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INTRODUCTION TO SUPPLEMENTAL AIR QUALITY ANALYSIS (SAQ)

Overview of Technical Supplement for Air Emissions Analyses

This supplemental document provides the detailed information associated with the League's comparisons between aircraft and motor vehicle air emissions for three air pollutants: nitrogen oxides (NOx), hydrocarbons (HCs) and carbon monoxide (CO). The current situation with the Lake Tahoe Airport, officially known as the Tahoe Valley Airport (TVL – the Airport's assigned initials), in addition to the reason for this comparison is explained in the League's Airport Report, for which this document serves as a supplement. The comparisons in this document are not intended to serve as an official air quality analysis of the Airport, but rather a quick look at a few selected aircraft and their potential emission levels. The League recognizes that there are many other scenarios and aircraft types that would need to be included in a full air quality analyses (that which is encouraged by the Airport Report and all associated findings therein). Further, League staff has attempted to be as accurate as possible in these comparisons given the information available. However, any questions that remain should be used to encourage the full environmental review that needs to be done for the Airport, as opposed to asking the League to perform further analyses. The point is, this is only a quick look at the air emissions from three air pollutants based on a selected group of aircraft and motor vehicles in order to determine the potential for air impacts from increased Airport use and with that, only intended to identify the need for a full, expert-performed air quality analysis of the Lake Tahoe Airport's existing and proposed operations. Additionally, the air quality review should be just a part of a full environmental review of all impacts, as identified by the League's full Airport Report.

<u>This report will:</u>

- Review the overall objectives of the air emissions investigation.
- Briefly explain the importance of NOx, HCs and CO to humans and the environment.
- Discuss emissions from motor vehicles and what is currently known in the Basin.
- Present information regarding aircraft emissions and trends.
- Explain the concepts behind and the methods used to perform the comparisons.
- Present the results of emissions comparisons and explain the potential impacts
- Provide concluding arguments that identify the need for a full environmental review of all Airport operations, including various scenarios associated with desired future uses.

BACKGROUND AND INTRODUCTION

Objectives

In response to growing concerns about air quality, lake clarity, and other environmental assets in the Lake Tahoe Basin, the League to Save Lake Tahoe (League) has performed several air emission-based analyses in conjunction with literature reviews to address one of the pollution sources of concern in the Tahoe Basin –aircraft using the Lake Tahoe Airport. Unfortunately, this air pollution source has thus far been given little attention from the regulators in the Basin's community, and current processes intended to set the stage for future regulations and development continue to neglect this potentially significant source of air pollution, and in fact have represented increased aircraft use as a way to alleviate the environmental pollution associated with motor vehicle use although thorough analyses based on today's technology and information have not been conducted. This issue has actually become an important topic across the nation as communities attempt to improve their air quality and discover that the technological improvements being applied to other motorized forms of transportation are not following suit when it comes to aircraft. In fact, just a few years ago, the House of Representatives requested the U.S. General Accounting Office (GAO) to review this same topic. Many of the GAO's findings, which indicate increasing NOx emissions in newer engines, are referenced in the League's report.

The League has used the best tools and information available to perform this comparison. While the League has attempted to be as accurate as possible, this analysis is solely intended to invite review and discussion of this topic and identify the need for a complete air quality analysis of Airport operations so that the alternative transportation options encouraged by resource managers do not actually result in *more* pollution**.**

The overall goals of the air quality review are to:

1) Call for a complete, scientifically-valid examination of aircraft emissions at the Airport associated with existing levels of use and proposed future levels of use to be performed and used in planning processes *before* any decisions are made about the Airport;
2) Compare potential air emissions generated by commercial aircraft use to motor vehicle emissions to examine whether aircraft is a better or worse environmental alternative;
3) Encourage discussion of this topic (and other transportation alternatives) by the public and those conducting planning processes in the Basin;
4) Provide information in conjunction with other environmental and economic reviews related to the Airport; and
5) Encourage the public to become involved in the Airport planning processes.

Air and Water Quality Concerns

Emissions from aircraft are of concern due to the contributions to air pollutants which harm human and forest health and can deposit to the Lake and reduce clarity. The primary emissions of concern from aircraft exhaust include nitrogen oxides (NOx), hydrocarbons (HCs) and carbon monoxide (CO). The following is a discussion of the impacts associated with these air pollutants. Not included in these comparisons are particulates, which are emitted by aircraft and motor vehicle exhaust, but also become airborne from motor vehicles traveling over roadways. Due to the importance of particles to air and water quality, the complete air quality analysis (as well as other transportation alternatives) called for by this report should also include a review of particulate matter (PM) in addition to other relevant pollutants (i.e. carbon dioxide, which contributes to global warming, toxic air pollutants, etc.). In this report, the heaviest focus is placed on NOx emissions due to the multiple and significant impacts to human and forest health, and to lake clarity, as summarized below.

Human & Forest Health and Lake Clarity

Nitrogen oxides (NOx):

Nitrogen oxides (commonly referred to as NOx) are of concern for several reasons. First, NOx is one of the two key components of ozone (O_3), which is a harmful pollutant that can cause health problems in humans. Ozone is created when NOx and hydrocarbons react in the presence of sunlight, and is often represented by the "smog" seen in most large areas. Common adverse impacts from exposure to unhealthy levels of ozone include, but are not limited to, respiratory irritation, impaired athletic performance and possible functional changes in the respiratory system. Some people are more sensitive to the adverse impacts than others, such as children, the elderly and those with respiratory conditions such as asthma. TRPA's second air quality standard is based on preventing unhealthy O_3 levels. Ozone has also been shown to cause damage to pine trees at concentrations lower than those which impact human health. Common types of damage to vegetation include injury to leaf tissue and reduced photosynthetic activity (TRPA 2001 Threshold Evaluation, AQ-2). The third concern in terms of NOx emissions is the loss of Lake Tahoe's famed clarity (addressed in TRPA's existing standards for atmospheric deposition, AQ-8). Lake Tahoe's clarity has been dropping by roughly one foot per year. This is due in part to the growth of algae, caused by increased inputs of nitrogen (N) and phosphorous (P) which have occurred with increased human development and use of the Basin. Particles are the other dominant pollutants reducing lake clarity. Examples are larger particles include dust and wood smoke. The nutrients N and P, along with particles, enter the Lake from both the ground (via runoff from streams, etc.) and from the air. The 2nd Annual Report on water clarity studies done by UC Davis staff estimates that atmospheric deposition contributes roughly 52% of the nitrogen, 16% of the phosphorous and 9% of the total fine particles to the Lake (UC Davis 2006; LRWQCB 2006). NOx emissions contribute to the nitrogen in the atmosphere (which then can deposit to the lake), and therefore NOx sources are of even more concern in the Basin. NOx finds its way into Lake Tahoe's atmosphere from local sources within Lake Tahoe (the primary sources being transportation-related) and from regional and distant sources through air entering the Basin from sometimes distant indeterminate locations (i.e. Sacramento Valley/Bay Area, Asia, etc.). However, the 2006 UC Davis report names local sources as primarily responsible for the nitrogen that enters the lake, estimating that "up to 90% of the nitrogen…is thought to originate in the Basin."

Since the external sources of NOx depositions are virtually impossible to manage locally, regional resource managers wanting to reduce the atmospheric deposition of nitrogen must focus heavily on sources such as vehicle emissions within the Basin's boundaries (which coincides with the legal jurisdiction of the TRPA, TMPO and others). In terms of emissions from aircraft, NOx is the pollutant that is most likely to impact lake clarity. [Note that although NOx is "hydrophobic" (i.e. it does not like water) and therefore is not as likely to deposit on the lake's surface, the large abundance of NOx in the Basin, in combination with other factors, keeps it a concern for Lake clarity since some NOx will contribute to nitrogen deposition into Lake Tahoe, directly or indirectly (i.e. after chemical reactions change it into another form that will readily deposit). For example (using hypothetical values), even if only 5% of the total NOx in the Basin's atmosphere may to the Lake's surface, that small proportion is still very important because the overall amount of NOx is so large that even 5% will mean a very large amount of nitrogen enters the Lake.

Therefore, it is clear that the Basin's policymakers must utilize the best and most recent information available regarding NOx emissions to create transportation programs and policies that secure a reduction of NOx emissions within the Lake Tahoe Basin. Recently available information includes current aircraft emissions data and scientific tools (such as the model FAA created to estimate aircraft emissions which is used for this comparison) that help planners estimate the associated impacts (and alternative options to reduce transportation-caused air pollution).

Hydrocarbons (HCs):

Hydrocarbons (HCs) are the other key component to the formation of ozone. The adverse human health and vegetative impacts of ozone are discussed in the previous section for NOx. While of great concern to human and forest health, HCs are not of concern in terms of lake clarity.

Human Health:

Carbon Monoxide (CO):

Carbon monoxide (CO) is a tasteless, colorless, odorless gas that is slightly lighter than air. It affects humans by reducing the supply of oxygen to the tissues of the body and is regulated because of the concern to human health. Common health affects may include headaches, dizziness, nausea, tiredness/fatigue and more severe cases can result in death. Levels of exposure that are not considered harmful at sea level may cause adverse health effects to humans in the Tahoe Basin because there is less oxygen in the air at the Basin's higher elevation, and due to how CO "mimics" oxygen in the blood, lower concentrations of CO can create impacts. For example, a CO concentration of 9 parts per million (or "ppm," a technical unit of measurement that represents the concentration of a pollutant per volume of air; however, understanding the specifics of this is not necessary for this explanation) may cause a certain adverse health impact to a person in Sacramento (far lower elevation) that will happen with exposure to only 6 ppm in the Tahoe Basin. For this reason, TRPA (AQ-1), CA and NV have adopted stricter CO standards specific to the Basin (or above certain elevations per NV's standard). In the Basin, CO is more of a concern during the winter months, when thermal inversions trap CO emissions at the surface and cooler temperatures cause vehicles to emit more CO, creating areas of higher CO concentrations (termed "CO hot spots") [motor vehicle impacts are the basis for TRPA's AQ-5]. Because the CO emissions associated with landing and takeoff of aircraft will generally be concentrated to limited areas unlike motor vehicle travel, the impacts of emissions around the Airport may be worse than when compared to the same level of CO emitted from a vehicle traveling around the Lake (this being shown as a relative comparison between vehicle emissions vs. aircraft emissions). These impacts may be even worse during thermal inversions. This is something that would be evaluated in an appropriate scientific review.

Human Health, Lake Clarity and Visibility

Particulate Matter (PM):

Particulate matter (PM) represents particles from a variety of sources, including dust, wood smoke, road salt, aerosols emitted by the conifer forests, etc. The human eye can only see the larger particles, such as a grain of dust, however those of greatest concern to human health are smaller than 2.5 microns in diameter (in technical air quality terms, particles in this size category are called "fine particles;" however, take note that in water quality terms, "fine particles" refers to a much larger size category). As a reference, a human hair is roughly 70-100 microns in diameter. On the other hand, the slightly larger particles, approximately 2.5 to 40 microns in size are believed to have the largest impact to lake clarity, since the "fine" particles are not as likely to deposit to the lake because they are, in general terms, not heavy enough to deposit. The larger particles may more readily deposit to the Lake (and can travel far enough across the land to make local sources that are not immediately next to the Lake still important in terms of clarity). Once in the lake, the larger particles can either settle to the lake's floor (therefore not impacting clarity), or change to sizes that remain in the water column, thereby reducing clarity). As stated above, the 2006 UC Davis report states that existing data indicates that perhaps 9% of the particles entering the Lake come from the air. This proportion may seem small but still plays a significant role in addressing lake clarity loss, and will be important when examining which methods resource managers can implement that create the greatest reduction in particle loading to the lake (including options that would result in the lowest economic cost).

Other Environmental Considerations:

Meteorological Processes:

Once emitted into the atmosphere, there are several different things that can happen to a pollutant. Chemical reactions can occur and modify or eliminate certain types of pollutants. A primary example of this is the formation of ozone by sunlight-stimulated reactions of NOx and HCs. Pollutants can readily fall to the ground, or they can be swept up in wind or air currents and carried somewhere else. They can make their way over the lake and deposit or continue to be carried in the air. Tahoe's weather and topography (i.e. being high elevation Lake surrounded by mountains on all sides) play a large role in determining what happens to pollution once emitted. For example, most residents are familiar with Tahoe's thermal (i.e. temperature-based) inversions which trap pollutants close to the ground. This can often be seen during the winter months, when a slight haze of what appears to be mostly made up of wood smoke from residential fireplaces, wood heaters, etc., is seen over the lake to a certain height. At that height, the haze appears "capped" in almost a straight, horizontal line. This is because of differences in temperature that keep the air masses from mixing. In terms of emissions related to the Airport, aircraft emit pollutants through all "layers" of air as they arrive and depart from the Airport. In the past, assumptions were made that emissions were only of concern when fairly close to the ground (i.e. from the ground to just 300 feet above, 1992 S.A., Exhibit D). However, we now know that such an assumption can not be so simply applied. Pollution can mix with other layers, up or down, from the ground's surface to miles above (in fact, the FAA's emissions modeling software acknowledges that emissions are of concern to up to 3000 feet above the ground). What is not known is how these "multi-layer" emissions from aircraft using the Airport truly impact our air quality and lake clarity. Researchers are currently working to gather better meteorological data (i.e. weather information) across these 'multiple air layers' in order to better understand what happens to pollution. In this case, it would be irresponsible to make any assumptions based on the outdated idea that emissions are only an issue close to the ground. This only further enforces the need for a thorough environmental analysis.

Elevation and Temperature Impacts on Emission Rates:

Another consideration is that Lake Tahoe's specific geographic location may result in increased emissions from aircraft (when compared to at sea level) due to changes in how aircraft must operate to accommodate for elevation and other impacts. However, for consistency and due to limited Tahoe-specific information, default values were used in the aircraft emissions model. This is another aspect of the Airport operations that requires additional review.

Motor Vehicle Emissions in the Lake Tahoe Basin

A comparison to motor vehicle emissions is included in order to assess the relative contribution of aircraft emissions to local pollutant emission levels and to allow for a general comparison among sources familiar to most Basin residents and those involved in planning for the Basin. The comparison is not intended to promote the additional use of motor vehicles. Rather, the League hopes that this information will raise attention to the need to focus on *appropriate, environmentally-beneficial* solutions to Tahoe's transportation needs based on *scientifically-sound environmental analyses*.

Motor vehicles are one of the most recognized source of air pollution in the Basin and are estimated to be responsible for a majority of the air pollution in the Basin (for the three pollutants evaluated in this report), as well as playing a significant (if not primary) role in the inputs of clarity-reducing pollutants into the Lake through direct and indirect run-off and the deposition of air pollutants into the Lake. A majority of Tahoe's visitors travel to the Basin in private automobiles, many from nearby areas such as the Sacramento Valley and Bay Area, or from the Reno/Carson Valley areas on the Nevada side. One of the issues transportation planners struggle with is how to accommodate the Basin's tourism-based economy yet reduce air pollution impacts (generally associated with visitors driving into the Basin). Resource managers spend millions of dollars and utilize extensive staff and other resources in attempts to reduce the use of motor vehicles in the Basin for the purpose of reducing the associated pollution. Over the past several decades, the Lake Tahoe Airport has been assumed to be a less-polluting alternative to motor vehicle use in the Basin. However, this assumption has never been analyzed in a complete, expert-performed scientific review of aircraft emissions.

The League's findings indicate significant potential for aircraft use to emit far more air pollution 'per passenger' than if an individual passenger drove. The gap between aircraft and motor vehicle NOx emissions is expected to only worsen because motor vehicle emissions are expected to continue to be reduced by technological advances in the near and distant future, unlike aircraft NOx emissions (see below). This raises serious concerns about existing transportation and Airport plans, which advertise increased Airport use as better for the environment (which, to make matters worse, means that other, environmentally beneficial alternatives may not be given due consideration and resources because they are focused on the Airport, thus compounding the problem). Another concern that should be addressed in a complete review is the current lack of a convenient and desirable in-Basin public transportation system. It would not make sense to bring in more people to the Basin and assume their environmental impacts will be alleviated because they will use public transit when the public transit system is not yet a desirable or convenient way to travel for many. In fact, the 2004 winter survey of travelers in the Basin performed by TRPA indicated that a majority of visitors prefer to travel in the Basin in private automobiles. Another conflict that needs to be addressed is how this situation will be dealt with, since the Settlement Agreement restricts the number of passengers that can rent cars at the Airport to just 20% (unfortunately, the survey failed to identify this when asking if people would fly if service were available, therefore many likely assumed they could rent a car upon arrival to Tahoe). Additionally, as discussed in the League's Airport Report – Economics Section, the survey failed to really address the question of whether increased Airport service would bring in passengers that would otherwise not come to Tahoe because of how questions were asked, let alone that the people interviewed were already here – and therefore obviously came to the Basin *without* commercial air service.

Aircraft Emissions

Many Airport proponents place faith in technical advancements to produce cleaner airplane engines. It is likely that this is in large part due to the common assumption that if motor vehicles are continuing to run cleaner as new technology is developed, then other motorized transportation must be following suite. Unfortunately, historical and current information regarding aircraft emissions indicates that this assumption is incorrect, since although technology has enabled reductions in aircraft *noise* levels, there have actually been *increases* in the emission rates of some air pollutants (GAO February 2003). In fact, today's research overwhelmingly indicates aircraft engine emissions will:

1) Emit pollutants on a far more severe level than today's automobiles (based on emissions per passenger traveling via each method);

2) Actually increase emissions of certain air pollutants unless serious efforts are taken to reverse current trends; and,
3) Not be changed for another several decades to come even if engines with improved fuel efficiency and reduced emission levels were to become required *now.*

The **first** statement above is evidenced not only by general aviation documents, but by the League's analyses performed specific to Tahoe's transportation conditions (which are included in this report). The **second** statement is evidenced by extensive information that is available to the public via the web or other means. One of the most reputable documents addressing the increases in emissions is from the United States General Accounting Office (GAO). In fact, the GAO, as a result of a request by the Subcommittee on Aviation, Committee on Transportation and Infrastructure in the House of Representatives, reviewed the issue of aircraft emissions and found that:

> "Research and development efforts by the federal government and the aircraft industry have improved fuel efficiency and reduced many emissions from aircraft, including hydrocarbons and carbon monoxide, but have increased emissions of nitrogen oxides, which are a precursor to ozone formation. As a result, **many new aircraft are emitting more nitrogen oxides than the older aircraft they are replacing**. For example, GAO's analysis of aircraft emission data shows that the engines employed on the newest models of a widely used jet aircraft, while meeting current standards for nitrogen oxides emissions, average over 40 percent more nitrogen oxides during landings and takeoffs than the engines used on the older models. Technologies are available to limit nitrogen oxides emissions from some other newer aircraft models. Many state and federal officials GAO contacted said that, in the long term, nitrogen oxides emissions from aircraft will need to be reduced as part of broader emission reduction efforts in order for some areas to meet federal ozone standards." (GAO 2003). http://www.gao.gov/new.items/d03252.pdf

The same report also provides the following comparison for the three main pollutants examined in this report, which clearly shows the conflicting trends in increasing versus decreasing aircraft emissions.

Table 2: Comparison of Emissions during Landing/Takeoff for Older and the Newest Model Boeing 737s

	Average emission (in pounds) per landing/takeoff		
Emission	**Older Boeing 737**	**Newest Boeing 737**	**Change**
Nitrogen oxides	12.1	17.8	47% increase
Carbon monoxide	16.8	10.7	37% decrease
Hydrocarbons	1.2	1.1	10% decrease

Source: GAO.

Note: Landing and takeoff data for U.S. aircraft in 2001 obtained from AvSoft; emissions calculated using FAA's Emissions and Dispersion Modeling System, version 4.01. See appendix VII for additional information on our emission calculations and Boeing 737 models and engines.

The **third** statement reflects the impacts of the fairly long lifetime of aircraft engines on air quality. Airport proponents have suggested that aircraft emissions are of little consequence since they will probably be far lower in just a few years. Unfortunately, this is not the case. While there are economical and other benefits associated with building an engine that will last for decades to come, what this means to air quality is that even if a new regulation were put in place 'tomorrow' requiring new aircraft engines to meet more strict emission standards, it would be decades before the benefits would truly be seen on a full scale. This is because existing engines are built to last for such a long time that the phase-out of the older, more polluting engines would not be complete for decades into the future.

Methods

While previous analyses indicate that a reintroduction of commercial air traffic would "divert" automobile traffic into and away from the Tahoe Basin ("diverting" means that people are 'diverted' from driving because with commercial service offered, they will instead fly, which in this case is assumed to reduce VMT), thereby reducing pollution from motor vehicles (which is another assumption requiring additional review as it is not supported by appropriate surveys), they fail to accurately account for the emissions caused by the aircrafts themselves (and associated ground support equipment [GSE]). Therefore, one goal for this comparison is to provide a direct comparison to the very sources for which aircraft are assumed to reduce emissions from (motor vehicles). A second goal is to provide a comparison in terms that are perhaps more generally understood; for example, explaining how much farther a vehicle would have to drive to emit "1,000 grams NOx" as opposed to merely saying "1,000 grams," the latter of which many will not likely understand the relative importance of (i.e. how important are 1,000 grams of NOx?).

<u>*Motor Vehicle Categories:*</u>

The first and second groups, **1965-2006 and 1997-2027**, represent emissions associated with the estimated fleet mix in Tahoe during those years (numbers correspond with CARB's summertime EMFAC data; see the associated discussion in the methods section for additional information). The future values were included to examine potential future impacts, especially when once considers that motor vehicles will continue to emit less pollution over time while trends suggest aircraft emissions will at best, not change much but at worst, could actually *increase* (specific to NOx). In either case, the aircraft technology section of this section discusses why it is important to consider future impacts as well.

The latter two vehicles are based on providing comparisons to typically observed (therefore "familiar") vehicles in Tahoe, as well as vehicles representative of the advances in motor vehicle technology that have significant reduced tailpipe emissions (emission rates are from **2005 models** of both). Many Lake Tahoe residents (and frequent visitors) have likely noticed many **Subaru Outbacks** in the Tahoe Basin, which are currently among the cleanest category of vehicles (LDA). The **Ford Expeditions** are fairly popular as well, and represent a more polluting SUV yet still benefiting from today's technology.

Methods were based on:

1. <u>Estimate emissions associated with several types of aircraft engines</u>
   Basic aircraft emissions are estimated based on the "Landing/Take Off" cycle, termed "LTO," which includes emissions from the arrival, time in between and departures for each aircraft. The emission estimates for each LTO are based on running the Federal Aviation Association's (FAA) Emissions and Dispersion Modeling System (EDMS), which was developed to estimate aircraft emissions and dispersion. For this report, only the emissions were inventoried. League staff selected the aircraft engines to be used in this comparison through a review of the following factors: 1) noise levels and suggested for use in the Basin, 2) ability to model emissions in EDMS and 3) whether the aircraft and associated engine types are still in use.

   <u>*Noise Levels and Proposed Use*</u>:

Aircraft were selected to represent aircraft types creating below 80 dBA noise upon arrival up to 86 dBA (see the noise section of the Airport Report for discussion of noise levels and issues). Additionally, the Bombardier Q400 was selected because it had been mentioned by Horizon Air as an aircraft that the airline may consider for use at the Airpot assuming Airport improvements were made (Tribune, 2-17-06), and is advertised as a "green" aircraft that boasts lower noise and air emissions than are required by federal regulations (Tribune and Q400 website). The DC 9-30 (JT8D-11) and BAE146-200 (ALF502R-5) were included because they carry roughly 100 passengers, an aircraft capacity that is often referred to when mentioning the re-introduction of commercial airline service. However, these two aircraft plus the Q400 do not meet the Airport arrival noise standard, therefore they would not be allowed at the Airport unless noise standards were changed to allow for more noise (even more than the temporary phase-in period allowed). The League could not locate any commercial aircraft with around 100 passenger capacity load that meet noise standards.

Emissions Modeling:

Emissions from the selected aircraft were obtained through the use of the FAA's Emissions and Dispersion Modeling System (EDMS). The modeling runs used default values and specified a 3000 foot mixing height (which was pre-set in the model with the Airport was specified); additionally, the model did not allow selected of engines that are out of circulation. Because defaults were used, the emissions figures are likely conservative estimates.. Even higher emissions could be realized due to elevation and geography impacts increasing LTO times. The emissions modeled also include those associated with ground support equipment (GSE), such as diesel-powered fuel, lavatory and service trucks and regular gasoline-powered equipment like baggage tractor and belt loaders. The GSE emissions appear to contribute mostly to CO emissions.

Status of engines:

Through internet research and use of the EDMS model's default aircraft and engine lists, League staff selected engines that are still commonly in use (though not necessarily still being manufactured) for the emissions comparisons.

2. Estimated emissions per flight or per year:

Emission estimates were performed based on 1) one passenger's share per flight, 2) one carload worth of passengers' share per flight, and 3) emissions based on flights carrying up to 100,000 passengers/year.

1) One passenger's share of emissions is based on the amount of pollution associated with their use of the aircraft. Basically, if one flight of an aircraft emits 8,000 grams of NOx and carries 100 passengers, then each individual passenger's share of emissions is "8,000 g divided by 100 passengers equals" 80 grams NOx. This "share" is then compared to how far that one passenger would instead have to drive a certain vehicle type to emit 80 g NOx.
2) One carload of people in the Tahoe Basin carries, on average, "2.7 people" per TRPA's estimates. Therefore, the emissions associated with one carload represent the collective sum of the emissions share from 2.7 passengers. This comparison is important because in Tahoe-based transportation planning documents and project review, mitigation measures are based on the assumption that people ride 2.7 per vehicle, not one person per vehicle. Therefore, the assumption that the air service would remove VMTs would be reviewed with reference to 2.7 passengers/vehicle when following standard Tahoe methods.

3) The Master Plan allows for up to 300,000 passengers (in Phase I, which remains 'unofficially extended' for 4 years since although it ended, the Airport has not moved to Phase II but continues to operate). However, more recent suggestions have referenced 'starting with' 100,000 passengers per year. Therefore, because the annual emissions of pollutants are of concern in addition to the daily or shorter term exposure, emissions are estimated based on 100,000 passengers per year (as are the associated VMT Equivalents). The potential air pollution impacts only increase in severity as one considers the increased air emissions associated with even higher annual ridership.

The following table indicates the number of flights per year for each aircraft calculated by assuming 100,000 passengers per year and dividing that by the number of passengers per flight (i.e. maximum passenger capacity).

Aircraft (abbrev.)	Passenger Capacity	Number of Flights per Year
Bombardier Q400	73	1,370
BAE 146-200	88	1,136
DC9-30	100	1,000
B737-600	121	826
B757-300	262	382
Cessna Citation II	8	12,500
Jetstream 31	19	5,263
Dornier 328-300	32	3,125

3. Vehicle Miles Traveled "Equivalents"

In order to compare aircraft emissions to motor vehicle emissions, rather than only compare "grams to grams emitted," the League developed the term "VMT Equivalent," which basically represents a certain "unit or amount" of air emissions. To explain what this means, first, assume that a given airplane may emit 3,000 grams of NOx per one landing and takeoff (LTO). Now, a certain automobile emits 1 gram NOx per mile it is driven. In order for the automobile to emit the same amount of NOx as one LTO of the airplane, it would have to be driven a certain number of miles. To determine the relative mileage, we divide 3,000 grams by 1 gram per mile to get 3,000 miles. In this example, the "VMT Equivalent" of the selected aircraft would be 3,000 miles. The other benefit of this method is that most readers are likely to understand the relative importance of "3,000 miles' worth of NOx" as opposed to "3,000 grams of NOx" since familiarity with transportation and associated terms, in addition to the ability to visualize the distance, is generally far higher than with air quality terminology. The equations used to generate the "VMT Equivalents" are explained below. One "LTO" represents one Landing and Take-off at the Airport. Comparisons include various combinations of different vehicle types, number of passengers and time periods. Readers are advised to pay close attention to the units associated with these combinations to fully understand the results.

<u>VMT Equivalent per flight (LTO) of Specific aircraft</u> *<u>(NOx used for examples)</u>*

Determine:

1) Total grams NOx emitted per flight (LTO) = # grams/LTO
2) Number of grams NOx emitted per mile of Vehicle Group A = # grams/mile

Calculate:

<u>NOx-based VMT Equivalent for one LTO</u> <u>= # grams/LTO *divided by* # grams/mile</u>

For example, the following hypothetical numbers would result in:

Determine:

1) Total grams NOx emitted per flight for aircraft "Tahoe" = 3,000 grams/LTO
2) Number of grams NOx emitted per mile by Vehicle "A" = 1 gram/mile

Calculate:

<u>NOx-based VMT Equivalent for **one LTO of aircraft "Tahoe:**"</u>

= 3,000 grams/LTO *divided by* 1 gram/mile <u>= 3,000 miles</u>

This means that Vehicle A would have to be driven 3,000 miles to emit the same amount of NOx as one LTO of aircraft "Tahoe"

However, estimates are then taken one step further and determined on a per-passenger basis. This is done for two reasons: 1) so that individuals and decision makers can evaluate the true environmental costs and benefits of transportation alternatives and 2) so that the relative air pollution emissions (expressed in units of "VMT Equivalents") associated with one year's worth of flights supporting 100,000 passengers can be determined. This is done by:

Determine:

1a) Total grams NOx emitted per flight for aircraft "Tahoe" = 3,000 grams/LTO

1b) Total number of passengers per flight on aircraft "Tahoe" = 100 passengers
(assuming full capacity)

1c) <u>VMT Equivalent per passenger</u>:* = # grams NOx/LTO *divided by* # Passengers *(at full capacity)*

* The VMT Equivalent per passenger represents the number of miles one passenger would have to drive the selected vehicle type (in this example, that is Vehicle "A") in order to emit the same amount of NOx (grams) as they are responsible for by traveling via aircraft. The amount a passenger is "responsible for" is basically their portion of the flight's emissions, so if there are 100 passengers, and 3000 grams of a pollutant emitted per flight, then each passenger is "responsible for" 30 grams of that pollutant (i.e. 3000 grams *divided by* 100 passengers [see below]).

2) Number of grams NOx emitted per mile by Vehicle "A" = 1 gram/mile

Calculate:

<u>NOx-based VMT Equivalent for **ONE passenger** on **aircraft "Tahoe"** ***per flight (LTO)***:</u>

a) *<u>NOx per passenger per LTO (i.e. Passenger responsible for):</u>*

= 3,000 grams/LTO *divided by* 100 passengers = 30 grams NOx/Passenger

b) *<u>VMT Equivalent per passenger:</u>*

= 30 grams/passenger/LTO *divided by* 1 gram/mile = 30 miles

This means that one person driving Vehicle A would have to drive 30 miles to emit the same amount of NOx as that one person would be responsible for if traveling via aircraft "Tahoe" on one LTO. *To bring it "full circle," we could multiply one passenger's share of NOx (i.e. responsible for 30 grams/flight) by the number of passengers (100) and end up with the total grams NOx emitted per flight (30 grams x 100 passengers/LTO = 3,000 grams/LTO).*

Since estimates are presented in tabular form, the example above is illustrated in that format as well:

FOR EXAMPLE PURPOSES ONLY

EMFAC Fleet Years - Selected Modeling Runs	**Aircraft Information**		**NOx Emissions from Aircraft** (grams)		1 Vehicle with **1 Passenger** could be driven this many miles to emit same **NOx** as if that one passenger traveled on **1 LTO**	1 Vehicle with **Average Tahoe Carload**[2] could be driven this many miles to emit same **NOx** as if carload passengers traveled on **1 LTO**
Fleet Year[3]	Plane Model (engine type)	Passenger Capacity*	Per LTO	Each passenger responsible for (g NOx)	**VMT Equivalent:** 1 Passenger per Vehicle (per flight comparison)	**VMT Equivalent:** 2.7 Passengers per Vehicle (per flight comparison)
A	"Tahoe"	100	3,000	30	**30**	
B				30		
C				30		

Vehicle Type

Aircraft Name

grams NOx / LTO

One Passenger is responsible for this many grams NOx

The table is repeated below for further explanation:

FOR EXAMPLE PURPOSES ONLY

EMFAC Fleet Years - Selected Modeling Runs	**Aircraft Information**		**NOx Emissions from Aircraft** (grams)		1 Vehicle with **1 Passenger** could be driven this many miles to emit same **NOx** as if that one passenger traveled on **1 LTO**	1 Vehicle with **Average Tahoe Carload**[2] could be driven this many miles to emit same **NOx** as if carload passengers traveled on **1 LTO**
Fleet Type	Plane Model (engine type)	Passenger Capacity*	Per LTO	Each passenger responsible for (g NOx)	**VMT Equivalent:** 1 Passenger per Vehicle (per flight comparison)	**VMT Equivalent:** 2.7 Passengers per Vehicle (per flight comparison)
A	"Tahoe"	100	3,000	30	**30**	81
B				30		
C				30		

NOx-based VMT Equivalent for one passenger

This is the left column multiplied by the average Tahoe carload: 2.7 people/vehicle – see below for more information.

Regarding the last column, this is meant to show how many miles one vehicle (in this example, Vehicle "A") carrying the average Tahoe carload (2.7 people/vehicle) would have to be driven to emit the same amount of NOx as would be the collective share of those 2.7 passengers if flying via aircraft "Tahoe." This value is obtained by multiplying one passenger's NOx–based VMT Equivalent by 2.7.

The results include additional columns, shown below, which represent additional estimates based on the per flight data.

EMFAC Fleet Years - Selected Modeling Runs	Sum of total miles that Vehicle would have to be driven to emit same **NOx** as **1 LTO**	Sum of total miles that Vehicle would have to be driven to emit same **NOx** as the **PER DAY** average Number of Flights (**average per DAY**; assume 100,000 Passengers/Year)
Fleet Type	**VMT Equivalent: *Total Miles*** (per flight comparison)	**VMT Equivalent: T*otal Miles*** (Daily Comparison [for TRPA AQ-7])
A	3,000	8,219
B		

TOTAL VMT Equivalents/LTO

Average Daily Emissions expressed in terms of "VMT Equivalents per Day"

The column on the **left** represents the total VMT Equivalents per flight, expressed as how far one vehicle (here, Vehicle A or B) would have to be driven to emit the same amount as one LTO of the aircraft. Although the per flight values are explained as "one vehicle driven 3,000 miles" for ease of understanding, the total per flight VMT Equivalents are the same whether examined with one person per vehicle or several per vehicle, because the number of total vehicles will be different. Specifically, either each of the 100 passengers drives one "Vehicle A" 30 miles (meaning a total of 100 vehicles are driven), or all 100 passengers instead ride in the average Tahoe carload, where instead a total of 37 vehicles* are each driven 81 miles (* 100 passengers divided by 2.7 passengers/vehicle = 37 vehicles). Since Tahoe-based transportation planning documents (and mitigation requirements) often reference VMTs based on 2.7 people/vehicle, presentation of those values is important for comparing the true impacts of aircraft.

The column on the **right** (specific to the NOx results only) represents the average daily air emissions as expressed in terms of VMT Equivalents. These values were estimated for the purposes of comparing the potential daily emissions to TRPA's existing VMT standard, which is based on a modeled value representing VMT for one day. Although daily flights would not be the same number per day over an entire year, first, there is no way for the League to know what the number of flights might be from one day to the next, and second, the air pollution concerns will not change so knowing daily forecasts is not necessary for considering potential daily impacts. For example, if more flights (than the estimated averages herein) occur on "Tuesday" then people are exposed to even higher levels of air pollution than estimated. If total flights on "Wednesday" are less than average, it does not "take away" the additional exposure to pollution on Tuesday. Federal, state and TRPA air quality standards recognize this and are based on specified time periods accordingly.

To estimate daily emissions in terms of VMT Equivalents, we multiplied the total VMT Equivalents per flight by the number of flights needed to transport 100,000 passengers per year, then divided that value by 365 days. In other words:

3,000 miles (total VMT Equivalent for one LTO of "Tahoe" aircraft)
multiplied by
1,000 flights (100,000 passengers divided by 100 passengers/flight)
= 3,000,000 miles/year
divided by
365 days/year
= 8,219 miles per day [VMT Equivalent/Day]

Comparison to Entries from Echo or Spooner Summits
Further estimates compare aircraft NOx emissions to the in-Basin emissions of NOx generated by passengers driving to the Basin via Echo or Spooner Summit instead of flying. Since the concern is based on in-Basin air quality, let alone the Basin's topography and climate can result in local emissions being "trapped" in the Basin, thereby creating higher concentrations of pollution in the Basin, the League has only examined the motor vehicle emissions associated with the total round trip miles driven within the Basin's airshed (from the different summits to Airport; Echo Summit: 16.4 miles and Spooner Summit: 24.0 miles, round trip).

The potential for emissions from vehicles driving up Highway 50 (Echo Summit only since Spooner is generally "downwind") to travel in air masses and enter the Basin is something that would need to be analyzed in a full environmental report of Airport impacts. However, in general, the League suspects that the conclusions will not change because the comparisons show aircraft emissions to far exceed motor vehicles (by orders of magnitude), and it is likely that the percentage of NOx or HCs (CO is generally a localized pollutant only) that could enter the Basin from the tailpipes of vehicles driving up highway 50 outside of the Basin's airshed (and counting only those generated by passengers who otherwise would *not* have already driven to Tahoe [about 15% based on most recent survey that asked visitors this question]), will not be so high as to 'cancel' out the emissions savings when driving versus flying. Whether those people would then drive more in the Basin because they have their own vehicles is 1) not valid to this analysis because according to the survey, they would not driver here anyway and 2) for the sake of comparing emissions, if they are to be considered, this would need to be addressed in a full environmental review and is beyond the scope of the League's comparisons.

4. <u>Motor vehicle emission estimates</u>*:*
Estimates for the VMT values of the 2006 and 2027 average fleet vehicles are based on emission rates generated by the California Air Resources Board's (CARB) EMFAC model (2002 version), which was developed by CARB to estimate motor vehicle emissions in all areas of California (regarding Nevada vehicles, Washoe County Air Quality staff have said CA estimates are appropriate since most NV vehicles meet CA emission standards due to CA residents shopping for vehicles in NV [TRPA 2004 Winter Fleet Survey & Report]. EMFAC estimates are based on vehicle types (i.e. "fleet distribution or mix"), vehicle speeds, weather conditions and other relevant factors. The default data in EMFAC come from various sources, including local DMV registration (vehicle population and mix) and county averages for speed and weather (i.e. averages

for entire counties of El Dorado and Placer). While it is recognized that the default values are not specific to the Tahoe Basin (for example, the DMV registration for SLT does not account for visitors' vehicles), previous discussions among TRPA/TMPO staff and CARB have resulted in the agreement that the default summertime values for fleet mix (most relevant to this investigation) are not assumed to be so different as to require separate summer studies at this time. The potential impacts to emission estimates from using county-wide speed and weather data may be important, but are beyond the scope of this report. (In 2004, TRPA staff collected Tahoe-specific data for several of these categories, however studies were focused only on the wintertime conditions). On a final note, because 'diverted' passengers are assumed to not create additional *heavy duty truck* traffic (i.e. semi's, buses), the emissions associated with these types of vehicles are not included in the overall comparisons. For example, EMFAC's fleet proportions showed that once the small percent influence of heavier vehicles was removed, "light duty autos" (i.e. passenger cars) made up about 26%, "light duty trucks" (i.e. light/medium weight SUVs and pickups) made up about 36% and "medium duty trucks" (i.e. heavy SUVs and pickups) made up about 38% of the remaining total fleet. To obtain an average VMT Equivalent value based on an average of vehicle emissions from the 2006 and 2027 fleet mix categories, the VMT Equivalents were determined by first estimating miles assuming all vehicles were in just one type (for each category), then the percentage values applied to each type to account for proportions, then the three "proportioned" estimates were added together for a final "average" value. A portion of the table used to estimate this for NOx is included below (the tables presented in the results section have the intermediate steps shown here removed for ease of viewing).

Except from: Calculations: VMT Equivalents for NOx Emissions

Vehicle Type	Aircraft Information				NOx Emissions from Aircraft (grams)			California Emission Factors*** (g/mile)			Annual VMT Equivalent: Nox (Assuming All Vehicles in Category- *For intermediate calculations ONLY*) [No. of miles]			Annual VMT Equivalent: Nox After Adjusting for Fleet Mix[1]; [No. of Miles] / 1 vehicle could be driven this many miles to emit same g NOx as 1 LTO
Fleet Year[3]	Plane Model (engine type)	Passenger Capacity*	Per LTO	Each passenger responsible for (g NOx)	LDA	LDT	MDT	LDA	LDT	MDT	**LDA** (26.4% of total fleet)	**LDT** (35.9% of total fleet)	**MDT** (38.1% of total fleet)	**Total of Adjusted Fleet Proportions**
1965-2006	Dornier 328-300 (PW306B)[3]	32	3,220	101	0.598	0.801	1.191	168	126	84	44	45	32	122
1997-2027				101	0.043	0.074	0.136	2,340	1,360	740	618	488	282	1,388
2005 Sub. Otbk				101	0.01	10,063	10,063	10,063						
2005 Ford Exp.				101	0.06	1,677	1,677	1,677						

In addition to comparisons to emissions from an 'average Tahoe vehicle,' emissions from two commonly observed vehicles in the Tahoe Basin were also compared in order to provide a familiar frame of reference in the presentation of the findings. These vehicles were a 2005 Subaru Outback and a 2005 Ford Expedition, and comparisons were based on the actual emission rates of the vehicles as certified by California (http://www.arb.ca.gov/msprog/onroad/cert/cert.php).

5. Relative Importance to TRPA VMT Standard:
   Without some basic information, it may be difficult to understand the relative importance of a given number of vehicle miles traveled (VMTs) in the Tahoe Basin. Therefore, a brief overview of TRPA's existing VMT threshold standard is being included in this report. TRPA's 2001 Threshold Evaluation (approved in July 2002) states that the estimate for 1999 VMT is 1.79 million miles (see below). (Although the 2001 review analyzed data through 2000, due to the complexity involved in modeling VMT, the most recent documented value was used). This number represents "[the] VMT calculated for [a] peak summer day using QRS (Quick Response System) transportation model or equivalent model." Traditionally, model inputs and other calculations used traffic data for a weekday in August to represent this value. The original standard was to reduce VMT by 10% of the 1981 value. Regarding the status of the standard, the 2001 Threshold Evaluation states:

> "Since VMT is a calculated value, derived from transportation models, TRPA can not know the exact 1981 peak summer day VMT in the region, but must attempt to calculate it. As computer models have changed and improved over the years, TRPA has modeled 1981 VMT several times. When TRPA adopted the thresholds in 1982, TRPA calculated 1981 VMT at 1.70 million miles, peak summer day. However, in 1991, TRPA incorporated technical improvements and corrections into the database and calculated 1981 VMT at 1.65 million miles, peak summer day."

Using the revised 1981 VMT, a 10% reduction in this value would mean a reduction of 165,000 VMT. The intent of this reduction was to reduce air pollution by the amount associated with emissions from 165,000 miles driven. Daily values were extrapolated so that the potential average daily aircraft-generated NOx-based VMT Equivalents could be compared to TRPA's original standard; this is discussed with the results. (Although as stated in current Pathway 2007 Update documents on www.pathway2007.org, the VMT standard requires thorough review and will likely be changed in the future, the existing standard still applies as of October 2006, and therefore is used in this report).

RESULTS & DISCUSSION

Data are presented in tables in this section; each pollutant analyzed is listed separately (in the order of NOx, HCs and CO), and data are presented as described in the methods section. Vehicle emission rates used to calculate the VMT Equivalents are included in smaller tables following the tabular presentation of the results. Information regarding assumptions used is included in footnotes and/or in the appendices, as appropriate. Results are followed by a brief discussion and comparison of distances to better illustrate what the equivalencies represent. The methods used and definitions for the terms in this tables are discussed in detail in the methods section. Readers are referred to that section prior to reviewing this table in order to clearly understand the results.

VMT Equivalents for NOx

Calculations: VMT Equivalents for NOx Emissions

Noise Level Range	EMFAC Fleet Years - Selected Modeling Runs	Aircraft Information	**NOx Emissions from Aircraft** (grams)	1 Vehicle with **1 Passenger** could be driven this many miles to emit same **NOx** as if that one passenger traveled on **1 LTO**	1 Vehicle with **Average Tahoe Carload**[2] could be driven this many miles to emit same **NOx** as if carload passengers traveled on **1 LTO**	Sum of total miles that Vehicle would have to be driven to emit same **NOx** as **1 LTO**	Sum of total miles that Vehicle would have to be driven to emit same **NOx** as the **PER DAY** average Number of Flights (**average per DAY**; assume 100,000 Passengers/Year)		
Noise Category[4]	**Fleet Type**[3]	Plane Model (engine type)	Passenger Capacity*	Per LTO	Each passenger responsible for (g NOx)	**VMT Equivalent:** 1 Passenger per Vehicle (per flight comparison)	**VMT Equivalent:** 2.7 Passengers per Vehicle (per flight comparison)	**VMT Equivalent:** ***Total Miles*** (per flight comparison)	**VMT Equivalent:** ***Total Miles*** (Daily Comparison [for TRPA AQ-7])
94.36	**1965-2006**	Bombardier DHC-8-400 ("Q400") [PW123]	73	3,070	42	51	137	3,713	13,938
	1997-2027				42	580	1,566	42,343	158,930
	2005 Sub. Otbk				42	4,205	11,355	307,000	1,152,301
	2005 Ford Exp.				42	701	1,892	51,167	192,050
87.2	**1965-2006**	BAE146-200 (ALF 502 R-5)	88	5,260	60	72	195	6,362	19,809
	1997-2027				60	824	2,226	72,548	225,872
	2005 Sub. Otbk				60	5,977	16,139	526,000	1,637,661
	2005 Ford Exp.				60	996	2,690	87,667	272,944
87.2	**1965-2006**	McDonnel	100	8,120	81	98	265	9,822	26,909

		l Douglass DC9-30 (JT8D-11)							
	1997-2027				81	1,120	3,024	111,994	306,833
	2005 Sub. Otbk				81	8,120	21,924	812,000	2,224,658
	2005 Ford Exp.				81	1,353	3,654	135,333	370,776
84.06	**1965-2006**	B737-600 (CFM 56-7B20)	121	7,630	63	76	206	9,229	20,895
	1997-2027				63	870	2,348	105,236	238,265
	2005 Sub. Otbk				63	6,306	17,026	763,000	1,727,516
	2005 Ford Exp.				63	1,051	2,838	127,167	287,919
85.16	**1965-2006**	Boeing 757-300 (PW2040)	262	17,640	67	81	220	21,337	22,313
	1997-2027				67	929	2,507	243,297	254,429
	2005 Sub. Otbk				67	6,733	18,179	1,764,000	1,844,709
	2005 Ford Exp.				67	1,122	3,030	294,000	307,452
79.8	**1965-2006**	Cessna Citation II (JT15D-4 (B,C, D)	8	1,170	146	177	478	1,415	48,465
	1997-2027				146	2,017	5,446	16,137	552,639

	2005 Sub. Otbk				146	14,625	39,488	117,000	4,006,849
	2005 Ford Exp.				146	2,438	6,581	19,500	667,808
74.7	**1965-2006**	Jetstream 31 (TPE 331-10)	19	1,180	62	75	203	1,427	20,581
	1997-2027				62	857	2,313	16,275	234,681
	2005 Sub. Otbk				62	6,211	16,768	118,000	1,701,528
	2005 Ford Exp.				62	1,035	2,795	19,667	283,588
79.5	**1965-2006**	Dornier 328-300 (PW306B)[3]	32	3,220	101	122	329	3,895	33,346
	1997-2027				101	1,388	3,747	44,411	380,234
	2005 Sub. Otbk				101	10,063	27,169	322,000	2,756,849
	2005 Ford Exp.				101	1,677	4,528	53,667	459,475

1 Adjustment is based on the assumption that passengers would instead drive vehicles in the light duty auto (i.e. passenger cars) and the light duty & medium duty trucks (i.e. SUVs/Pickups, etc.); percentages have been adjusted to remove vehicles that would not be 'diverted' to, such as heavy duty (i.e. semis), motorcycles, etc.

2 Fleet years represent the years entered into EMFAC model. The 1965-2006 group represents all vehicles assumed to be on the road in 2006, accounting for the small percentage of older vehicles and phase in of newer vehicles. The 2006 group represents only 2006 models of vehicles, which due to technological advances, represent the cleanest on the road at this time. The 1997-2007 represents recent trends and future projections based on anticipated changes in technology and the phase-in of new vehicles over the next ~20 years.

3 Emission rates for fleet types are shown below this table.

4 Average carload is 2.7 persons per vehicle based on TRPA/TMPO data

5 Noise levels are measured as required in TRPA's Code of Ordinances, Chapter 23. See www.trpa.org for details. Also, the report discusses the impacts of the arrival noise on whether the aircraft can use the Airport at this time.

6 Q400 Noise level Source: www.q400.com/q400/en/specifications.jsp. B737-600: Noise levels vary by weight - 84.0 is based on a Total Gross Weight of 124,000 lbs (noise levels are higher for different weights). B757-300:

FAA Noise Circular includes aircraft w/different engine; the approaching noise level range for all aircraft of this type is 85.1-86.2.

NOx Emission Rates (g/mile)			
Vehicle Category	LDA	LDT	MDT
1965-2006	0.598	0.801	1.191
1997-2027	0.043	0.074	0.136
2005 Sub. Otbk.	0.01		
2005 Ford Exp.	0.06		

The estimated NOx-based VMT Equivalents clearly show that even when comparing the "dirtiest" group of motor vehicles analyzed (1965-2006) to one of the "larger" aircraft that can meet the 80 dBA standard (Dornier 328), one vehicle driven by passengers riding in the average Tahoe carload would have to be driven 329 miles in order to emit the same level of NOx as they would be their collective "share" if traveling via the aircraft. A total of 3,895 miles would have to be driven in order to emit the same amount of NOx as just one landing and takeoff of the aircraft. If considering the newer, cleaner 2005 Expedition and Outback vehicles, a total of 53,667 and 322,000 miles, respectively., would have to be driven to emit the same about of NOx.

To compare these values to TRPA's VMT-based air quality standard (AQ-7), the levels of NOx emissions (represented in units of VMT Equivalents) "on an average day" were estimated as described in the methods section (results are included in the right-most column in the table above). The VMT-based standard is 'to reduce VMT by 10% of the 1981 value,' which was most recently estimated to be 1.65 million. Therefore, a 10% reduction would be equal to 165,000 VMT (a per day value). To allow for a direct comparison, the VMT reduction associated with TRPA's standard was estimated on a per year basis. Without a specified time period listed in the standard, it is assumed to cover the 20 year period of the first Regional Plan. Therefore, to reduce VMT by 165,000 miles over 20 years, the average annual reduction would have to be 165,000 divided by 20 = 8,250 VMTs per year. Values in the right-most column show that by comparison, the average daily increase in NOx-based VMT Equivalents for all aircraft evaluated are roughly 2 to 3 times this amount, which means that the aircraft would be adding far more NOx into Tahoe's atmosphere than the amount that TRPA has required be *reduced* each day to meet air and water quality goals. Even when the miles from Echo or Spooner Summit (round trip) are "subtracted out" from these increases, the values still result in a significant increase in air pollution over what the current Regional Plan says needs to be reduced. In all cases, **the League's results strongly suggest that aircraft do not appear to be an environmentally-beneficial solution to Tahoe's transportation needs as has been claimed**, **and therefore a complete analysis of the Airport and associated impacts must be performed before any future decisions are made.**

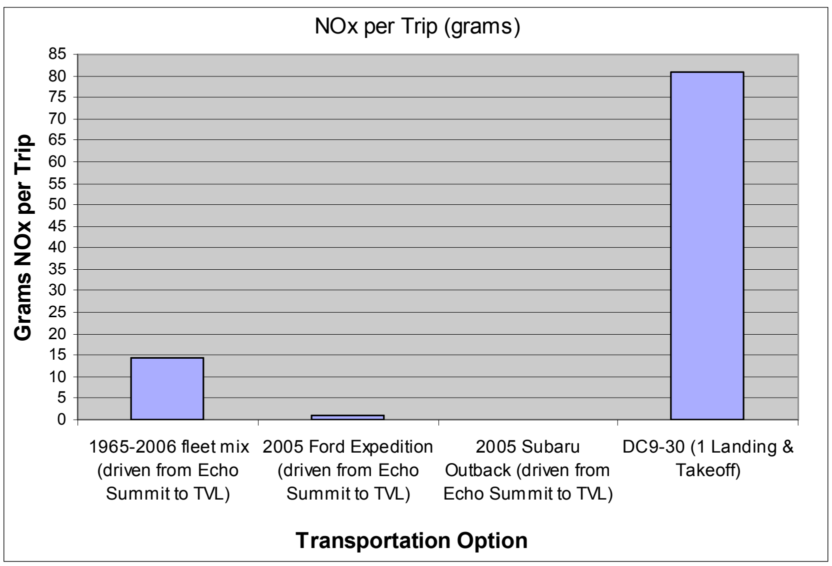
<u>Distances: What this means</u>

The tables below show the estimated distances associated with the NOx-based VMT Equivalents for two selected aircraft types *(per passenger, per flight*). The comparison to the distance around Lake Tahoe (72 miles total) is merely intended to provide an additional frame of reference for readers to visualize the actual distances driven.

Vehicle Type	Miles driven to emit same NOx as 1 LTO of DC9-30	Approx. times driven around Lake Tahoe to emit same NOx as 1 LTO of DC9-30
Average Tahoe Fleet[2]	98	1.4
2005 Ford Expedition	1,353	19
2005 Subaru Outback	8,120	113

Vehicle Type	Miles driven to emit same NOx as 1 LTO of Dornier	Approx. times driven around Lake Tahoe to emit same NOx as 1 LTO of Dornier
Average Tahoe Fleet[2]	122	2
2005 Ford Expedition	1,667	23
2005 Subaru Outback	10,063	140

In fact, a comparison of the actual grams of NOx *per passenger per trip* (in this example, the emissions per vehicle trip are based on 16.4 miles, the round trip distance from Echo Summit to Airport) provides a visual representation of the relative emissions.



Naturally, when considering *annual ridership*, the air quality impacts from aircraft increase as the number of passengers increases. To estimate the annual impacts in terms of VMT Equivalents, one can simply multiply the total VMT Equivalents per flight by the number of annual passengers (in this case, starting with 100,000). Below are tables showing the same information as above, but now based on 100,000 passengers per year. Clearly, the potential annual impacts should be analyzed before any increases in aircraft are allowed, otherwise significant impacts to Tahoe's air quality could result.

Vehicle Type	Miles driven to emit same NOx as 1 Year of DC9-30	Approx. times driven around Lake Tahoe to emit same NOx as 1 Year of DC9-30
Average Tahoe Fleet[2]	9,800,000	140,000
2005 Ford Expedition	135,300,000	1,900,000
2005 Subaru Outback	812,000,000	11,300,000

Vehicle Type	Miles driven to emit same NOx as 1 Year of Dornier	Approx. times driven around Lake Tahoe to emit same NOx as 1 Year of Dornier
Average Tahoe Fleet[2]	12,200,000	200,000
2005 Ford Expedition	166,700,000	2,300,000
2005 Subaru Outback	1,006,300,000	14,000,000

VMT Comparisons from two Summits of Entry:

The League examined the VMT generated in-Basin by passengers that may drive to the Basin via Echo or Spooner Summit (round trip mileage is 16.4 and 24, respectively). When compared to the VMT Equivalents generated by the aircraft, this comparison allows for yet a further look at whether the assumption that aircraft reduces VMT and thereby air pollution may be true or not. The estimates below are based on one flight of the Dornier 328-300 aircraft, which has a passenger capacity of 32 (this is the highest passenger capacity of aircraft meeting the current noise standards that were analyzed by the League). First, a quick overview of the columns is presented.

- The *Total VMT if all passengers drove individually* is based on assuming that all 32 passengers (one flight's worth) instead drove one vehicle each into the Basin; this would be estimated by multiplying 32 vehicles by 16.4 and 24.0 miles. The results represent the total VMTs added to the Basin from 32 people driving.

- The *Total VMT if all passengers rode in the Average Tahoe Carload* is based on assuming that the 32 passengers (one flight's worth) ride, on average, 2.7 people in a vehicle. Because people are carpooling, there are fewer vehicles driving the distances from the Summits to Airport, therefore the VMT generated is less. Again, the importance of this comparison goes back to current regulatory processes which allow mitigation based on the average ridership.

- The *Additional VMT (Equivalents) if all passengers traveled via aircraft instead of driving* is the difference between the aircraft's NOx-based VMT Equivalents per flight and the VMT that would be added to the Basin if the passengers instead drove. Basically, this number represents the additional air pollution (in terms of VMT Equivalents) that is emitted into the Basin when the 32 people opt to fly into the Basin on the Dornier aircraft instead of drive. In order to be consistent with current Tahoe regulations involved how VMT mitigation is measured, the League has calculated the difference in terms of emissions from the passengers riding in average Tahoe carloads.

NOx Emissions: Motor Vehicle Travel vs. Aircraft

Based on Emissions from: Dornier 328-300 (PW306B)	*Travel via Aircraft*				**Echo Summit**			**Spooner Summit**
VMT Equivalents *Per LTO Value*	Round Trip Miles: **Echo Summit** to Airport	Total VMT if all passengers drove **individually** (1 person/vehicle)	Total VMT if all passengers drove in the **Average Tahoe Carload** (2.7 persons/vehicle)	Additional VMT (Equivalents) if all passengers traveled via aircraft instead of driving (per	Round Trip Miles: **Spooner Summit** to Airport	Total VMT if all passengers drove **individually** (1 person/vehicle)	Total VMT if all passengers drove in the **Average Tahoe Carload** (2.7 persons/vehicle)	Additional VMT (Equivalents) if all passengers traveled via aircraft instead of driving (per

flight)* flight)*

NOx	*3,895*	16.4	525	194	**3,700**	24.0	768	284	**3,610**

* Comparison is between the 32 passengers riding 2.7 per vehicle versus taking one flight of the aircraft.

These results are based on one flight only. When extrapolated to represent the impacts of 100,000 passengers per year (which with the Dornier 328-300 aircraft would require 3,125 flights), the additional VMT exceeds 11.5 million. However, these estimates assume that the passengers would NOT otherwise have driven to the Basin had there been no air service, when in fact the most recent survey that assesses this shows about 80% of the visitors would still have driven to the Basin. Therefore, only 20% of the VMT generated by passengers driving should be compared to the total VMT Equivalents for aircraft, which would result in the additional aircraft-generated VMT Equivalents being much higher than is estimated here.

Once again, the data reviewed here clearly suggest that the proposed commercial service <u>is NOT an environmentally-beneficial alternative to motor vehicle use,</u> but in fact is an option that would be more detrimental to air pollution than motor vehicles, already a significant source of pollution in themselves.

VMT Equivalents for Hydrocarbons (HCs) and Carbon Monoxide (CO)

Calculations: VMT Equivalents for HC Emissions							
Noise Level Range	**EMFAC Fleet Years -** Selected Modeling Runs	**Aircraft Information**		**HC Emissions from Aircraft** (grams)		1 Vehicle with **1 Passenger** could be driven this many miles to emit same **HC** as if that one passenger traveled on **1 LTO**	1 Vehicle with **Average Tahoe Carload**[2] could be driven this many miles to emit same **HC** as if carload passengers traveled on **1 LTO**
Noise Category[4]	**Fleet Year**[3]	Plane Model (engine type)	Passenger Capacity*	Per LTO	Each passenger responsible for (g HC)	**VMT Equivalent:** 1 Passenger per Vehicle (per flight comparison)	**VMT Equivalent:** 2.7 Passengers per Vehicle (per flight comparison)
94.3 [6]	1965-2006	Bombardier DHC-8-400 ("Q400") [PW123]	73	730	10	30	80
	2005 Sub. Otbk				10	1,429	3,857
	2005 Ford Exp.				10	112	303
87.2	1965-2006	BAE146-200 (ALF502 R-5)	88	2,840	32	96	259
	2005 Sub. Otbk				32	4,610	12,448
	2005 Ford Exp.				32	363	979
87.2	1965-2006	McDonnell Douglass DC9-30 (JT8D-11)	100	6,340	63	188	508
	2005 Sub. Otbk				63	9,057	24,454
	2005 Ford Exp.				63	712	1,923
84 [6]	1965-2006	B737-600 (CFM56-7B20)	121	2,440	20	60	162
	2005 Sub. Otbk				20	2,857	7,714
	2005 Ford Exp.				20	225	607
85.1 [6]	1965-2006	Boeing 757-300 (PW2040)	262	2,290	9	26	70
	2005 Sub. Otbk				9	1,286	3,471
	2005 Ford Exp.				9	101	273
79.8	1965-2006	Cessna Citation II (JT15D-4 (B,C,D)	8	3,980	498	1,478	3,990
	2005 Sub. Otbk				498	71,143	192,086
	2005 Ford Exp.				498	5,596	15,108
74.7	1965-2006	Jetstream 31 (TPE331-10)	19	560	29	88	236
	2005 Sub. Otbk				29	4,143	11,186
	2005 Ford Exp.				29	326	880
79.5	1965-2006	Dornier 328-300 (PW306B)[3]	32	6,090	190	565	1,526
	2005 Sub. Otbk				190	27,143	73,286
	2005 Ford Exp.				190	2,135	5,764

(See footnotes under CO table)

HC Emission Rates* (g/mile)			
Vehicle Category	LDA	LDT	MDT

1965-2006	0.337	0.314	0.365
2005 Sub. Otbk.	0.007		
2005 Ford Exp.	0.089		

* Emission rates are actually for Reactive Organic Gases (ROGs), which make up a portion of total hydrocarbons. EMFAC provides only ROG emission rates for motor vehicles. Therefore, the actual HC emissions may be slightly higher than what is presented using the ROG rates.

Calculations: VMT Equivalents for CO Emissions

Noise Level Range	**EMFAC Fleet Years** - Selected Modeling Runs	**Aircraft Information**		**CO Emissions from Aircraft** (grams)		1 Vehicle with **1 Passenger** could be driven this many miles to emit same **CO** as if that one passenger traveled on **1 LTO**	1 Vehicle with **Average Tahoe Carload**[2] could be driven this many miles to emit same **CO** as if carload passengers traveled on **1 LTO**
Noise Category[4]	**Fleet Year**[2,3]	Plane Model (engine type)	Passenger Capacity*	Per LTO	Each passenger responsible for (g CO)	**VMT Equivalent:** 1 Passenger per Vehicle (per flight comparison)	**VMT Equivalent:** 2.7 Passengers per Vehicle (per flight comparison)
94.3 [6]	1965-2006	Bombardier DHC-8-400 ("Q400") [PW123]	73	20,060	275	34	92
	2005 Sub. Otbk				275	687	1,855
	2005 Ford Exp.				275	119	323
87.2	1965-2006	BAE146-200 (ALF502 R-5)	88	47,370	538	1,599	4,317
	2005 Sub. Otbk				538	76,899	207,628
	2005 Ford Exp.				538	6,048	16,330
87.2	1965-2006	McDonnell Douglass DC9-30 (JT8D-11)	100	54,030	540	1,605	4,333
	2005 Sub. Otbk				540	77,186	208,401
	2005 Ford Exp.				540	6,071	16,391
84 [6]	1965-2006	B737-600 (CFM56-7B20)	121	44,870	371	46	124
	2005 Sub. Otbk				371	927	2,503
	2005 Ford Exp.				371	161	435
85.1 [6]	1965-2006	Boeing 757-300 (PW2040)	262	46,630	178	22	60
	2005 Sub. Otbk				178	445	1,201
	2005 Ford Exp.				178	77	209
79.8	1965-2006	Cessna Citation II (JT15D-4 (B,C,D)	8	21,920	2,740	339	917
	2005 Sub. Otbk				2,740	6,850	18,495
	2005 Ford Exp.				2,740	1,191	3,217
74.7	1965-2006	Jetstream 31 (TPE331-10)	19	13,270	698	87	234
	2005 Sub. Otbk				698	1,746	4,714
	2005 Ford Exp.				698	304	820
79.5	1965-2006	Dornier 328-300 (PW306B)[3]	32	19,020	594	74	199
	2005 Sub. Otbk				594	1,486	4,012
	2005 Ford Exp.				594	258	698

[1] Adjustment is based on the assumption that passengers would instead drive vehicles in the light duty auto (i.e. passenger cars) and the light duty & medium duty trucks (i.e. SUVs/Pickups, etc.); percentages have been adjusted to remove vehicles that would not be 'diverted' to, such as heavy duty (i.e. semis), motorcycles, etc.
[2] Fleet years represent the years entered into EMFAC model. The 1965-2006 group represents all vehicles assumed to be on the road in 2006, accounting for the small percentage of older vehicles and phase in of newer vehicles.
[3] Emission rates for fleet types are shown below this table.
[4] Average carload is 2.7 persons per vehicle based on TRPA/TMPO data
[5] Noise levels are measured as required in TRPA's Code of Ordinances, Chapter 23. See www.trpa.org for details. Also, the report discusses the impacts of the arrival noise on whether the aircraft can use the Airport at this time.
[6] Q400 Noise level Source: www.q400.com/q400/en/specifications.jsp. B737-600: Noise levels vary by weight - 84.0 is based on a Total Gross Weight of 124,000 lbs (noise levels are higher for different weights). B757-300: FAA Noise Circular includes aircraft w/different engine; the approaching noise level range for all aircraft of this type is 85.1-86.2.

CO Emission Rates (g/mile)			
Vehicle Category	LDA	LDT	MDT
1965-2006	7.73	8.59	7.95
2005 Sub. Otbk.	0.4		
2005 Ford Exp.	2.3		

Though not as dramatic as the differences in NOx emissions, airplanes on the whole clearly emit higher levels of HC and CO per passenger. While the GAO report published in 2003 shows some reduction of these emissions from aircraft engines over time, the differences still remain very high between aircraft emissions and motor vehicle emissions. Additionally, although engine emissions have been reduced, due to the decades-long lifetime of older engines, it is likely that at best, just a small portion of the proposed aircraft might contain the newer engines, therefore a majority may still operate with higher emission levels of these pollutants. Further, more specific to CO is the concern regarding localized emissions (i.e. from aircraft at and in the vicinity of the Airport as opposed to "spread out" emissions (as the motor vehicle emissions would generally be). Because CO is a pollutant that tends to be of most concern in very localized areas called "CO hot spots," often contributed to by thermal inversions (which are extremely common in Tahoe), the concentrated CO emissions from the aircraft should be reviewed spatially in even greater depth to examine the potential for nearby residents to be exposed to high levels of CO (for which effects can occur with relatively short term exposures, like an hour or less).

Additional Considerations

"Diverted Drivers" and VMT

The Lake Tahoe Airport has been advertised as a way to provide an alternative means of traveling to the Basin versus motor vehicles (2004 RTP, TMPO), where the goal of motor vehicle reduction in terms of environmental needs is based on reducing air and water quality impacts. While the simple analyses performed in this investigation show that aircraft use may in fact pollute air and water quality more than if those same passengers drove into the Basin (based on NOx, HCs and CO only), the point that motor vehicle use is not being encouraged must be reiterated throughout this discussion. However, thus far, the analyses have only compared aircraft emissions to their VMT Equivalents for the three pollutants reviewed. What has not been addressed is the issue of "diverted" passengers, which can affect overall VMT estimates for driving. Surveys suggest that a majority of aircraft passengers would still travel to the Basin if service to the Airport were not available; therefore, only a relatively small percent of passengers would truly be "diverted" from motor vehicles.

Induced Passengers:
On the reverse side, Airport proponents and those promoting economic progress suggest that the Airport will bring in additional visitors (i.e. those who would not have come using another form of transportation), therefore will increase the tourism-based money spent in Tahoe's economy. This idea only "works" if passengers visit the Basin solely because commercial aircraft service was provided at the Airport. Therefore, the key question to address this issue is how many of those projected 100,000 annual passengers might not enter the Basin at all if flying to the Airport were not an option? The Master Plan Settlement Agreement required the City of SLT to perform surveys on passengers on a regular basis to provide this type of information, however as of September 2006, surveys that include the necessary questions have not been performed in roughly two decades. Therefore, the previous sections' comparisons assumed that *all* passengers would drive to the Basin for the emission comparisons, but in reality, some small portion of the annual visitors may not otherwise visit, resulting in even more conservative estimates. In fact, according to the last appropriate survey performed on Airport passengers (1987), roughly 15-20% of the aircraft passengers surveyed said that they only came to Tahoe because commercial aircraft service was offered (CSLT and TRPA). However, in the last 19 years the Reno/Tahoe Airport has significantly grown, including the addition of low-cost providers such as Southwest Airlines. Therefore, it is expected that the lack of commercial service to the Airport may in fact be even less of an impediment (than in 1987) for tourists to get to the Basin because there are now many more options through the Reno/Tahoe Airport. Further, the results in these analyses suggest that even if passengers drove over Spooner Summit to the Airport (i.e. those renting vehicles from the Reno/Tahoe Airport), their in-Basin air emissions would still be far less than if they had traveled on an airplane to the Airport. On that note, the difference becomes even more dramatic when one considers the regular shuttle service from Stateline, NV to the Reno/Tahoe Airport, which would suggest that not all Reno/Tahoe passengers would drive individual vehicles to the Basin, therefore the additional in-Basin VMT from Reno/Tahoe passengers would be even less.

Induced Passengers and Economics:
There is another issue altogether that needs to be identified – the issue of whether the environmental and operational costs of the commercial aircraft/Airport exceed the economic gains. For example, if 15% of the 100,000 annual passengers are "induced" by providing commercial service at the Airport, that translates into 15,000 additional people visiting and spending money in the Basin each year (although it is suspected that given the current level of service through the Reno/Tahoe Airport, the proportion of total induced passengers is likely far less). Regardless, an appropriate review of the Airport's role in the Basin would need to evaluate the following:

Gross **revenue from commercial service** (meaning this estimated cost *does not* account for money spent to operate the Airport and provide commercial service):

- How much money is pumped into Tahoe's economy from these "induced" visitors (in this example, 15,000 people per year), including any Airport profits from their use of the service [not yet accounting for subsidies; see below])?

Total costs associated with operation of Airport and additional commercial service:

- How much money is spent to subsidize the Airport?
- How much will it cost to reduce air and water pollution that is caused by these additional 15,000 people visiting the Basin? (i.e. must account for emissions from aircraft, motor vehicle use, wood heater use, BBQs, campfires, etc.)
- How many additional VMTs will result from those among these 15,000 that opt to rent a vehicle or contribute to motor vehicle use in the Basin in some way? (Note that TRPA's 2004 survey shows roughly ¾ of the visitors surveyed prefer to use private automobiles to travel in the Basin).
- What are the costs to other environmental resource areas, such as noise (i.e. quality of life/enjoyment of the Basin), wildlife, SEZs and restoration costs (see next bullet), scenic and historical resources, etc.?
- What are the costs of the environmental restoration projects in the area (planned or needed in the future) that are necessary to reduce pollution that is in part, or wholly, a result of having and utilizing the Airport?
- Additionally, what would be the economic impacts of other transportation alternatives that could be promoted in lieu of commercial aircraft service?
- What are the costs to homeowners related to regulatory requirements that are needed to reduce the additional pollution caused by the Airport?

Clearly, if the total costs associated with the Airport and proposed commercial service exceed the "Gross economic gain" then increased use of the Airport would not make environmental or economic sense and would instead create a net negative environmental impact and financial loss to the Basin's economy.

VIII. Findings and Conclusions

Emissions of NOx, HCs and CO associated with aircraft use were compared to those generated by motor vehicle use, currently the largest recognized source of these emissions in the Lake Tahoe Basin (Basin). Referring back to the reasons and perceptions providing the basis for the purpose and objectives of this study, the following concepts, ideas and assumptions were evaluated by performing relatively simple air quality emissions comparisons between these two transportation modes. Associated with each assertion is a response including discussions of the related finding(s) from this report and what they mean.

1. <u>Some feel that the existing Master Plan Settlement Agreement is sufficient to account for environmental impacts of the proposed commercial service.</u>

- The 1992 Master Plan Settlement Agreement, accompanied by the 1992 NOx Offset Assessment, concludes that NOx emissions associated with the planned activities for the Airport at that time and into the future would be offset by the mitigation proposed at that time. The mitigation stated in the 1992 Assessment included partial funding of a project that was intended to reduce nitrogen loading at a level equal to what would be emitted by the Airport. The estimated NOx impacts are based on emission rates that are over 10 years old; as has been discussed and illustrated in this report, emissions of NOx have actually been increasing during that time (GAO estimates include increases of around 40%), therefore even if the offsets chosen years ago had been appropriate, they would surely fail to account for all aircraft NOx emissions today.
- The assumptions used for the 1992 Assessment were based on the false assumption that air pollution can only impact humans and the environment at levels close to the ground. Additionally, the VMT calculations used in Exhibit D of the 1992 Assessment did not attempt to compare aircraft NOx emissions with motor vehicle emissions, thereby further failing to accurately characterize the impact of commercial aircraft on atmospheric NOx levels in the Basin.
- Additionally, documents in and prior to 1992 attempted to estimate the amount of NOx emissions that would deposit to the Lake. Whether or not the methods used at that time were correct, the fact remains that in the last 10-15 years, extensive information has become available regarding atmospheric deposition that has proven many past assumptions to be incorrect or underestimated.

2. <u>Given that technological advances have reduced motor vehicle tailpipe emissions over the last several decades, many assume that similar pollution-reducing advances are being made with aircraft engines as well.</u>

- As the League's literature review and emissions analyses have shown, the aircraft industry has not experienced the same technological advancements to reduce air pollution as has the motor vehicle industry. While emissions of HCs and CO have seen slight downward trends, NOx emissions have actually dramatically *increased*. Clearly any increase in harmful emissions is bad for humans and the environment; however, NOx emissions contribute to the formation of ozone, a pollutant that remains of major concern to human and forest health in the Basin and to the nitrogen loading affecting Lake Tahoe's declining clarity, all of which are serious issues in the Basin.

- To make matters worse, even if new regulations were passed tomorrow requiring new engines to have lower emissions, due to the very long lifetime of aircraft engines (i.e. decades), the benefits of the new technology would not be seen for possibly 20 years or more.

3. <u>There is the assumption that visitors traveling to and from the Basin via aircraft will produce fewer air emissions than if they drove.</u>

- An analysis of all subject pollutants illustrates that based on the assumptions used, aircraft carrying passengers to and from the Basin will generate more emissions of NOx, HCs and CO in the Basin's airshed than if those same passengers opted to drive to the Basin. This is evidenced both by the comparison between how many miles travelers would have to drive to emit the same level of pollutants as annual aircraft operations and the emissions associated with all passengers diverted to motor vehicles from either the Echo Summit and/or Spooner Summit entry points. Although, as stated previously, this report is merely a preliminary comparison intended to show the need for a true, scientifically-valid environmental analysis of Airport operations, data are clear enough in their implications.
- Additionally, estimates are based on an additive mix of conservative assumptions, therefore air emissions may actually be even greater than what is estimated in this report.

4. <u>The re-introduction of commercial service at the South Lake Tahoe Airport will result in a net reduction in air pollution in the Lake Tahoe Basin.</u>

- As stated in the objectives, one of the preferred outcomes of this report is that a complete, expert-performed scientifically-valid analysis be done regarding air quality impacts of the Airport in order to support sound scientific planning (and assure that environmental goals are being supported by planning efforts). Also, to reiterate previous comments, this report is not intended to serve as an alternative to a complete air quality analysis, nor is it intended to promote increased motor vehicle use. Therefore, the answer to this particular question is solely based on the simple comparisons presented in this report, which *clearly* suggests that given the current assumptions used, increased service at the Airport will NOT result in a net reduction of air pollution but rather may actually increase air pollution, and worse yet, do so in a relatively small area (as compared to the entire Basin).

5. <u>The reintroduction of commercial service at the Airport would result in net economic gain to the Basin</u>.

- Although the League does not have the information or tools to complete such a comparison, it is clear that this assumption has never been fully analyzed because all environmental, economic and social costs and benefits have not been considered. The combined costs could very well exceed any potential gains from the small percentage of induced passengers and it is therefore important to truly evaluate this issue before further environmental, and financial, damage may be done. The League further investigates the economic considerations in the associated chapter of the Airport report.

In summary, although this analysis addresses emission comparisons using a fairly simple (but direct) method, this review of available information suggests that until aircraft engine technology follows the direction of the automotive industry and utilizes technology that significantly reduces emissions of NOx, HCs, CO and other pollutants, and until such improvements are incorporated into aircraft using the Airport, the Lake Tahoe community can not consider commercial air service as a transportation solution that will bring us closer to attainment of TRPA's air quality threshold goals, nor does it represent a direction in transportation policy consistent with the TRPA Compact. As illustrated by the comparisons in the previous sections, if commercial air service is reintroduced to the Lake Tahoe Basin, its relative contribution to NOx emissions in the Basin will likely grow substantially over the next two decades (as will the gap between motor vehicle emissions of HCs and CO versus aircraft emissions assuming current trends and a 20-30 year lag time in engine turn-over). With continuing initiatives (and expenditures of money, time, etc.) to reduce emissions from motor vehicles and to seek out environmentally beneficial alternatives to the use of polluting vehicles, any discussion of transportation policy that allows expanded air service into the Lake Tahoe Basin must consider the short and long-term potential for aircraft emissions to impede efforts to reduce harmful pollutants in Tahoe's atmosphere, let alone *increase* the overall emissions of harmful pollutants.

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