. As are many diesel vehicles. On the whole, about three times the amount of $PM_{2.5}$ is emitted from gasoline vehicles than diesel vehicles, though the latter only comprise about 5% of vehicle miles traveled. Further, about half of $PM_{2.5}$ from gasoline is from high emitters and smoking vehicles, though these make up just a fraction of all the vehicles on the road.[107]

One of the biggest air quality reductions could come from keeping the worst offenders off of the road. In the future, Utah may have the technology to set up automated emissions sensors that determine tail pipe exhaust and, if emissions exceed the allowed limit, would take pictures of emitter's license plates. These emitters would be notified and required to bring their vehicles into compliance.

Another group of big emitters are school buses. Diesel school buses emit nearly 20 times more direct $PM_{2.5}$ on average than diesel city buses per mile, though only about 30% more when idling. School

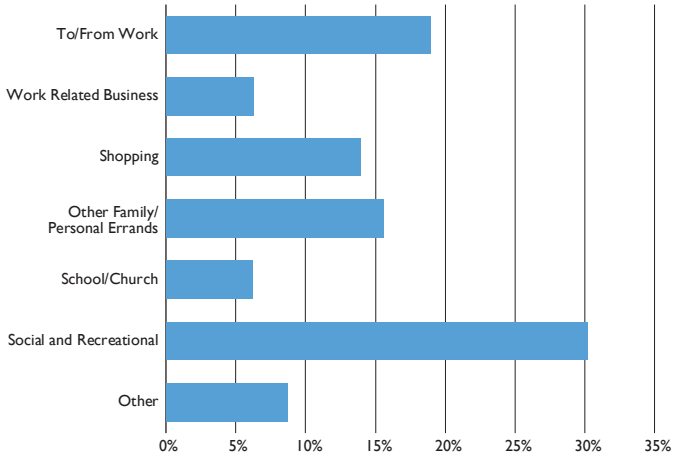
buses also produce higher PM_{10} and VOC but only about 70% of the CO and NO_X as city buses.[108] In Utah, 2,821 school buses in the district school fleet transport approximately 175,000 students to school. Over 60% of these buses operate in districts along the Wasatch Front and Cache County. Approximately 47% of district buses are under 10 years old, 45% are 11 to 20 years, and 8% are 21 years or older.[109]

In order to reduce the pollution from these older vehicles, Utah received a grant from the National Clean Diesel Program. The funds were used by the Utah DAQ and the Utah State Office of Education as part of the Clean Diesel School Bus Project to retrofit 1,200 school buses and replace 27 old buses at a cost of approximately $6 million. This program did not take care of all of the older, heavy polluters. The Governor's 2015 budget recommends a $14.3 million allocation of funds toward additional replacements and retrofits of aging school buses, as well as for state fleet vehicle improvements.

The National Clean Diesel Program also "utilized a systems approach to reducing sulfur emissions" through the Utah DAQ to install auxiliary power units on 53 long-haul trucks (which use 80-90% less fuel than main engine), install auxiliary power units on 32 agricultural trucks, replace 31 pieces of diesel equipment, and retrofit maintenance vehicles/snow plows with diesel oxidation catalysts to reduce emissions. Utilizing this program, between 2010 and 2012 the Utah DAQ helped convert diesel engines to compressed natural gas (CNG) and replace old diesel vehicles with CNG vehicles. Since 2009 the Utah DAQ provided nearly $1 million in grants and over $350,000 in loans toward CNG conversion and replacement.

In 2013 the Utah Legislature passed Senate Bill 275 – Energy Amendments – which provides improvements to Utah's natural gas infrastructure and vehicle fleet, especially buses. CNG may be one step toward cleaner air. However, the mobile source section manager at the Utah DAQ has expressed that with recent diesel improvements, emissions from diesel fuel systems should compare to CNG systems in the short-term but at a lower cost.

Figure 13: Percentage of Average Annual Person-Miles of Travel by Trip Purpose, 2009, U.S.



Source: Federal Highway Administration's National Household Travel Survey.

Other Reduction Efforts

Individuals can make a significant difference in decreasing mobile source emissions. There are a host of things people can do when poor air quality is on the horizon. In addition to carpooling and taking transit, there are many smaller changes people can make. They can reduce idling. They can simply reduce trips by putting off errands or working from home. Not only does this reduce the pollution of the vehicle that is left parked in the garage, it reduces congestion on the highways to further lower pollution levels. Drivers accumulate more person-miles of travel during shopping and errands than traveling to-and-from work and other work related miles (see Figure 13). People even spend more time behind the wheel for social and recreational travel than work.

Drivers can also chain trips together; instead of running one errand in the morning and one at night, drivers could run them one right after the other. Chaining trips helps with cold starts, which is one of the five key pollution issues with vehicles:

- Cold starts
- Running
- Evaporative (VOC exhaust from fuel seeping out of systems whether running or not)
- Refueling (VOC)
- Extended idle (overnight trucks, of which there are approximately 300-400 trucks in the Salt Lake Valley per night which contribute as much as 7% of the daily NO_X). [110]

At least one quarter and possibly over one half of winter vehicle pollution results from cold starts.[111] This is because catalytic converters need to reach 600 or 700 degrees before they are effective in converting NAAQS pollutants to less harmful emissions. This takes an average of two minutes, which is why reducing trips and trip chaining is important, though the EPA estimates that drivers start their vehicles about six times per day. Tier 3 includes automotive standards which decrease cold-start emissions.

People can also purchase less-polluting vehicles. In the past, buying cleaner emitting cars required research. Alternately, people could estimate emissions based upon the fuel economy stickers. The EPA has now implemented a Green Vehicle Guide program. This program requires a "Smog Rating" on the EPA/DOT Fuel Economy and Environment label that is required on the windows of all new cars. The scale is displayed using a slider bar from 1 (worst) to 10 (best). "The scale is based on the U.S. vehicle emissions standards, which incorporate specific thresholds for NO_X, non-methane organic gas, carbon monoxide, particulate matter, and formaldehyde."[112] The Legislature continues to help drivers purchase these less-polluting vehicles. In 2013 the legislature passed House Bill 96 – Cleaner Burning Fuels Tax Credits Amendments and Related Funding – which extends the tax credit for vehicles with reduced emissions.[113]

Some research suggests that the Utah DAQ's Air Action system works. While the mandatory stipulations under "Mandatory Action" days only pertain to wood burning, there is also an advisory that people should reduce trips. Analysis of 14 automated traffic recorders between November 2012 and February 2013 shows that on "Mandatory Action" days there were 3.9% fewer vehicles on the road.[114] To put that into context, this reduction of vehicles on

the road had an effect approximately the same as transit on the reduction of vehicle miles traveled along the Wasatch Front. A recently released, longer-term study found different results. This study suggests that people drove more during higher levels of $PM_{2.5}$ – particularly on weekends for trips to the mountains to escape the pollution.[115]

The longest-term option for reducing or maintaining mobile source pollution levels has to do with how Utahns plan for their future growth. In terms of planning, the Wasatch Front Regional Council, Mountainland Association of Governments, and Envision Utah are focusing on the concept of growth in "centers" with their concerted efforts focused on a process called Wasatch Choice for 2040. This is a regional vision for growth and development utilizing a collaborative process between businesses, government and the community. The gist of the concept is that there will be numerous city centers, and people will do better living where they work.

POINT SOURCE POLLUTION

Point source pollution comes from large industrial sources that emit more than 100 tons of pollution per year. Utah's point sources are

- Oil refineries: General Refiners, Big West, Chevron, Holly, and Tesoro
- Waste services: Wasatch Integrated Waste Management, Clean Harbors, Deseret Chemical Depot, Brush Resources Mill, and Central Valley Water Reclamation
- Power plants and power-related companies: Bountiful City Power, six PacificCorp power plants, Constellation Energy Resources, Payson City Power, Provo City Power, Heber Light and Power, Intermountain Power, Murray City Power, Springville City Power, El Pas Field Operations, and Westinghouse Electric Company
- Chemical companies: Chemical Lime, Great Salt Lake Minerals, US Magnesium, and Geneva Nitrogen
- Large institutions: University of Utah, Brigham Young University, and Hill Air Force Base
- Mining: Kennecott Utah Copper's smelter and power plants and its Bonneville Copper Mine
- Metal fabricators: Pacific States Cast Iron Pipe, Nucor Steel, Utelite, and Vulcraft
- Other manufacturers: Olympia Sales, ATK, Hexcel, Silver Eagle Utility Trailer, Geneva Rock, Interstate Brick, Ash Grove Cement, Holcim, and Procter & Gamble
- Other: Dugway Proving Ground

Point sources are high emitters of NO_X, which leads to ozone and $PM_{2.5}$ formation. These sources emit almost all of the state's SO_2, which contributes to $PM_{2.5}$. While a majority of Utah's electricity is generated from the combustion of coal, the resultant emissions do not contribute significantly to Utah's periodic inversions because a majority Utah's power is generated outside of the Wasatch Front and Cache County. However, large, rural power companies do have a role in summer ozone in rural areas and the rest of the state since ozone can travel great distances.

Much of the large industry along the Wasatch Front has been here for many years. The first refinery was built in 1908. The four others were built in the 1940s and 1950s. Bingham Canyon, too, has been mined for over 150 years. While some Utahns argue that these operations should relocate, it is not a particularly feasible proposition. In fact, due in part to cost barriers, there has not been a new refinery built in the U.S. since 1976, though there is one currently under construction in North Dakota and one is permitted for construction in Green River, Utah.

Operations at many of Utah's point source polluters have expanded, and continue to expand. The Holly Refining and Marketing Company refinery expansion was recently approved by the Utah DAQ for an additional capacity of 50%. At the Holly refinery, while direct $PM_{2.5}$ will increase, SO_2 and NO_X will actually decrease by a considerable amount as a result of refining low-sulfur oil from the Uintah Basin. However, this thick oil – or waxy crude – will need to be trucked in from eastern Utah which will erode some of the emissions gains. Additionally, the Tesoro refinery is seeking an expansion approval.

Kennecott Utah Copper operations are also expected to expand at some point in the future after receiving approval from the Utah DAQ. The expansion would increase air pollutants for the point source emitter that is the largest in the state.

Reduction Efforts

With point source expansions and tightening federal standards have come requirements by the Utah DAQ for emissions reductions. For example, Utah's five refineries have spent over $750 million to comport with these requirements. Point sources are required to reduce emissions through the installation of a combination of "Reasonably Available Control Technology" or "Best Available Control Technology." Utah's oil refineries will see large emissions reductions from the required application of state-of-the-art emissions controls required by Utah's SIP. Costs to install point source controls will range between $1,300 and $85,000 per ton of emissions reduced. When fully implemented, the major source controls will reduce annual emissions by over 4,600 tons per year from current emission rates. Of the 40 or so point source emitters in the state, reductions under the SIP between 2014 and 2019 at the five power plants make up the lion's share of the reductions (well over 50%).[116] However, these specific pollution reductions will be counteracted by increases in operations, mainly from Kennecott Utah Copper, U.S. Magnesium, and Nucor Steel.

Two vocal advocacy groups are particularly interested in point source polluters: Physicians for a Healthy Environment and HEAL Utah. The latter points to an increase under the SIP of the NAAQS pollutants from 15,253 tons in 2010 to 17,108 tons by 2019, arguing that the point source polluters are erasing some of the gains made by area and mobile source polluters.[117] Further, the EPA has deemed that the new SIP is not stringent enough on point sources when equipment is not working correctly and during startup and shutdown modes.[118] During these periods, the point sources emit much more pollution than when operating normally, just as automobiles do during periods when not in compliance with IM tests and during cold starts. The Utah DAQ will continue to try to rein in pollution at point source emitters, while balancing the desire for economic development in the state.

AREA SOURCE POLLUTION

Area source pollutants make up the remaining non-mobile and non-point sources. Area pollution is from smaller, localized sources and includes the following:

- Small industrial and commercial areas that emit less than 100 tons of pollution per year
- Dry cleaners, auto body and paint facilities, bakeries, restaurants, and gas stations
- Home and commercial heating
- Consumer products like personal care products, household cleaners, and paints

In Utah, area sources are the lowest – but still high – contributors of NO_X. This emission leads to ozone and $PM_{2.5}$ formation. Area sources are the highest contributor of VOCs.

SIP Reduction Efforts

The Utah DAQ has generally focused on area sources. However, the Utah Air Quality Board, as part of the Utah DAQ's SIP process, approved 23 new area source rules that will reduce area source emissions. New rules will reduce emissions from a variety of area sources, including:

- Commercial cooking
- Consumer products
- Printing and publishing
- Painting and degreasing
- Wood stoves and boilers

Consumer products and commercial paints sold in Utah are now required to follow California standards; for example Utah used to have an 80% VOC standard but is now going down to 55% (like hair spray, kitchen cleaner, and wall paint which can lead to poor indoor air quality). Costs for area source controls will range between $0 and $10,000 per ton of abated emissions, and are expected to reduce area source pollution by 6,044 tons per year by 2019. Governor Hebert – when naming May as Clean Air Month – highlighted area source pollutants, directing Utahns to get rid of old, VOC emitting gas cans and quit using high-VOC paints.

In 2013, the only Utah legislation directly related to area source pollution was HB 394 – Outdoor Wood Boilers. This bill would have potentially worsened air quality conditions by prohibiting the Utah Air Quality Board from regulating devices that use wood any differently than other devices that use solid fuel. The bill was defeated in the Utah Senate. Wood burning in general has recently gained attention in Utah media as a large player in $PM_{2.5}$ pollution.

Wood Burning Overview

People have fires in their homes for different reasons. Some have a sentimental attachment to fires, both in terms of the appearance and the smell. Some people burn wood because it can be less expensive than the cost of natural gas or the repair or replacement of an old natural gas furnace. Some may even use wood as an alternative to natural gas because it is "off the grid." Wood is definitely not a healthier alternative. In fact, wood smoke is the principal reason for the development of the Air Action system from the Utah DAQ. The residential Air Action wood smoke and solid fuel control program is designed "to help control wood smoke emission between November 1 and March 1."[119] Only as a secondary measure is the program used to advise industry operations and vehicle drivers to pollute less.

It is unknown at this time just how many people heat their homes with wood and other solid fuels during the winter inversion periods. What is known is the number of people on the Utah DAQ's "sole source of heat" registry: just over 200 in the $PM_{2.5}$ nonattainment areas. The registry is closed, and the Utah DAQ is currently culling the list to make sure that registrants need to remain on the list. Regardless of the size of the sole source of heat registry, there are many households that heat their homes with wood for pleasure or out of necessity during mandatory no-burn days.

According to the inventory of pollutants detailed in Utah's SIP, wood smoke is responsible for an estimated 16% of directly-emitted $PM_{2.5}$. However, recent research suggests that a higher percentage of the Wasatch Front's direct $PM_{2.5}$ is due to wood smoke than previously believed. Utilizing an approach called source attribution, the research took filter samples from three monitoring stations in Davis, Salt Lake, and Utah counties between 2007 and 2011. While most of the result line up well DAQ estimates, the study found that wood smoke may be responsible for 38% of direct $PM_{2.5}$.[120] Since direct $PM_{2.5}$ makes up approximately 30% of the total $PM_{2.5}$, this research suggest that wood smoke is responsible for over 10% of the pollution problem during Utah's inversions.[121]

The EPA estimates that a typical fireplace emits over 3,373 times the amount of $PM_{2.5}$ as a typical gas furnace[122] Even EPA-certified woodstoves emit upwards of 168 times more than gas.[123] Recent Utah winter-inversion estimates show that burning one wood stove for one hour is equal to the $PM_{2.5}$ emissions that result from driving a car 525 to 1150 miles. [124] Similarly – in terms of direct $PM_{2.5}$ pollution – heating one home with a wood stove is equal to heating hundreds of homes with natural gas.[125]

Homes using wood for heat – and their neighbors' homes – have worse air quality than those not burning wood. $PM_{2.5}$ levels were 26% higher, and cancer-causing polycyclic aromatic hydrocarbons were 400% higher around such homes.[126] Research suggests that the lifetime cancer risk from wood stove emissions are greater than cigarette smoke, though neither are as harmful as motor vehicles emissions.[127] Effects of wood burning in the home is particularly harmful to children between one and five years of age.[128]

Wood Burning Reduction Efforts

New SIP measures have strengthened the Utah DAQ's no-burn enforcement. The mandatory no-burn designation was previously set only when $PM_{2.5}$ reached 25 micrograms, but is now applied on the forecast of 25 micrograms. There is also a contingency in place so that Utah DAQ can lower its no-burn requirement to 15 micrograms if deemed necessary.

On "Mandatory Action" days, Utah DAQ compliance staff enforce the no-burn regulation. However, the Utah DAQ currently has only six personnel across the state for all of its pollution enforcement activities and has only one vehicle dedicated to wood smoke enforcement. According to the Utah DAQ, it only has the resources to investigate wood smoke complaints, not seek out

offenders. During the winter of 2012-13, compliance personnel only issued 16 tickets and eight warning letters.[129] The fines for burning are as follows:

- First-time offenders: $25
- Second-time offenders: $50-$140
- Third-time offenders: $150-$299

The Utah DAQ as not studied whether these fines are sufficient to deter wood burning. Numerous other communities have larger fines. For instance, King, Kitsap, Pierce and Snohomish counties (half of Washington State's population) fine residents up to $1,000 for burning wood during "burn bans." Regulators in the Tacoma-Pierce County nonattainment area have increased enforcement in the past couple years, a portion of which revenue is used to help replace old stoves.[130] The $1,000 fines can be reduced for low-income residents and reduced by offenders attending no-burn educational classes; the Puget Sound Clean Air Agency is "more interested in changing behaviors and helping residents become aware of the dangers of burning during a ban than fining people."[131] Revenue from large fines can also used to pay for compliance staff employed to enforce wood smoke violations.

Utah's new SIP prohibits the sale of non-EPA certified stoves. Arizona, Colorado, Washington, and many California communities have similar laws.[132] EPA-certified catalytic wood stoves are cleaner than non-certified stoves, but are still prohibited on "Mandatory Action" days in Utah. [133]

Other efforts for the reduction of wood smoke could include additional education and outreach, improved community reporting, and incentives for reducing emissions.[134] One example of community reporting is the Salt Lake Tribune posting air quality alerts on the front page of its paper. It is expected that UCAIR's 2014 air quality media campaign will focus part of its efforts on reducing wood burning.

One possible emission reduction incentive could be in the form of a tax credit, like the long expired one in Utah for "the purchase cost and installation services cost of each pellet burning stove, high mass wood stove, and solid fuel burning device purchased and installed that is certified" by the EPA.[135] Idaho has a similar credit, and Arizona has offered a tax deduction (up to $500) for replacing a wood fireplace with a qualifying wood stove since 1994.[136]

Since December of 2012, Massachusetts has offered rebate vouchers through the Commonwealth Woodstove Change-Out Pilot Program.[137] This program assists eligible Massachusetts residents with the cost of replacing non-EPA-certified wood-, wood-pellet-, or coal-burning stoves with high efficiency, low emissions wood stoves or fireplace inserts, or wood-pellet stoves or fireplace inserts. New stoves must be professionally installed and the installation must be coordinated and certified by the retailer. Old stoves must be permanently removed from service and rendered unusable. The retailer is charged with the coordination of stove disposal and recycling. Low income residents who qualify for the program are eligible for a flat $2,000 rebate, and standard residential customers who qualify for the program are eligible for a flat $1,000 rebate.

There are many related programs in other communities. The San Joaquin Valley Air Pollution Control District offers its residents subsidies to change their old wood- or pellet-burning devices with new, cleaner hearth options such as a natural gas insert or an EPA Phase II certified wood insert. The subsidies range from $100 to $500 depending upon the stove, and $1,500 for low-income residents.[138] Montana offers an income tax credit for the purchase of "a low emission wood or biomass combustion device."[139] Since 1992 Washington has assessed a flat fee on the sale of every wood-burning device to fund the education of citizens about wood smoke health and air quality impacts and the benefits of cleaner burning wood stoves.[140]

There is also some chance that the Utah DAQ will eventually eliminate the sole source of heat registry. The state could then help pay for the conversion of solid fuel heating to natural gas, and potentially help subsidize natural gas for a period of time. A bill is expected during the 2014 General Session that would pay for such conversion and subsidy.

Another option for reducing wood smoke is to restructure existing rules so that the norm is no-burn. Bernalillo County (Albuquerque) New Mexico has one such ban, with a no burn period from October 1 through February 28 except as exempted.[141] In such a case, the Utah DAQ could publicize when people can burn, instead of when people cannot.

The Utah DAQ is currently looking into wood stove certification during real estate transfers. In Oregon, "in connection with the sale of a residential structure, all used solid fuel burning devices, other than cooking stoves, in the residential structure or on the real property sold with the residential structure, must be removed and destroyed unless the solid fuel burning devices were certified for sale as new"[142]

One missing piece in Utah DAQ's enforcement is that wood burning policies primarily directed at residential wood smoke and solid fuel burning. Commercial burning is typically still unregulated. Wood-fire cooking is not prohibited. However, Utah's new SIP does require catalysts on chain-driven, broiler-type cooking areas like the ones used at Burger King.

Other Reduction Efforts

There are many other short-term options for decreasing area source pollution, like purchasing and using home products that have low VOCs. Medium-term options include upgrading boilers in buildings and converting to solar power, as well as utilizing solar water heating systems. Solar power is showing yearly improvements in its return on investment.

The Utah DAQ believes there is a potential for reducing 83% of VOCs in the Uinta Basin.[143] These improvements will assist the Basin in the Statewide Improvement Plan process and in bringing the area back into attainment if it does in fact fall out of attainment this year. The Utah DAQ will focus primarily on VOCs from fuel storage tanks and from truck loading.

CONCLUSION

All Utahns are part of the air pollution problem. All Utahns have a role to play in improving air quality. According to the Utah House of Representatives Majority Leader, Utahns need to be better at "owning the problem."[144]

One option for Utahns to avoid ozone and fine particulates is to wear particulate respirators. Another is to start taking steps toward emitting less pollution. A former Salt Lake City Mayor - currently the Executive

Director of UCAIR - noted that "at lot of people making a lot of small changes leads to a big result."[145] Clean air will come from these small changes, but there are also a few larger changes, including Tier 3 and wood smoke reduction.

What can you do? Don't burn wood during no-burn days, and report people who are burning wood and other solid fuels to the Utah DAQ at 801-536-4000. Also drivers with cars that have poor fuel economy and/or smoke out the tailpipe should keep those cars in the garage on poor air quality days. People can report heavy emitters to regulators in their respective counties.

- Cache County - 435-792-6611
- Davis County - 801-546-8860
- Salt Lake County - 385-468-7664
- Utah County - 801-851-7600
- Weber County - 801-399-7140

All Utahns will need to focus on their changing behavior during times of poor air quality. UCAAT members, the Utah DAQ, university researchers, non-profits and others are continuing research on Tier 3 and wood smoke as well as other air quality strategies. Utah Foundation expects to work with the UCAAT on the development of near-term air pollution policy solutions.

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