12-1999

# Systemic environmental analysis of the legal mechanisms for controlling air pollution in the Las Vegas Valley

Richard Little
*Univeristy of Nevada Las Vegas*

# SYSTEMIC ENVIRONMENTAL ANALYSIS OF THE LEGAL MECHANISMS FOR CONTROLLING AIR POLLUTION IN THE LAS VEGAS VALLEY

**by**

**Richard Little**

**A thesis submitted in the partial satisfaction of the requirement for the degree of**

**Bachelor of Arts**

**in**

**Environmental Studies**

**Department of Environmental Studies**

**University of Nevada Las Vegas**

**December 1999**

Abstract:

This study examines the air pollution control structure for the Las Vegas Valley. A System Dynamics computer model was created that represents the structure of the real world system for controlling air pollution, in order to examine how the current air pollution control system might behave in the future.

**TABLE OF CONTENTS**

**LIST OF FIGURES**

**ACKNOWLEDGMENTS**

I would like to thank God, my family and D.F. for exceptional support and encouragement. I would also like to thank Dr. James Deacon and the entire Department of Environmental Studies for creating an atmosphere of discovery and learning.

A special thank you to Dr. Krystyna Stave for providing direction and insight while giving freely of her time and efforts.

INTRODUCTION

**The Las Vegas Valley maintains a significant amount of ambient air pollution, and the amount of carbon monoxide measured in ambient air often exceeds federal standards.[1] As the population of the valley continues to grow and the number of automobiles increase, the amount of carbon monoxide released will most likely increase.[2] The goal of this paper was to examine my hypothesis that the current air pollution control structure in the Las Vegas Valley will be inadequate to control future increases in carbon monoxide pollution and exceedances[3].**

**In order to test my hypothesis I used the System Dynamics approach. This approach focuses on dynamics, which is change over time. According to Andrew Ford (1999), a dynamic problem has multiple factors constantly interacting and affecting each other over time. Because these problems have variables that are in a constant state of change, or dynamics, it is necessary to study these problems in a way that can account for the constant interaction and change. Jay Forester along with others from MIT developed the field of System Dynamics as a way of studying these types of problems.**

**One tool available in the System Dynamics (SD) paradigm is computer modeling. The use of modeling is based on the central tenet of SD that behavior is a function of structure (Ford 1999). Which is to say that the observable output over time of a given system is directly caused by the way that system is structured. If the general behavior of a model can replicate the general behavior of the real world system being modeled, then it can be assumed that elements of the real world structure have been replicated in the model structure. When this is established, the model can then be used to test the behavior of the real world system under different conditions by operating the model under those conditions.**

**The general pattern of behavior that this paper seeks to understand is the number of times per year that the valley exceeds the maximum allowable level for carbon monoxide (CO) in ambient air observed from 1992 to 1999. The federal government uses the number of exceedances per year in a given location to assess the effectiveness of air pollution control in that location. Therefore, I used the trend in exceedances per year as the target model**

---

[1] According to the 1999 report on ambient air quality submitted to the Environmental Protection Agency by the Clark County Health District Air Pollution Control Division (Naylor 1999).
[2] According to major automakers and the California Air Resources Board, it will not be technologically possible to significantly reduce automobile emissions below current levels. (Sperling 1994)
[3] The term exceedance refers to a violation of the federal standard of 9ppm of CO in ambient air in a 24 hour period

**behavior to create a model that represents the current air pollution control structure for the Las Vegas Valley as accurately as possible.**

## BACKGROUND

**Pollution in the air, like pollution in the terrestrial and marine environments is a problem that affects all living things. However, air pollution is different from pollution on land or sea in that the pollutants carried by the air have the ability to reach and cause harm to all forms of life in all types of environments. The problem of air pollution is complex. A pollutant in the air can have an immediate effect on a specific target, it can also have a delayed chronic effect on another target and it can combine physically or chemically with other pollutants to create yet another threat to living systems.**

In order to address the problem of ambient air pollution the federal government established the Clean Air Act (CAA). This extensive piece of legislation created in 1970 has been through three major revisions and from 1970 to 1991, has directed over 700 billion dollars towards efforts at reducing air pollution (Rosenbaum 1991). However, despite these efforts, air pollution remains a problem in almost every large metropolitan area in the country, including Las Vegas, Nevada.

In the metropolitan area of the Las Vegas Valley, the pollutants carbon monoxide (CO) and particulate (PM-10) are consistently measured at levels that come close to and occasionally exceed the maximum concentrations allowable under federal law (Naylor 1999). Since the CAA of 1970 it has been understood that the predominant source of CO in large metropolitan areas is gasoline and diesel powered engines. Although the total contribution from these sources has dropped from approximately 97% to 94%[4] between 1973 and 1996, gasoline and diesel engines still contribute over half of all urban air pollution and almost all of the carbon monoxide (Sperling 1994).

[4] 1973 emissions in Los Angeles (Friedlander 1977) 1996 emissions in Las Vegas (Naylor 1996)

In order to formulate an understanding of how pollution control operates in the Las Vegas Valley, it is necessary to first examine each different stakeholder group involved in air pollution and control. Understanding the way that the stakeholders define and react to the problem of air pollution will help in an understanding of why the Las Vegas valley maintains high levels of air pollution.

The major stake holder groups are the federal government, the state government, the county government, the Clark County Health District Air Pollution Control Division, and the resident population of the Las Vegas Valley.

The federal government's involvement with the problem of air pollution is divided into two main parts. Congress created and continues to modify air pollution law and the Environmental Protection Agency (EPA) administers that law (Worobec & Hogue1992). From the congressional perspective the problem is defined as, polluted air existing in large metropolitan areas. This pollution is at such a significant level that human sickness and death is attributable to its prevalence in ambient air (Dockery et. al, 1993). Congress has explained that the reason for this significant and wide spread pollution problem is the inability of state governments to properly monitor and apply control strategies for polluters. As a result of this determination, Congress produced the Clean Air Act (CAA) which was created in order to allow the federal government to assist state governments in the control and reduction of air pollution. This assistance comes in the form of administrative and policy direction for the states as well as financial and technical assistance. The link between the federal law and the state implementation of that law, is the EPA (Tabb & Malone 1992).

State and Federal Relations

The EPA is directed by congress to oversee the implementation of the CAA. This means that the EPA must establish scientific standards for air pollution levels that reduce the negative impact on living systems. In addition to the research, the EPA is responsible for overseeing every aspect of the state's compliance with the Clean Air Act. As a result of this directive the EPA established Air Quality Control Regions (AQCR), which are set up to provide nation wide access for states to the EPA (Rosenbaum 1991). Through this access, states get help and advice from the EPA on how to set up a plan for administering and regulating specific air pollution reduction needed in their area. Once this plan is formulated, the EPA is then required to give official approval or disapproval according to how well the plan functions according to the air pollution guidelines established by the CAA. This places the EPA in a situation where they are required to first consult on a state's action and then pass judgement on that same action. The difficulty with this scenario is that the states can be reluctant and sometimes politically dissuaded from implementing the full force of EPA recommendations, due to the economic magnitude and political lobbying of the industry in question. As a result the EPA faces a challenge in its relationship with the state. The EPA needs the states to be receptive and willing to accept technical and regulatory suggestions, while serving as the authoritative agent of the federal government that will pass judgement the state's adherence to requirements of the CAA.

The state government of Nevada must complying with the CAA by satisfying the EPA's AQCR #9 in two distinct ways. First, the state must submit and obtain approval for its State Implementation Plan (SIP). Second it must reduce the amount of ambient air pollution in its large metropolitan area, Las Vegas (Tabb & Malone 1992). In order to satisfy these requirements the state of Nevada developed air pollution control laws at the state level, which became part of the

Nevada Revised Statutes (NRS). As part of these laws, the state created an air quality enforcement structure that developed an air quality division of the Nevada Department of Conservation and Natural Resources (NDCNR). However, this air quality division does not cover Clark County, instead it defers the responsibility of Clark County to the Clark County Health District. By doing this the state effectively abdicated its direct contact and control for the air pollution in the Las Vegas valley, while still maintaining a plan for air pollution control that included reference to Las Vegas, as part of Clark County, which would be regulated at the county level. The codification of air pollution laws into the NRS and the deferment of responsibility for air pollution in the Las Vegas valley were attempts by the state of Nevada to satisfy the requirements of the CAA by demonstrating that a viable plan for air pollution control had been devised. However, the EPA refused to accept this plan as valid. To date, the beneficiary of the state's plan seems to be the state itself. By passing the responsibility to Clark County, the state avoids the costs and difficulties of controlling a pollution problem that it is unable to address, as well as preserving the positive political relationship with Clark County, which has the majority of economic and political power in the state of Nevada.

Regional Pollution Control

**The Clark County Health District Air Pollution Control Division (CCHD APCD) is required by the NRS to control pollution in the Las Vegas valley. The control strategy that the CCHD APCD adopted was partly EPA recommended, such as monitoring stations, field agents for enforcement and monetary penalties for violations. However, as the second draft of the CCHD APCD's enforcement and compliance policy manual shows in its mission statement, there is a strategic focus on " the needs of the regulated community." This demonstrates the expanded view of the air pollution problem that the CCHD APCD maintains. While the CAA, the EPA guidelines and the NRS have language that is singular in purpose, i.e. to protect human health, the CCHD APCD broadens the focus to also protect the economic health of the polluter. As a result, several steps have been taken to encourage industry, despite the EPA and the requirements of the CAA. Diesel engines, which emit CO and PM-10 in amounts that are above EPA recommendations, are encouraged to be brought into the state of Nevada when other states such as California and Arizona have passed legislation that prevents their operation (Mahal 1999). In addition, monetary penalties for air pollution violations by industry are rarely enforced. A review of the 1996 minutes from several APCD meetings dealing with air pollution violations by industry show that a majority of the monetary penalties for the construction industry are reduced to minimum amounts.**

**The structure of the CCHD APCD seems to be addressing the letter of the law rather than its intent. The CAA and the EPA regulations require the CCHD APCD to minimize the number of times per year that pollution is measured in excess of the federal standard. A review of newspaper articles, public presentations and the public documents produced by the CCHD APCD reveal that the majority of actions are directed at reducing the amount of pollution measured in ambient air[5], rather than reducing the amount of pollution present in ambient air. One example of this was the monitoring station located at Charleston and 29th street, which detected CO in excess of the federal standard. As a result the CCHD APCD invested resources into petitioning the EPA for modifications to the site and an extension of time before the EPA imposed sanctions as a result of the data from that site. After 8 months of attempting to minimize the amount of CO measured at the site, an alternate site was set up at Sunrise Acres**

---

[5] (Rogers 1996) (Manning 1996) (Naylor 1996)

**elementary school. The alternate site was the result of a compromise between the CCHD APCD and the EPA to determine if the original site was detecting anomalies in CO levels. The new site detected levels that were higher than the original site (Manning 1996).**

**A review of CCHD APCD data reveals several interesting trends. Over the last 20 years, from 1980 to 1995, there have been significant reductions in CO air pollution as reflected in a reduction in the number of exceedances per year, while at the same time the population of the Las Vegas Valley has increased significantly. As Daniel Sperling points out in his book *Future Drive* (1994), the combination of more stringent emissions standards, reformulated gasoline, and the phasing out of older cars from the fleet has resulted in a nation wide reduction in average vehicle emissions of some 75 % between the 1960's and 1990's. This coincides with a 90% decrease in exceedances nation wide between 1970 and 1991(Shrouds 1994). Most likely the reason for the decline in exceedances in Las Vegas between 1980 and 1995, can also be attributed to reduced vehicle emissions. However, the last 5 years, from 1995 to the present, the number of exceedances per year has begun to fluctuate between 1 and 4 per year. If the effectiveness of air pollution control has in fact leveled off, as Sperling suggests, then a drastic increase in air pollution is possible as the population of the Las Vegas Valley is projected to more than double during the next 25 years, from year 2000 to 2025. Even if population estimates are not reached, it is possible that current air pollution control strategies have reached a threshold for effectiveness. In addition, the central mechanism in the CAA for controlling air pollution is a reduction in vehicle usage, and to date, studies have demonstrated that the maximum reductions achieved through the CAA incentives and disincentives, are between .5 and 2 percent of total daily vehicle usage (Sperling 1994).**

**The resident population of the Las Vegas valley also holds a stake in the valley's air pollution problem as they contribute to and suffer the effects from ambient air pollution. Members of the population who are also polluters include industry owners and individual automobile owners. Every person who is a polluter is faced with some sort of regulation, which is intended to control the amount of pollution they will release. For an automobile owner this comes in the form of a smog check; for a construction company owner this comes in the form of permits and procedures. While these types of controls burden the**

**individual, the population as a whole receives the benefits. It is this collective population that is represented by the Clean Air Alliance of Southern Nevada (CAASN). This citizen group views the problem of air pollution in the Las Vegas valley as one that is caused by the failure of the CCHD APCD to actively and aggressively regulate and control industry. CAASN describes this failure to control industrial pollution as a result of the lack of an EPA-approved SIP combined with what they see as the "pro-industry" charter of the CCHD APCD (Greene 1996). CAASN claims that this combination is allowing Clark County to avoid strict adherence to the CAA while providing the appearance of an attempt at compliance.**

The stakeholders that have similar interests are the State of Nevada and Clark County. They have an existing alliance and have utilized it in the formation and development of the current air pollution control system. By contrast, the EPA and the residential population represented by CAASN are allied in their focus on an effective implementation of the CAA in Clark County. The difficulty for these groups is in their individually weak positions of power. The EPA is attempting to balance its advisor/supervisory role against its role as adjudicator on CAA compliance, while the CAASN is effectively powerless unless they were to bring forth some type of pressure such as a successful lawsuit in federal court, or a significant amount of public pressure.

MATERIALS & METHODS

In order to study the present structure and its behavioral possibilities for future air pollution control in the Las Vegas Valley, I have employed systemic environmental analysis. I constructed a model that attempts to reproduce the general trends in behavior of the pollution control system in the Las Vegas Valley for the period between 1992 and 1999. I then ran the model 60 years into the future to the year 2059 to test the hypothesis that the current structure will be unable to minimize exceedances as the population increases.

The modeling program used is called VensimPLE.32. The general guidelines followed for model construction come from the fundamental principles of the System Dynamics (SD) approach (Ford 1999). The first step is to describe the general problem that is being studied. In this problem statement the problematic trend is represented by a graph that shows behavior over time. This is referred to as the reference mode. The next step is to develop a dynamic hypothesis about what is causing the observed trend based on the SD concept that the behavior is caused by the structure. Next, a diagram is constructed called the causal loop diagram, which represents the factors involved in the problem statement, reference mode and dynamic hypothesis. From the causal loop diagram and all other sources of information the computer model, referred to as the stock and flow diagram, is developed.

## Problem Statement

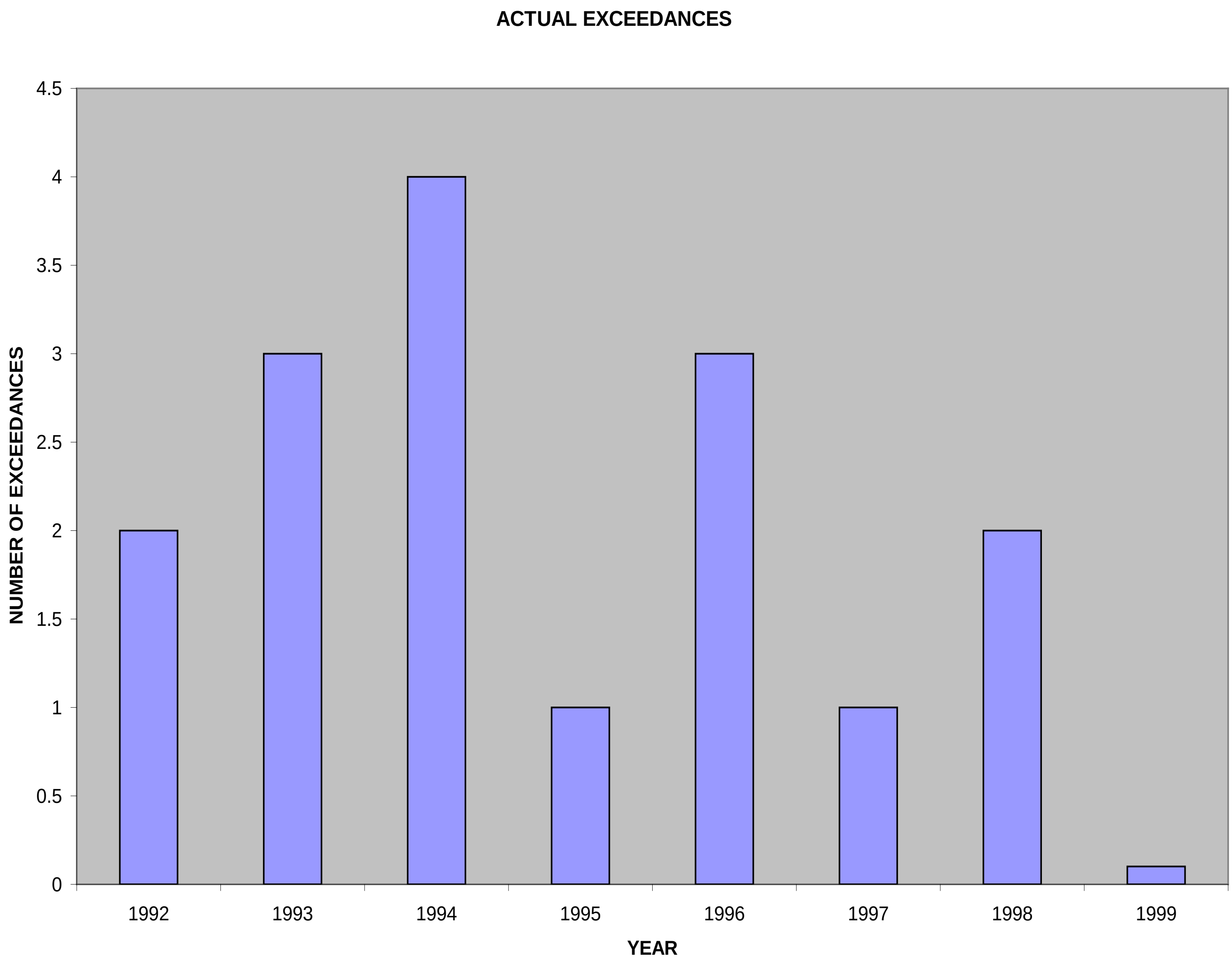
During the past 20 years, the Las Vegas Valley has experienced a reduction in the number of days per year that the level of carbon monoxide in ambient air exceeds the maximum level allowable by federal regulations. However, the past 7 years demonstrate that this trend has changed to an oscillation in the number of exceedances per year fluctuating between 1 and 4.

The trend established over the last 7 years is a problem for two reasons. First, the ideal number of exceedances per year is zero, meaning that air quality always meets Federal standards. Any number of exceedances above zero indicates that air quality is worse than Federal standards at some given time during that year. Second, as the population in the Las Vegas Valley continues to expand, releases of pollution could also rise as the number of vehicles operated in the valley increases in direct proportion to the population growth.

### Reference Mode

The reference graph (Fig. 1) displays the trend in number of days per year that the Las Vegas Valley exceeds the maximum level for carbon monoxide in ambient air between 1992 and 1999.

**(Fig. 1 Reference Mode Graph)**



Dynamic Hypothesis

**(Fig. 2)**

**The Las Vegas Valley maintains a significant level of ambient air pollution. The pollutants, carbon monoxide (CO) and particulate (PM-10) are consistently measured at levels which come close to and occasionally exceed the maximum concentrations allowable under federal law. The sources of these pollutants are all related to the extensive growth that has taken place in the valley over the last 20 years. The significant number of automobiles now in the valley is responsible for the majority of the CO, and the wide spread construction activities are responsible for the majority of the PM-10. For the purpose of constructing a dynamic model that represents the behavior of the pollution control system in the valley, the pollutant CO will be used.**

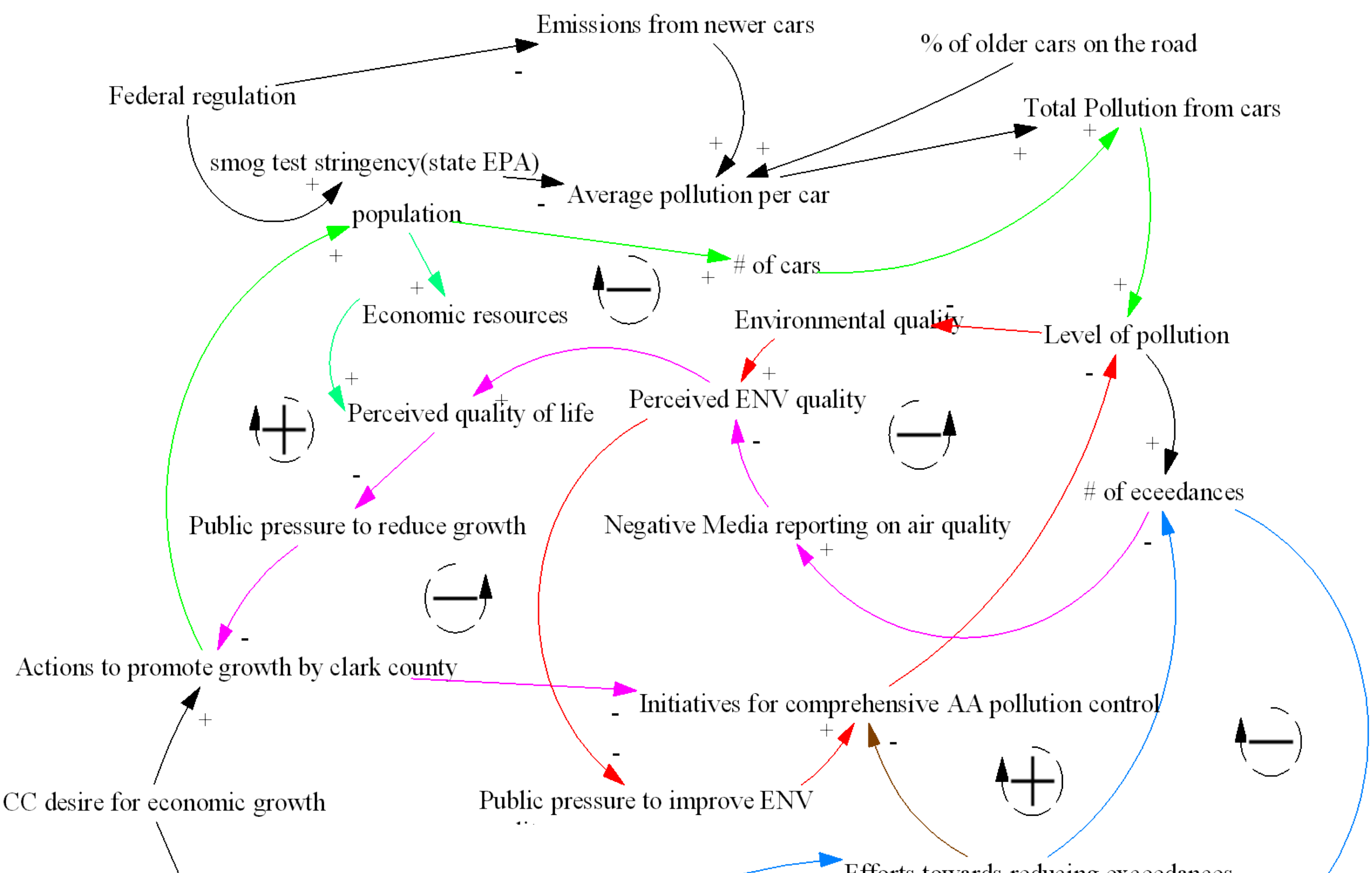
**In order to address the problem of urban air pollution, the federal government established laws that require states to work with the EPA to formulate and implement pollution control strategies. In the Las Vegas Valley, the Clark County Health District Air Pollution Control Division (CCHD APCD) is the agency responsible for implementing federal regulations. An examination of the public information provided by the CCHD APCD reveals that there is a focus on minimizing the number of days per year that CO exceeds the federal limit. An examination of newspaper articles reveals that the information that the public receives concerning air pollution also focuses on the exceedances of federal standards. This results in a situation where the CCHD APCD is the agency responsible for reducing overall levels of ambient air pollution, as well as minimizing the number of times that pollution levels exceed federal standards. Because both the federal and public pressures center on exceedances, priority is given to actions that reduce exceedances rather than long term strategies to reduce overall levels of ambient air pollution.**

**The significant decrease in exceedances from 1981 to 1991 coincides with the implementation of stricter emission standards for new cars, as well as emission monitoring of existing vehicles. By 1992, federal emission standards had been maximized, and the trend of decreasing exceedances had leveled off to a fluctuating number of exceedances per year between 1 and 4. This should then result in an**

**increase in exceedances as the population of the valley increase, which will increase the number of automobiles in use.**

**The result of these basic factors is a pollution control system, which is centered on the short-term goal of minimizing exceedances per year. When exceedances increase, the CCHD APCD is pressured by the EPA and the public to reduce the exceedances. The actions produced by the APCD are targeted at minimizing the amounts of pollution that is measured. As a result, the exceedances are minimized in the short term. However, as the population continues to grow, pollution levels continue to increase, which lead to exceedances. The CCHD APCD responds with addition short-term action s to reduce exceedances, which minimizes the number of exceedances in the short term but does not address the long-term pollution levels. As the population continues to grow the cycle repeats until a point where the population is at a level where the amount of pollution produced raises the total level in ambient air to a point where short term actions to reduce exceedances will begin to loose effect.**

**(Fig. 2 Causal Loop Diagram)**



Model Structure

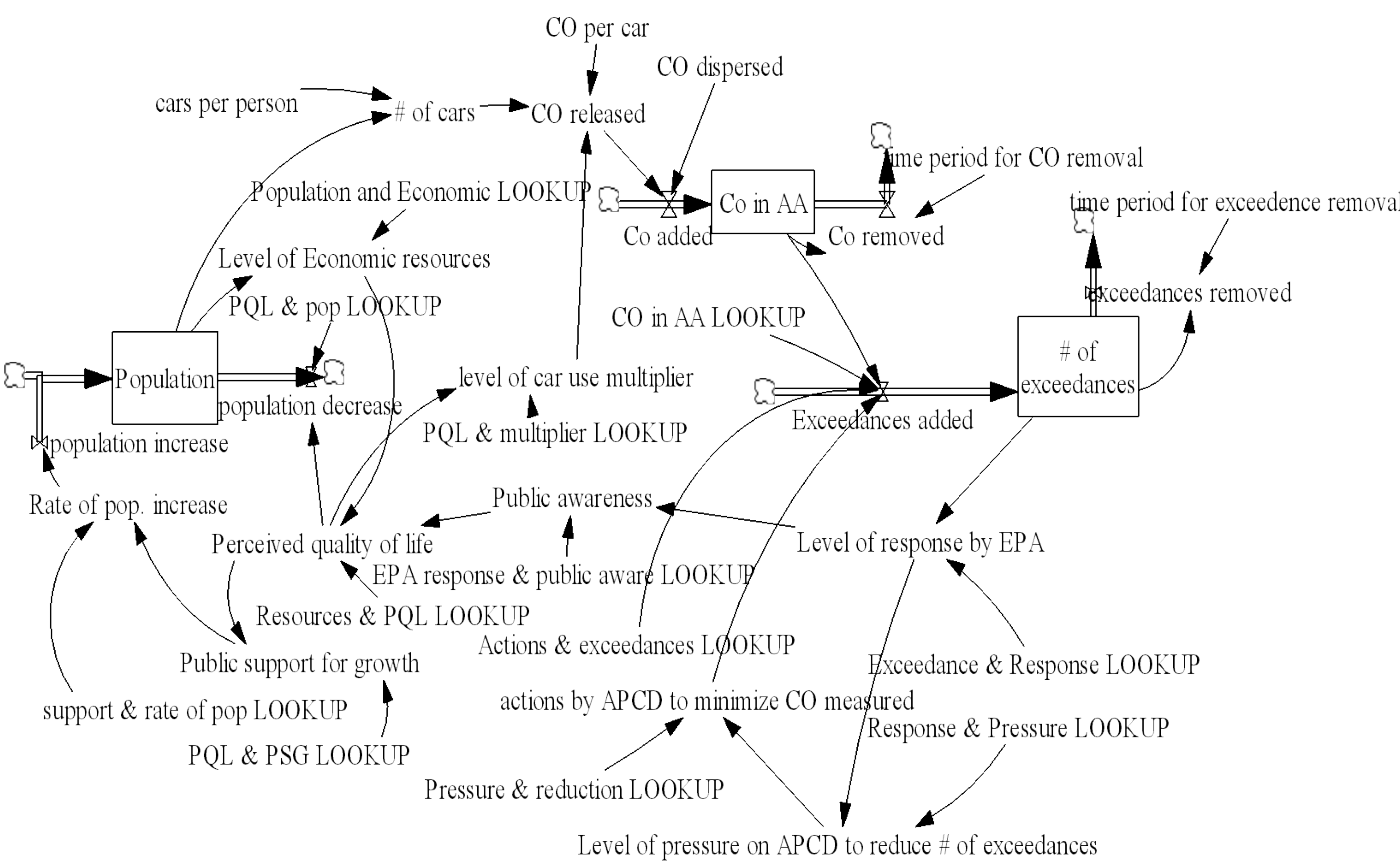
(Fig. 3)

The purpose of this model is to represent the dynamic behavior involved in pollution control in the Las Vegas Valley. The goal is to represent the dynamic interactions of the CCHD APCD, EPA, the public and the significant population growth, on the number of exceedances per year, which ultimately reflects the overall level of ambient air pollution.

The model structure is based on a simplistic representation of the air pollution source for CO. In order to simulate the release of CO, which is the trigger for creating exceedances, an assumption is used that the average release of CO per car needs to be represented as a fraction of the total average amount of CO in ambient air per year. The actions of the APCD are also presented in a simplistic manner so that each short-term action to reduce the amount of CO measured, results in the elimination of a certain number of exceedances for that year. As the number of actions increases, the number of exceedances removed increases.

The three stocks in the model are population, carbon monoxide and exceedances. As population increases the number of cars in use increases. As the number of cars in use per year increases the average amount of CO produced each year increases. When the average amount of CO produced each year reaches specific levels, it is directly correlated to a specific number of exceedances per average amount of CO per year. When the number of exceedances increase in a year, the EPA applies pressure to the CCHD APCD, which in turn acts to reduce exceedances. When exceedances are reduced, the pressure on the APCD is in turn reduced. In addition to pressuring the APCD, the EPA alerts the public when exceedances increase. The public has many factors, which contribute, to reactions. Economics perceived quality of life and awareness; all combine to result in varying degrees of support for growth, as well as voluntary reduction of automobile usage.

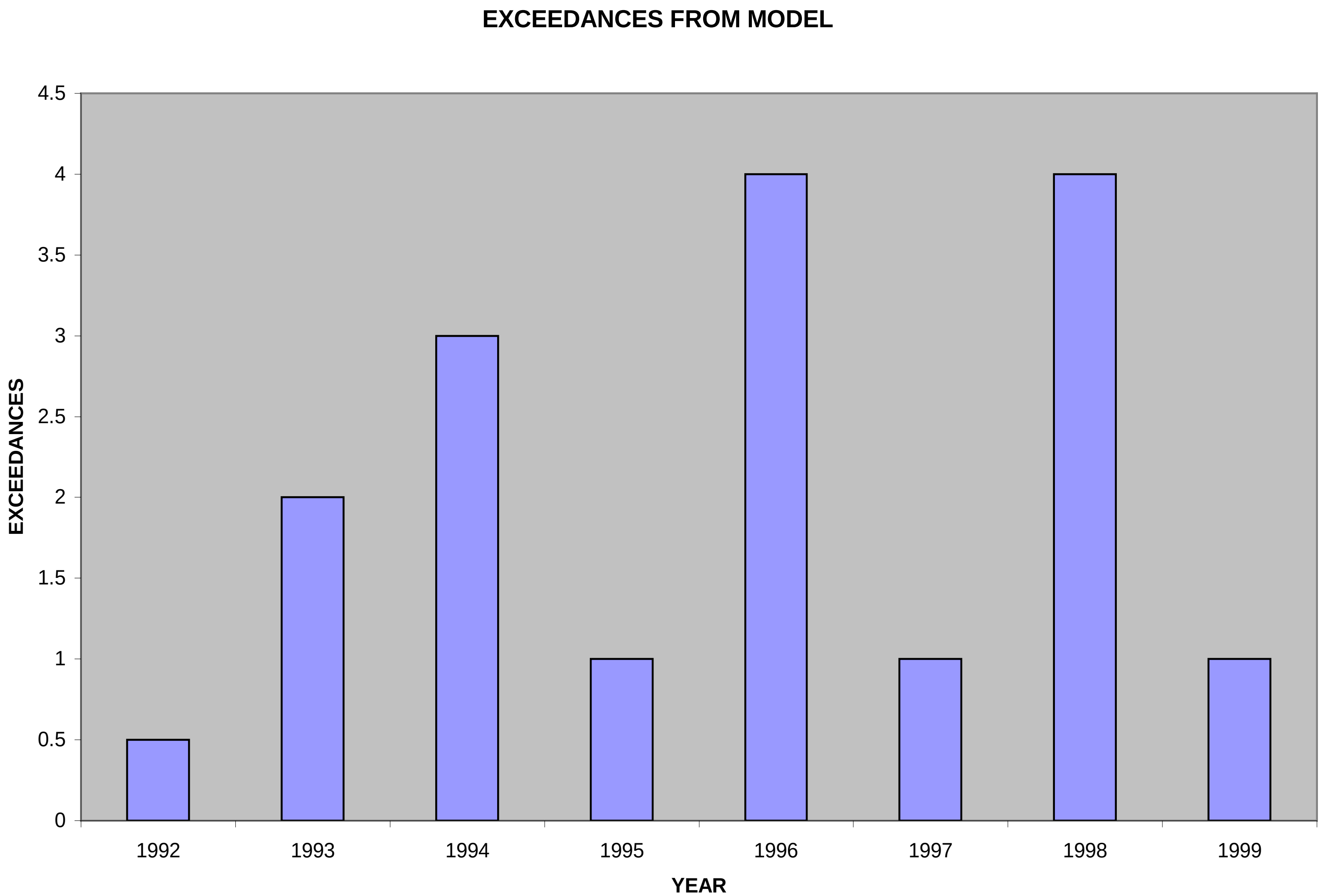
(Fig.3) Stock and Flow Diagram



## RESULTS

The model was designed to represent the general behavioral characteristics of the air pollution control structure in the Las Vegas Valley from 1992 to 1999. In order to be used as a possible test bed for examining future behavior of the air pollution control structure, the model output needs to display similar behavior to the output of the actual system. The general behavior it generated is displayed in figure 4.

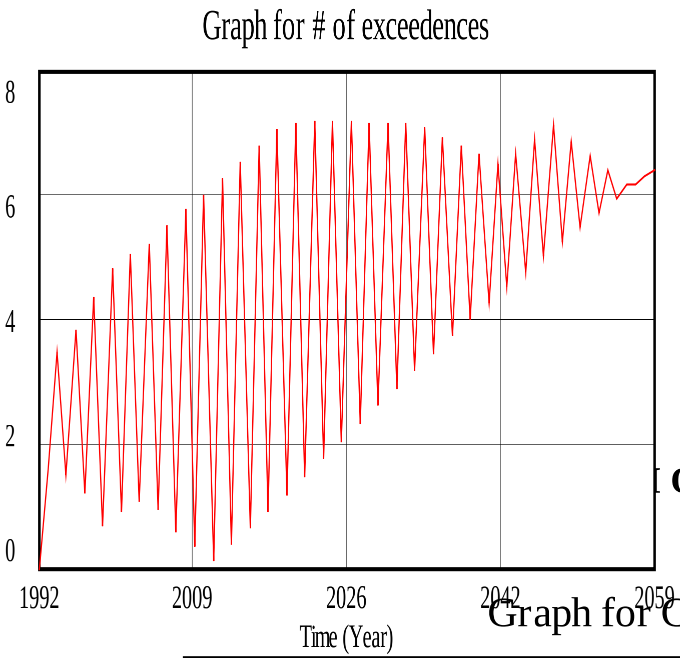
**(Fig. 4 MODEL OUTPUT)**
**In addition to the model output represented by figure 4, which is**

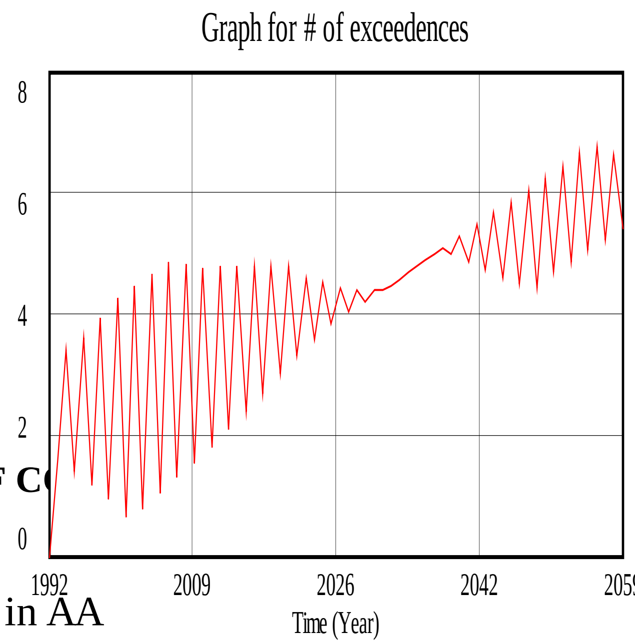


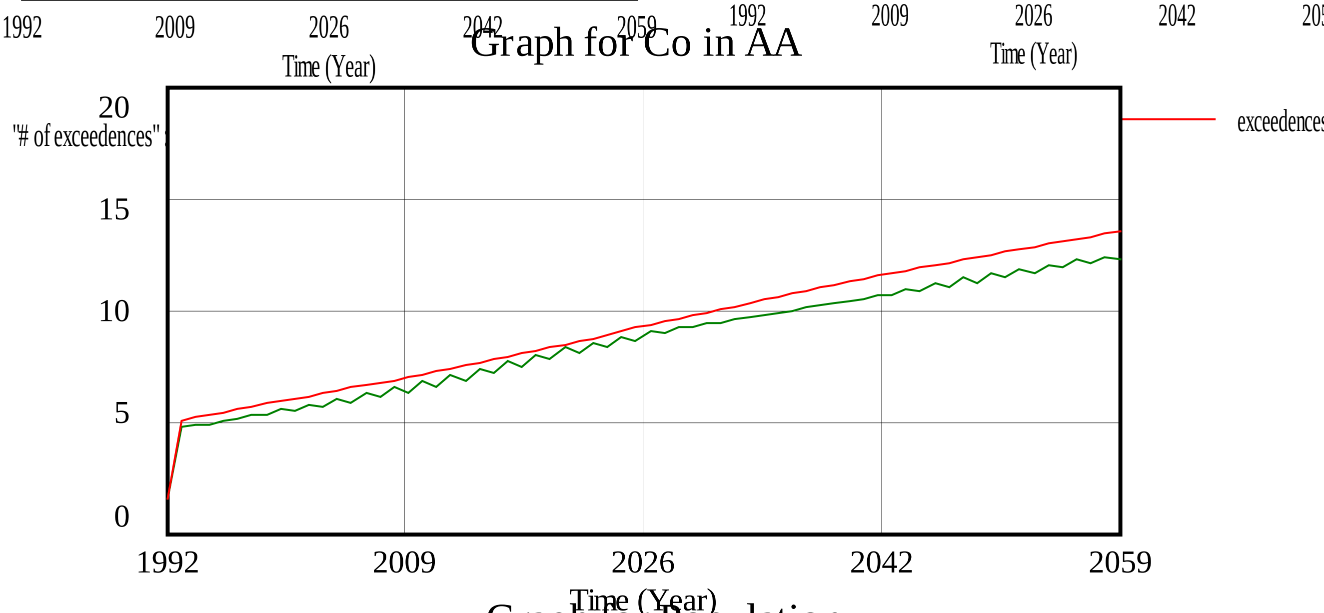

**in the same time frame as the reference mode graph, other model outputs were observed. The time period from 1992 until 2059 was tested, and results are represented in figures 5 – 8.**

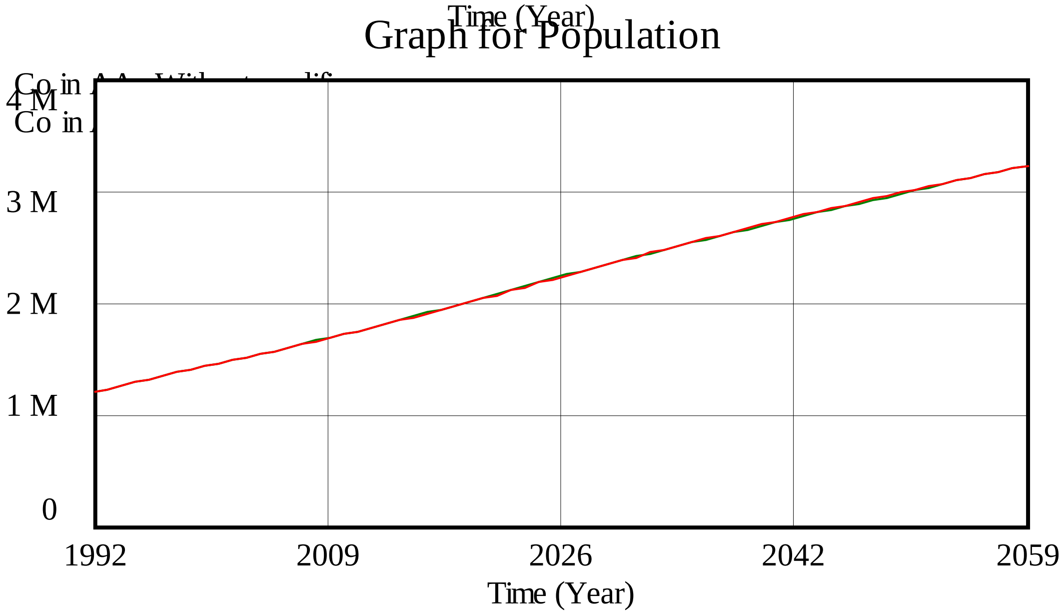
**According to the literature search, the primary mechanism in the CAA for reducing ambient air pollution is the reduction of vehicle usage. To account for this, the model was run in two different modes for the time period between 1992 and 2059. The first mode was without the vehicle usage modifier, and the second mode was with the vehicle usage modifier. When the model was run without the modifier there was no reduction in vehicle usage. When the model was run with the modifier there was a reduction in vehicle usage that ranged from 1 %, up to 10 %.**

**(Fig. 5 MODEL OUTPUT WITHOUT MODIFIER)　　　(Fig. 6 WITH MODIFIER)**



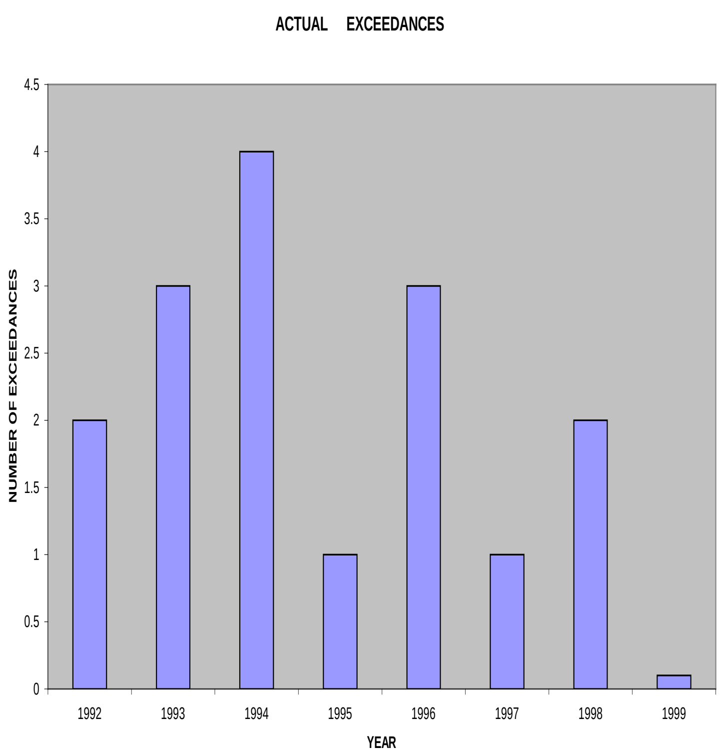



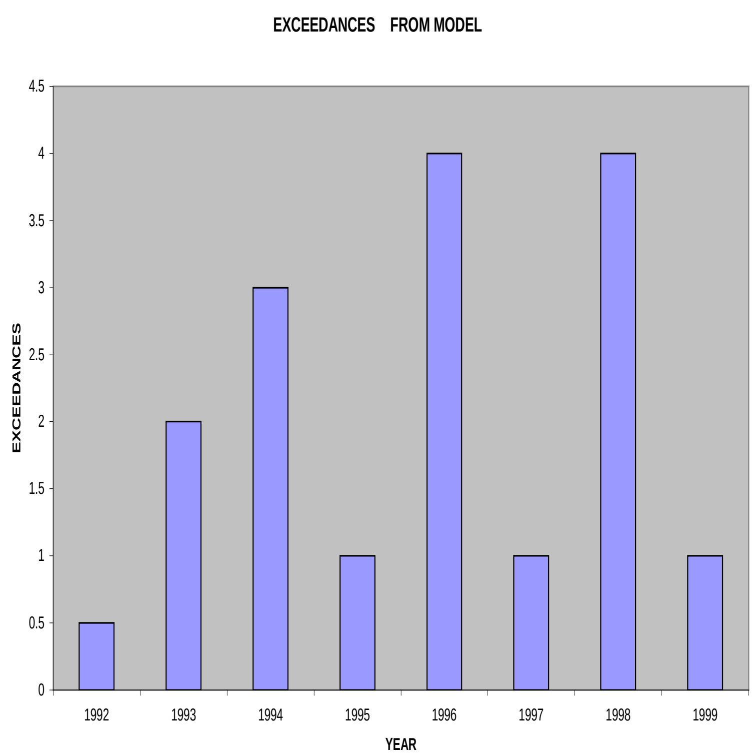



DISCUSSION

**While the output of the model does not identically match the numerical data of the reference mode, it does appear to represent the general behavioral characteristics. Both graphs show a general pattern where there is an increase in exceedances for the early 1990's, followed by up and down fluctuations for the remainder of the 1990's decade.**

(Fig.9 Actual Exceedances) (Fig.10 Model Exceedances)



**After an investigation into the development and operation of air pollution control in the Las Vegas Valley, I became interested in two basic lines of inquisition. What are the positions and relationships of the entities involved, which make up the air pollution control system in the Las Vegas Valley, and can the current system be effective into the future as the population is projected to increase significantly. After reviewing literature from federal and state law, as well as documentation from the CCHD APCD, I developed some basic premises about the way in which this system operates**.

**It appears as if the foundation of air pollution control efforts are based on responding to the requirements of the federal law. While this approach is legally correct, it is different from a foundation that is based on reducing present and future releases of pollution into the air. While the CCHD APCD does take some actions toward reducing ambient air pollution, the main orientation is toward satisfying the requirements of the CAA, which includes the need to minimize the number of times per year that pollution levels are measured to be in excess of the federal standards. As a result, the model was developed with this feedback loop, which creates the oscillating pattern of exceedances from year to year.**

When the model was run for the time period between 1992 and 2059, the oscillating pattern of exceedances continued and rose steadily. Along with the rise in exceedances, the population rose, according to estimates from the state of Nevada and Clark County.

And, in conjunction with the increasing population and subsequent increase in vehicle usage, pollution in ambient air rose.

The results of this analysis suggest the possibility that the current structure will not be able to address future increases in CO pollution. However, there was still one important factor to consider. The primary mechanism in the CAA for addressing urban air pollution such as CO, which comes primarily from automobiles, is the reduction of vehicle usage. As of 1999 the Las Vegas Valley has not yet implemented a comprehensive plan for reducing vehicle usage. Therefore, I wanted to examine what effect this type of plan could have on the output of the model. According to research by the California Air Resources Board the total reduction in vehicle usage attained, as a result of the comprehensive EPA approved plan has been between ½ % and 2 % of all daily travel. In order to test the maximum potential for future operation of the current structure in the Las Vegas Valley, I used a vehicle usage modifier that would reduce vehicle travel across the board by 1% and would further reduce usage up to 10% when exceedances began to rise. These optimistic numbers for vehicle use reduction were used in order to be able to test the established structure given the full implementation of CAA provisions for addressing ambient CO pollution. The result was a slight reduction in exceedances and ambient CO, but the same basic pattern of fluctuation and steady increase was still present (Figs.5, 6&7).

From the trial runs of the model, with the modifier and without, I concluded that it is a likely possibility that the current structure for air pollution control will be inadequate to address degradation of air quality as the population increases in the future. This suggests to me that one course of action might be to change the actual structure of air pollution control in the valley. When I considered the background information that I studied as well as the model that was constructed, it appeared to me as if the best place to alter the structure was at the point of pollution generation. I believe that a good place to focus future efforts will be to examine ways of eliminating the source of CO pollution. With electric and hybrid electric cars already in production it would seem as if a feasible and highly beneficial structural change in this current system would be the significant elimination of CO emitting vehicles. However, without some type of change in structure, the current system of air pollution control in the Las Vegas Valley will most likely be inadequate to control future increases in carbon monoxide pollution and exceedances as the population increases during the 21$^{st}$ century.

BIBLIOGRAPHY

Dockery, D, W.Sc.D., et.al. (1993) An Association Between Air Pollution and Mortality In Six U.S. Cities. *The New England Journal of Medicine*. Vol. 329:1753-1759

Ford, A. (1999) *Modeling the Environment.* Washington D.C. Island Press. 1-181

Friedlander, S.K. (1977) *Smoke Dust and Haze.* New York John Wiley & Sons 296

Greene, S. (1996) *Grass Roots Key to Solving Air Pollution*. Review Journal, August 29,1996 Las Vegas, Nevada. Greeenspun communications.

Mahal, K. (1999) President of Nevada Seniors Coalition. Personal Interview, January 25, 1999.

Manning, M. (1996) *Pollution Monitor Readings Unhealthy*. Review Journal, October 25,1996 Las Vegas, Nevada. Greeenspun communications.

Naylor, M, H. (1998) *Air Quality Issues in the Las Vegas Valley*. Las Vegas, Clark County Health District. 1-20

Naylor, M, H. (1996) *Air Quality Issues in the Las Vegas Valley*. Las Vegas, Clark County Health District. 1-20

Naylor, M, H. (1996) Draft. *Enforcement and Compliance Policy Manual*. 2nd edition. Las Vegas, Clark County Health District. 1-20

Naylor, M, H. and L, F. Durosinmi (1999) *EPA Progress Report on Workplan for FY99, Page 9 Referencing Ambient Air Monitoring.* Las Vegas, Clark County Health District 1-32

Rogers, K. (1996) *Valley to Get Second Chance on Air Readings*. Review Journal, March 14,1996 Las Vegas, Nevada. Greeenspun communications.

Rogers, K. (1996) *Winter Smog Season Ends on Gloomy Note*. Review Journal, March 2nd, 1996 Las Vegas, Nevada. Greeenspun communications.

Rosenbaum, W, A. (1991) *Environmental Politics and Policy*. 2nd edition. Washington, D.C. CQ Press 169-194.

Shrouds, J.M. (1994) Conformity and the New Transportation Covenant. *Transportation Planning and Air Quality 2*. New York, American Society of Civil Engineers 1-4

Sperling, D. (1994) *Future Drive, Electric Vehicles and Sustainable Transportation*. Washington D.C. Island Press.1-175

Tabb, W, M. and L, A. Malone eds. (1992) *Environmental Law Selected Statutes and Regulations*. 1992 edition. Charlottesville, Virginia, the Michie Company 98-485.

Worobec, M, D. and C. Hogue. (1992) *Toxic Substances Controls Guide*. 2nd edition Washington D.C. BNA Books 101-126.