

# **Review of the California Ambient Air Quality Standard for Ozone**

**April 28, 2005**



**Air Resources Board**

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**California Environmental Protection Agency**

Good afternoon Madame Chairman and members of the Board. This afternoon we are presenting Staff's findings on the review of the ambient air quality standard for ozone, and our recommendations for amending the standard. We have arrived at these recommendations as the result of an extensive critical review of the scientific literature on the health and welfare effects of ozone exposure.

# Overview

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- Criteria for standard setting
- Process for standard setting
- Findings of the scientific review
- Basis for the standard recommendations
- Health impacts of current ozone exposure
- Public comments and staff responses

We'll be focusing on several issues in this presentation, including

why we are reviewing the State ozone standard,

the legal and regulatory criteria for standard review,

our findings and proposed revisions to the existing ozone standard,

the health basis for the proposed ozone standard, some of the public health impacts of current ozone levels, and an overview of the comments we received from the public.

# Criteria for Standard Setting

We'll start by defining what an ambient air quality standard is, and why we are reviewing the ozone standard.

# What is an Ambient Air Quality Standard?

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- Legal definition of clean air
- Has four parts:
  - Pollutant definition
  - Concentration
  - Averaging time
  - Monitoring Method
- Based solely on health and welfare

Under California law, an ambient air quality standard is the legal definition of clean air. This definition is key for today's consideration of the proposed amendments to the ozone standard. Based on this definition, a standard represents the highest exposure that is unlikely to induce adverse health effects, and represents the highest safe concentration for the given averaging time.

Standards have four parts. They include a definition of the pollutant, in this case ozone, a concentration, an averaging time, for example 1-hour or 8-hours, and a monitoring method.

By state law, ambient air quality standards are based solely on health and welfare considerations.

## Standard Setting Does Not Include

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- Attainment designation
- Cost of controls
- Feasibility of controls
- Implementation of controls
- Addressed by separate regulatory processes

Standards do not include plans for attainment, they are the GOAL to which attainment plans aim. Attainment designations are governed by a different regulatory process, and consequently issues related to attainment are NOT considered in the standard setting process.

Standard setting also does not include consideration of such things as cost, feasibility, or implementation of controls. However, these issues are considered when specific control measures are proposed.

## Why Are We Reviewing the State Ozone Standard?

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- Address requirements of Children's Environmental Health Protection Act (SB25, Escutia, 1999)
- Assure public health protection
- Comply with State laws and regulations requiring periodic review

As I mentioned, California ambient air quality standards are based solely on health and welfare considerations. This review of the ozone standard addresses provisions of the Children's Environmental Health Protection Act, SB25 passed in 1999 requiring that ambient air quality standards be reviewed and set at levels that protect public health, with a particular emphasis on the health of infants and children.

State law requires that ambient air quality standards be periodically reviewed to ensure that they do adequately protect public health with an adequate margin of safety.

The CA ozone standard was last reviewed in 1987, and considerable new health research has been published since that time that is relevant to evaluating the adequacy of the existing standard.

(70101 CCR; and H&S Code 39606)

## Why Are We Concerned about Ozone?

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- Significant health effects
- Substantial scientific evidence for adverse health effects
- High exposure in California
- Children may be particularly vulnerable

We are concerned about ozone because exposure to this pollutant results in significant and wide-ranging health effects, as consistently reported in the scientific literature.

Also, statewide ozone levels frequently exceed the current standard, meaning that many Californians are at risk of experiencing adverse health effects multiple times per year.

In addition, children may be especially vulnerable.

## Nature of Public Health Risk Associated with Ozone

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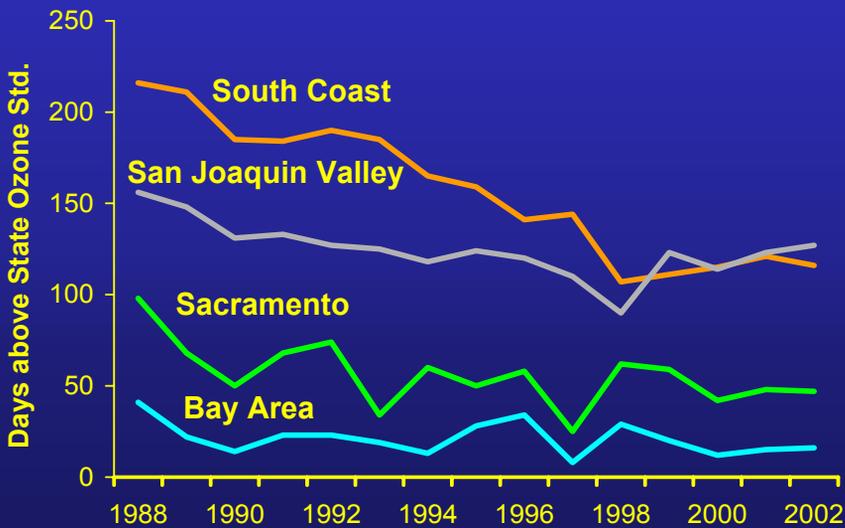
- Primarily an outdoor pollutant
- Risk proportional to inhaled amount of ozone
- Greatest risk to people who are active outdoors
  - Adults who exercise or work outdoors
  - Children

Ozone exposure is widespread, although there can be considerable differences in total exposure among individuals. This is because ozone is primarily an outdoor pollutant, so, people who spend more time outdoors are at greater risk of experiencing adverse responses.

In addition, research has shown that the health effects of ozone exposure are roughly proportional to the amount of ozone a person inhales, so the more a person breathes, the greater their risk of experiencing adverse effects.

So, generally speaking, the individuals at greatest risk are those who exercise or work outdoors, and children who typically spend a greater amount of time in outdoor activity, and breathe at a higher rate relative to their size than adults.

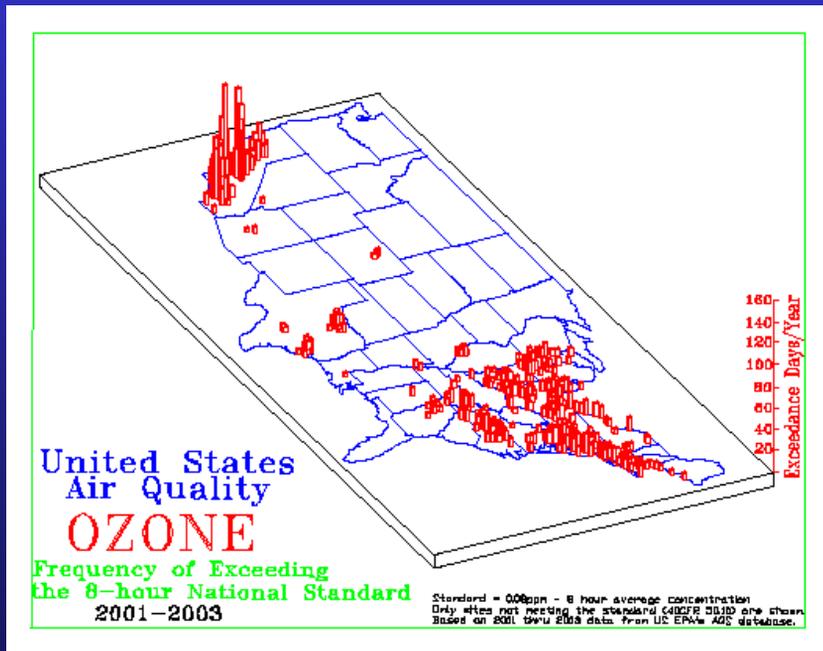
# Days of Unhealthy Ozone Levels



The most populated areas of California have many exceedences of the current state ozone standard each year. This figure shows the trend in the number of days exceeding the CA ozone standard for the period 1988 to 2002 in the four largest California air basins. As you can see, the trend over the past 14 years is toward fewer days per year above the standard.

However, the large number of days per year exceeding the state standard, along with the large population affected gives an indication of why the ozone standard received a high priority for full review.

## National 8-Hr O<sub>3</sub> Standard Exceedances



This slide gives a perspective on the extent of ozone pollution in California, compared to the rest of the country. The vertical bars on the figure are the number of exceedances of the federal 8-hour ozone standard. As you can see, California has by far the largest number of exceedances in the country.

The slide also illustrates the seriousness of the ozone problem in California, and California's need for authority to address a significant statewide public health issue, which it has through provisions of the federal Clean Air Act.

## Current Ozone Standards (ppm)

	1-Hour	8-Hour
California (1987)	0.09	--
US EPA (1996)	0.12	0.08*
WHO for Europe	--	0.06
Canada	0.082	--

\*selected from a range of 0.07 to 0.09 ppm

Currently, California has a one-hour ozone standard of 0.09 ppm, not to be exceeded, which is more stringent than the federal one-hour ozone standard of 0.12 ppm. The federal 1 hr standard is in the process of being phased out in favor of an 8-hr average standard of 0.08 ppm that was set in 1997. This concentration was selected from a range of 0.07 to 0.09 that was recommended by the EPA staff. The Federal standards also allow several exceedences per year.

For comparison, the World Health Organization has recommended an 8-hour average standard of 0.06 ppm for Europe, and Canada has a 1-hour standard of 0.082 ppm.

## Recommendation to Revise the California Ozone Standard

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- Retain ozone as the pollutant definition
- Establish a new 8-hr standard of 0.070 ppm, not to be exceeded
- Retain the current 1-hr standard of 0.09 ppm, not to be exceeded
- Retain the UV monitoring method

Today we are proposing to amend the California ambient air quality standard for ozone as follows:

First, we recommend retention of ozone as the pollutant definition.

We recommend establishment of a new 8-hr average standard of 0.070 ppm, not to be exceeded, based on recent health studies.

In addition, we recommend retaining the current 1-hr standard of 0.09 ppm, not to be exceeded because the scientific literature indicates that peak exposures are important.

Finally, we recommend that the ultraviolet absorption monitoring method currently in use continue to be the monitoring method for ozone, and that all Federally-approved ultraviolet absorption samplers be adopted as California approved samplers. This will not result in any changes in current monitoring practices, and will align California's monitoring methods with those of USEPA.

# Process for Standard Setting

Next I'd like to turn your attention to the process and procedures for setting ambient air quality standards in California.



# Air Quality Advisory Committee (AQAC) Review

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- Required by State law
- Members appointed by University of California President
- Purpose of AQAC review:
  - Assess adequacy of scientific basis for proposed standards
  - Assess adequacy of proposed standards to protect public health

As I mentioned, State law requires AQAC to peer review the draft staff report and recommendations. The committee is appointed by the Office of the President of the University of California, and each member is an expert on one or more aspects of the staff report.

The purpose of AQAC's peer review is to assess the completeness and conclusions of the scientific review on which the proposed standards are based. The committee also makes findings as to whether the proposed standards are supported by the findings of the literature review, and whether the proposed standards adequately protect public health.

## Findings of the AQAC Review

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- Scientific conclusions and findings consistent with available data
- Staff recommendations scientifically sound, and well justified
- Suggested clarifications, additional papers and/or more detail in some sections of the report
- Staff responses to the AQAC review

At the conclusion of their 2 day public meeting, AQAC found that the scientific conclusions presented in the staff report are consistent with the available data.

They further found that the staff recommendations are scientifically sound, and well justified.

The committee made a number of suggestions for changes to the staff report, largely oriented toward more detailed discussion on or clarification of several topics, and addition of several scientific papers.

The committee unanimously endorsed the proposed amendments to the state ozone standard.

Staff responded to the AQAC review by revising the report to incorporate the suggestions for clarification, expanded discussion, and inclusion of additional scientific papers. In addition, the revised report released on March 11 also addressed issues raised by the public both orally at workshops, at the AQAC meeting, and through written comments.

# Findings of the Scientific Review

Next I'll briefly discuss the findings of that review.

As I mentioned, the proposed revision of the ozone standard is based solely on health and welfare considerations. Staff reviewed about 1000 health-related scientific papers in the course of preparing the staff report before you today.

# Health Studies

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## Three types of health studies:

- Controlled human exposure
- Controlled animal exposure
- Epidemiological

Published scientific papers that have investigated the impacts of ozone exposure on human health broadly fall into three categories, controlled human exposure studies, controlled animal exposure studies, and epidemiologic studies.

Because there is a very large body of controlled human exposure data, we have primarily relied on these studies in selecting the averaging times and concentrations in our recommendation. These data have been supplemented by epidemiologic and animal study data.

## What Are the Health Effects of Ozone?

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- Reduced lung function
- Respiratory symptoms
- Airway inflammation
- Increased hospital and ER usage
- Increased school absenteeism
- Asthma induction in active children (needs confirmation)
- Premature death

Collectively, the health literature shows that ozone exposure is associated with a number of adverse health effects, including reduced lung function, increased respiratory symptoms, airways inflammation, increased hospital and emergency room usage, increased school absenteeism, and there is preliminary evidence that high ozone exposure in active children may be related to asthma induction. There is also increasing evidence that ozone is associated with premature death.

The next few slides present a more detailed summary of the health effects of ozone exposure.

# Controlled Human Exposure Studies

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- Simulate real world exposures
- Typical subjects: healthy adults
  - Some studies on children, older adults, and people with chronic heart or lung disease
- Advantage: Good measures of exposure and response
- Disadvantages: Mostly healthy adults; small samples; limited endpoints; only investigate acute exposures

Controlled exposure studies have several features that make them particularly useful for standard setting. Typically, these studies include healthy adults, although there are some studies of children, adolescents, and people with mild degrees of chronic heart or lung disease.

These studies give good measures of exposure and response, and the protocols are designed to simulate outdoor exposure patterns representative of people's actual activity patterns.

However, they are very labor intensive to perform, and consequently only small groups can be studied, exposures to complex mixtures of pollutants are not logistically possible, and some subject populations can not be studied at all for ethical reasons, such as the seriously ill.

However, these studies provide important dose-response information about the groups most likely to have elevated exposure to ozone: those who work, play and engage in active recreation outdoors.

## Controlled Human Studies (1 to 3 Hours): Lowest Concentrations Showing Effects

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- Lung Function Decrements: 0.12 ppm
- Increased Respiratory Symptoms: 0.12 ppm
- Increased Airway Resistance: 0.18 ppm
- Airway Inflammation: 0.20 ppm

Review of the controlled human exposure studies led to the finding that for 1-3 hour exposures, the lowest ozone concentrations at which adverse effects have been documented are:

0.12 ppm for lung function decrements and increased respiratory symptoms;

0.18 ppm for increased airway resistance;

and 0.20 ppm for airway inflammation.

There are several limitations to this database, including little or no data at concentrations below those noted above, except for lung function and symptoms. There are only a few studies on children, adolescents, and people with chronic diseases, although the available literature does not support the notion that these subpopulations respond at lower ozone concentrations than healthy people.

## Studies of Multi-Hour Ozone Exposures: Lowest Concentrations Showing Effects

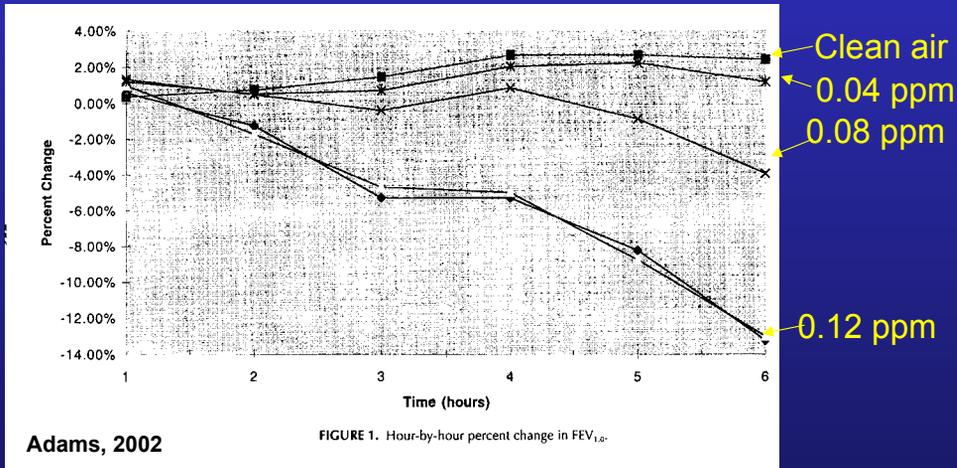
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- Lung function decrements: 0.08 ppm
- Increased respiratory symptoms: 0.08 ppm
- Increased airway reactivity: 0.08 ppm
- Airway inflammation: 0.08 ppm
- No effects reported at 0.04 ppm

Review of multi-hour controlled human exposure studies led to the finding that for 6-8 hour exposures, 0.08 ppm is the lowest ozone concentrations at which lung function decrements, increased respiratory symptoms, increased airway reactivity, and airway inflammation have been reported.

Again, there are several limitations to the available database. For example, there are few data at concentrations below 0.08 ppm: There is one published study at 0.04 ppm, and one unpublished study at 0.06 ppm, both reporting no statistically significant effects. And again, there are few or no studies on children, adolescents, or people with chronic diseases. As with 1 to 3 hour exposures, the available literature does not support the notion that these subpopulations respond at lower ozone concentrations than healthy people.

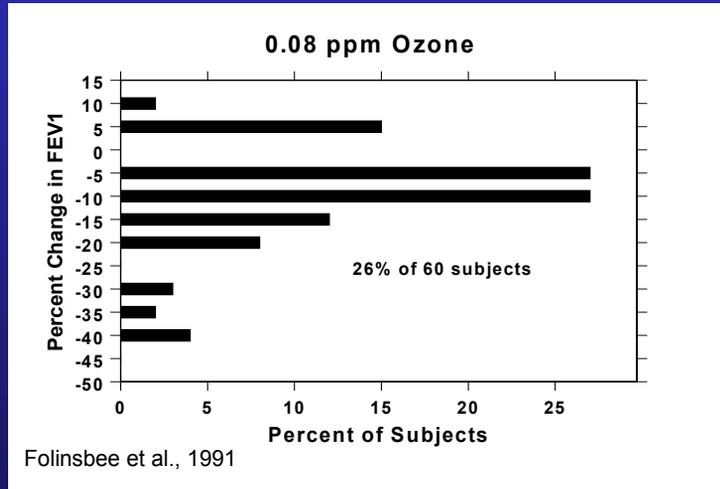
## Change in FEV1 with Length of Exposure



The next several slides show actual data from a controlled exposure study, and illustrate several key points about responses to ozone. This slide shows the typical time course of change in a measure of lung function, forced expiratory volume in 1 sec, abbreviated as FEV<sub>1</sub>, with exposure duration in subjects exposed to filtered air, 0.04, 0.08 and 0.12 ppm ozone for 6.6 hrs. As you can see, FEV<sub>1</sub> decreases as a function of both ozone concentration and length of exposure, although ozone concentration has the greater effect.

The slide also illustrates the reproducibility of the responses with repeated exposure of the same subjects to 0.12 ppm indicated by the double trend lines for 0.12 ppm ozone.

## Some Individuals Are Particularly Responsive (6.6 hr exposure)



This slide illustrates the range of individual changes FEV1 in response to 6.6 hr exposure to 0.08 ppm ozone. The exposures included moderate exercise for 50 min of each hour, in simulation of a day of outdoor work or active recreation. Each bar shows the percentage of the people studied who had the specified percentage change in FEV1 following the exposure. Note that with 6.6 hour exposure to 0.08 ppm ozone 26% of the subjects studied had decrements in FEV1 greater than 10%, which represents an adverse health effect. The slide also illustrates that some individuals are especially sensitive to ozone.

## Influence of Demographics and Ethnicity on Responsiveness

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- Few studies conducted
- Factors Investigated
  - Gender
  - Age
  - Socioeconomic Status
  - Ethnicity
- Insufficient data to draw conclusions, except for gender

Few controlled exposure studies have investigated the effects of demographic factors, or ethnicity on responsiveness to ozone.

There is no evidence that men and women have different degrees of sensitivity to O<sub>3</sub>. Adults over 50 years of age typically have smaller lung function and symptoms responses to O<sub>3</sub>, but there are no data on airways responsiveness or inflammation for this age group.

Only one study has investigated the influence of socioeconomic status and one has compared responses of African-Americans with Caucasians. Both found no differences in responses between groups. There are no data on other ethnic groups.

Overall, there are insufficient data available to draw conclusions as to whether or not these factors impact responsiveness to ozone, with the exception of gender.

## Findings From Animal Studies

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- Acute responses similar to humans:
  - Increased airway resistance
  - Airway inflammation
- Fibrosis with repeated injury-repair cycles (> 0.25 ppm)
- Altered airway architecture with chronic exposure to high O<sub>3</sub> concentrations (> 0.20 ppm)

Animal toxicology indicates that laboratory animal species have similar acute responses to ozone as humans, including increased airway resistance, airways inflammation and reduced lung function.

Studies have shown that alternating periods of ozone and air exposure result in repeated injury-repair cycles that can lead to fibrosis of the lung tissue. These studies used higher ozone concentrations than are currently typical of ambient conditions, and it is unknown whether episodic exposure of humans to ambient concentrations of ozone causes similar effects.

Chronic exposure to O<sub>3</sub> concentrations greater than 0.20 ppm, which is somewhat higher than current ambient concentrations, leads to changes in airway architecture in infant and young animals.

# Characteristics of Epidemiologic Studies

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- Evaluate exposures and responses of free-living populations
- Difficult to determine relevant
  - Exposure averaging time
  - Lowest effects level
- Possible confounders, such as weather and co-pollutants

We also reviewed epidemiologic studies, which investigate the relationship between exposures and responses of naturally exposed populations. Because these studies do not involve altering people's natural exposures, they can include many people who can not be studied under controlled conditions.

These studies can examine both short and long-term exposures.

However, epidemiologic studies also have several limitations, including that it is difficult to determine the relevant exposure averaging time, and the specific pollutant concentrations inducing the observed effects.

Because ambient air is a complex mixture, these studies also account for potentially confounding factors, such as weather and other pollutants present in the ambient air.

# Findings From Epidemiologic Studies

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Ambient concentrations of ozone have been associated with:

- Respiratory hospital admissions
- Emergency room visits
- Asthma exacerbation
- School absences and respiratory symptoms
- New onset of asthma (with exercise)
- Reduced lung function with long term exposure
- Premature death

The epidemiologic literature has reported significant associations between ambient concentrations of ozone and a number of adverse health outcomes, including

Respiratory hospital admissions

Emergency room visits for asthma

Asthma exacerbation

School absences and respiratory symptoms

New onset of asthma (with exercise)

Reduced lung function with long term exposure

Premature death

## New Evidence for an Association between Ozone and Mortality

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- Study of 29 cities in Europe implicates summer ozone concentration (Gryparis et al. 2004)
- Study of 95 largest U.S. cities implicates both summer and all-year ozone concentrations (Bell et al. 2004)
  - Controlled for PM10 and weather
  - Multi-day concentrations increase effect

Two recently published studies, one from Europe and one from the US, provide new, and stronger evidence than previous studies, that ozone is associated with premature death. The Gryparis et al. study of 29 European cities implicates summer ozone concentrations, which are generally higher than during other parts of the year. Bell et al.'s study of 95 US cities found an association for both summer and year-round ozone concentrations for all age groups. Bell et al. also reported that the association between premature death and ozone was greater when the analysis included consideration of the ozone concentration over several days.

## Findings on Infants and Children Under SB 25

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- No evidence that children respond to lower O<sub>3</sub> concentrations than adults
- Exposure patterns:
  - Frequent high exposures due to outdoor activity
  - Greater exposure per unit lung surface
- Susceptibility: Early exposure may:
  - Affect lung development
  - Reduce adult lung function
  - Induce asthma
- No evidence for interactions between pollutants

The Health & Safety Code requires Staff to make findings relating specifically to effects on children and infants, including susceptibility, exposure patterns, and interactions between ambient pollutants.

We concluded that there is no evidence that children respond to lower O<sub>3</sub> concentrations than adults.

However, children often have a different exposure pattern that includes high exposures due to more frequent and longer duration of outdoor activity.

In addition, dosimetry studies suggest that children experience greater exposure per unit lung surface area than adults.

Several studies suggest that high ozone exposure during childhood may affect lung development, leading to a lower attained level of lung function at adulthood. There is also some evidence that high childhood ozone exposure may induce asthma.

Our review found no evidence for interactions between pollutants in any population group.

## Findings on Infants and Children (cont.)

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- Adverse health outcomes reported for children include:
  - Asthma exacerbation and ER visits
  - Hospital admissions
  - School absenteeism
  - Upper and lower respiratory symptoms
  - Possible onset of asthma
  - Decreased lung function in young adults raised in high ozone areas

Adverse health outcomes reported by studies specifically of children include:

Asthma exacerbation and emergency room visits for asthma,  
Hospital admissions,  
School absenteeism,  
Upper and lower respiratory symptoms,  
Possible onset of asthma in active children living in high ozone areas, and  
Decreased lung function in young adults raised in high ozone areas

# Basis for Standard Recommendations

Now I'd like to turn your attention to the basis for staff's recommendations for the ozone standard, and how we used the findings from the scientific review to develop the recommendations for revision of the state ozone standard.

## Basis for 1-Hour Standard Recommendation

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### Retain the current 1-hr standard of 0.09 ppm

- Controlled human exposure studies report lung function and symptoms effects at 0.12 ppm
- Epidemiologic studies suggest adverse effects below 0.12 ppm, but relevant averaging time and concentration difficult to determine
- Studies on ER visits for asthma suggest a lowest effect level between 0.075 and 0.11 ppm

As I mentioned earlier, controlled human exposure studies formed the primary basis for the staff recommendations.

For a 1-hour averaging time we recommend retention of the current standard of 0.09 ppm, based on controlled human exposure studies reporting lung function and symptoms effects at 0.12 ppm, the finding that epidemiologic studies suggest adverse effects below 0.12 ppm, and epidemiologic studies on emergency room visits for asthma suggesting a lowest effect level in the range of 0.075 to 0.11 ppm.

## Basis for 1-Hour Standard (cont.)

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- Includes a safety margin to address uncertainties in the data
- Protects against short, peak exposures
- Relevant averaging time for:
  - Children playing outdoors
  - Adults exercising outdoors
  - Outdoor home maintenance activities

State law requires inclusion of a margin of safety in the recommended standards to address uncertainties in the available data. Epidemiologic and animal toxicology data contributed to development of the margin of safety.

We believe that this recommendation includes an adequate margin of safety to protect children and other susceptible groups, as well as protecting against airway inflammation.

This standard will protect against relatively short, peak exposures, and is particularly relevant for protection of children and adults who are playing, exercising or working outdoors for relatively short time periods.

## Basis for 8-Hour Standard Recommendation

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### Establish an 8-hr standard of 0.070 ppm

- Controlled human exposure studies report symptoms, lung function changes, and airway responsiveness effects at 0.08 ppm
- 26% of individuals exhibited large changes with 6.6 hr exposure to 0.08 ppm
- Studies at 0.04 and 0.06 ppm reported no significant effects

We also recommend establishing a new eight hour average standard of 0.070 ppm, based on 6.6 to 8 hour controlled human exposure studies reporting lung function and symptoms effects, airway hyperreactivity and airway inflammation at 0.08 ppm.

We have applied a margin of safety in consideration of the finding that about 26% of individuals participating in the supporting studies exhibited large changes in lung function following 6.6 hr exposure to 0.08 ppm ozone. The two controlled human studies at 0.04 and 0.06 ppm reported no statistically significant effects.

## Basis for 8-Hour Standard (cont.)

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- Epidemiologic studies suggest adverse effects at 8-hr concentrations less than 0.08 ppm
- Studies on ER visits for asthma suggest a lowest effect level between 0.065 and 0.09 ppm
- Includes a safety margin to address uncertainties in the data
- Protects against multi-hour exposures
- Relevant averaging time for:
  - Outdoor workers
  - Multi-hour recreational and outdoor activities

Epidemiologic studies suggest that there may be adverse effects at 8-hr concentrations less than 0.08 ppm.

In addition, studies on emergency room visits for asthma suggest a lowest effect level in the range of 0.065 to 0.09 ppm for an 8 hour averaging time.

This standard will provide protection from multi-hour exposures, and is particularly relevant for outdoor workers and people who engage in multi-hour recreational, exercise and outdoor activities.

## Why Do We Need Two Standards?

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- Responses related to inhaled dose
- O<sub>3</sub> concentration has greatest influence
- Address different exposure patterns

We are proposing two standards to address different exposure patterns.

Ozone-induced health effects are roughly proportional to the amount of ozone inhaled, although ozone concentration has the greatest influence on response magnitude.

Because of this, we need standards that protect against both short-term peak exposures, and longer, lower concentration exposures to provide adequate public health protection.

# Health Impacts of Current Ozone Exposure

I'd now like to turn your attention to some of the health impacts of current levels of ozone exposure. We performed an analysis to estimate some of the public health impacts associated with current ozone levels compared to the recommended ambient air quality standards for O<sub>3</sub>. The purpose of the analysis was NOT to select or justify the recommended standards, and it was performed after the recommendations were finalized. Rather, the purpose was to illustrate the public health impacts associated with ozone exposures today.

The numbers we are presenting today are somewhat different than those in our staff report, to reflect the results of an incremental analysis approach that I will explain momentarily.

# Health Impact of Current Ozone Concentrations

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## *Estimated annual count comparing today to attainment:*

- 630 (310 - 950) premature deaths
- 4,200 (2400 - 5800) hospitalizations for respiratory diseases
- 660 (400 - 920) emergency room visits for asthma for children under 18 years of age
- 3.7 million (470,000 - 6.8 million) school absences among children 5 to 17 years of age
- 3.1 (1.3 - 5.0 million) million minor restricted activity days for adults above 18 years of age

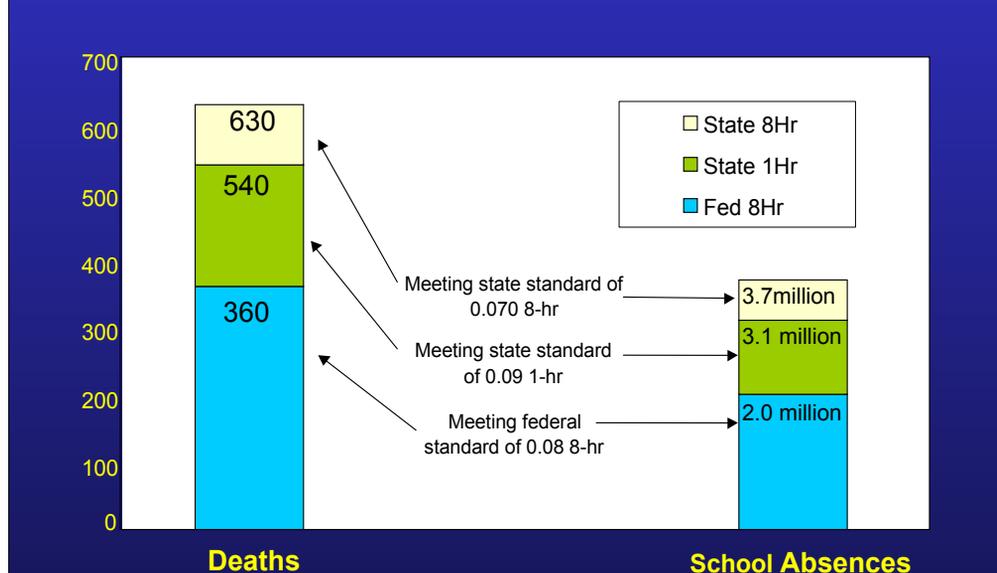
Our calculations suggest that current ozone levels are associated with a number of health impacts compared to attainment of the proposed standards. Specifically, we estimate that the following impacts are associated with current ozone concentrations that would be avoided with attainment of the proposed standards:

- 630 premature deaths
- 4,200 hospitalizations for respiratory diseases
- 660 emergency room visits for asthma for children under 18 years of age
- 3.7 million school absences among school children
- 3.1 million minor restricted activity days among adults

Since the analysis did not include all possible endpoints, it is likely that the total impacts of current ozone levels are greater than presented here. It is important to recognize that the endpoints used in the benefits analysis are NOT those on which the proposed standards were primarily based. The health impacts analysis was performed using population based studies of more rare, but also more serious, endpoints to obtain an estimate of some of the public health impacts associated with current ozone levels.

# Incremental Impacts Analysis

## Annual Statewide Avoided Cases with Attainment of Ozone Standards



The numbers presented on the previous slide compare the health impact of current ozone levels with those that would occur with attainment of the proposed standards. In response to public comments we also estimated the incremental reduction in health impacts that would accrue with reaching each air quality goal on the way to full attainment. This slide shows our findings for two endpoints: premature death and school absences. Note that the scale is different for the two endpoints.

For premature death, the incremental analysis estimates that attainment of the federal 8 hour standard of 0.08 ppm would avoid 360 deaths. An additional 180 deaths would be avoided with attainment of the state one-hour standard of 0.09 ppm, and another 90 deaths would be avoided with attainment of the proposed eight-hour standard, for a total of 630 cases avoided at full attainment.

For school absenteeism, the incremental analysis estimates avoidance of 2 million school absences with attainment of the federal eight-hour standard, an additional 1.1 million avoided school absences with attainment of the current state one-hour standard, and another 600,000 avoided school absences with attainment of the proposed eight-hour standard, for a total of 3.7 million fewer school absences at full attainment.

# Public Comments and Staff Responses

During the 45 day public comment period we received comments from industry and community groups. The comments fall into several basic topic areas.

# Comments and Responses - 1

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- Proposed standards overlap background ozone
  - Long-term average is 0.04 ppm
  - Exceptional events policy
- Ozone reduction of UVB radiation
  - Available literature does not support a benefit at ground level

One issue is concern that the proposed standards may overlap natural background levels. Our literature review led to the conclusion that the long-term average background ozone concentration in California is about 0.04 ppm, which is below the proposed standards.

Several commenters have also expressed concern that stratospheric ozone intrusion could lead to nonattainment designations since the proposed ozone standards are close to the background level. Existing air quality analysis methods are able to identify such exceptional events. Further, existing policy allows values identified as exceptional events to be excluded from the attainment designation process.

This process is only applied if a questionable measurement would be the deciding factor between an attainment/nonattainment designation.

There was also a comment that we have not considered the beneficial effect of reduced skin cancer due to ground level UVB absorption by the ground level ozone. Staff believes it is likely that any such effect would be very small because the change in UVB absorption would be restricted to only a very short path length, typically a few hundred meters. The limited literature on this topic does not support the commenter's contention.

## Comments and Responses - 2

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- Economic costs of attaining proposed standards not presented
  - Not a consideration under California law
- Request for incremental benefits assessment
  - Requested analysis included in presentation

Several commenters believe that we have not adequately considered the economic cost of meeting the proposed standards. As I noted at the beginning of the presentation, under California law, ambient air quality standards are the definition of clean air, and are based solely on health and welfare considerations. We are not permitted to consider costs of attainment in standard setting. State law deliberately separates the processes of defining clean air through ambient air quality standards, and attaining the defined clean air goal. Staff recognizes that it will likely be difficult to attain the proposed standards, but the scientific literature clearly demonstrates that the proposed standards are necessary to protect public health in the manner specified by State law. There will be economic costs involved in attaining the proposed standards, but under State law, these can not be considered in the standard setting process. The costs of particular control measures are evaluated in detail when control measures are proposed.

We also received several requests that we present the health impacts analysis in an incremental manner, the results of which we have already discussed in today's presentation.

# Summary

So, to summarize, Staff is recommending that the Board adopt the proposals to amend the State ambient air quality standard for ozone.

## Summary: Staff Recommendation

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- Retain ozone as the pollutant definition
- Establish a new 8-hr standard of 0.070 ppm, not to be exceeded
- Retain the current 1-hr standard of 0.09 ppm, not to be exceeded
- Retain the UV monitoring method

As I discussed earlier, State law defines ambient air quality standards as the maximum safe concentration for a given averaging time. This means that adverse effects are unlikely in people who undergo the defined exposures. The recommendations are based on an extensive critical review of the scientific literature on the public health impacts of ozone exposure. In summary, we recommend that the Board adopt Staff's recommendations.

Thank you for your attention. We would be pleased to respond to any questions you may have.