

# **Exposure to Ozone and Health**

Barbara Malczewska-Toth, Ph.D., D.A.B.T.

Glenda Hubbard, RN, MPH

November 6, 2002

# What is to be Covered Today?

- What is Ozone?
- Kinds of health effects ozone can cause
- Who should be concerned
- What we can do to avoid dangerous exposures
- Asthma and Ozone Exposure

# What is to be Covered Today?

- *What is Ozone?*
- Kinds of health effects ozone can cause
- Who should be concerned
- What we can do to avoid dangerous exposures
- Asthma and Ozone Exposure

# What is Ozone?

- ✓ An odorless and colorless gas composed of three atoms of oxygen (**O<sub>3</sub>**).
- ✓ Occurs both in the Earth's upper atmosphere and at ground level
- ✓ Can be **Good** or **Bad**, depending on where it is found.

# What is Ozone?

## **Good Ozone:**

- Occurs naturally in the Earth's upper atmosphere – 10 to 30 miles above the Earth's surface
- Forms a protective layer that shields us from the sun's ultraviolet rays
- Is gradually being destroyed and depleted by man-made chemicals

# What is Ozone?

## **Bad Ozone:**

- Occurs at or near ground level
- Formed when pollutants
  - emitted by cars, power plants, industrial boilers, refineries, chemical plants, and other sourcesreact chemically in the presence of heat and sunlight
- Can harm the health of people who breathe it.

# What is to be Covered Today?

- What is Ozone?
- *Kinds of health effects ozone can cause*
- Who should be concerned
- What we can do to avoid dangerous exposures
- Asthma and Ozone Exposure

# How Can Ozone Harm Our Health and What are the Symptoms?

## ➤ **Irritates the Respiratory System:**

- Coughing
- Throat irritation
- Uncomfortable sensation in the chest

*These symptoms can last for a few hours after exposure to ozone and may even become painful.*

# How Can Ozone Harm Our Health and What are the Symptoms?

- **Reduces “Lung Function”** = the **volume** of air that we draw in when we take a full breath **and** the **speed** at which we are able to blow it out:
  - **Difficulty to breathe deeply and vigorously** as we normally would
  - **Uncomfortable breathing**
  - **More rapid and shallow breaths** than normal during an exercise

# How Can Ozone Harm Our Health and What are the Symptoms?

## ➤ **Aggravates Asthma:**

- **More** asthmatics have **asthma attacks** that **require a doctor's attention** or the use of additional **medication**
- **Makes people more sensitive to allergens**, that are the most common triggers for asthma attacks

# How Can Ozone Harm Our Health and What are the Symptoms?

- **Inflames and Damages the Lining of the Lung** (the effect similar to the effect of sunburn on the skin):
  - **Damages the cells that line the air spaces in the lung.** The damaged cells can be replaced within a few days and old cells will be shed.
  - **May cause permanent damage to the lung** if this type of damage occurs repeatedly. *Long-term health problems and a lower quality of life may result.*

# How Can Ozone Harm Our Health and What are the Symptoms?

## ➤ **Other Effects on People's Health:**

- **Aggravates chronic lung diseases**, such as emphysema and bronchitis.
- **May reduce the immune system's ability to fight off bacterial infections in the respiratory tract.**

*These effects may cease once the person is no longer exposed to elevated levels of ozone.*

# How Can Ozone Harm Our Health and What are the Symptoms?

## ➤ **Other Effects on People's Health:**

- **Repeated short-term damage** from elevated levels of ozone **may permanently injure the lung.**
- **Repeated ozone impacts on** the developing lungs of **children may lead to reduced lung function as adults.**
- **Damage to the respiratory tract may occur without symptoms** or with symptoms too subtle to be noticed.

# What is to be Covered Today?

- What is Ozone?
- Kinds of health effects ozone can cause
- *Who should be concerned*
- What we can do to avoid dangerous exposures
- Asthma and Ozone Exposure

# Should We be Concerned about Exposure to Ozone?

- About one out of three people in the U.S. is at a higher risk (a “sensitive group”) of experiencing ozone-related respiratory problems
- When ozone levels increase (usually during the summer months), more people experience respiratory problems and these problems become more serious
- When levels are very high, *Everyone* should be concerned about ozone exposure

# Who is Most at Risk from Ozone?

- ✓ Children
- ✓ Healthy adults who are active outdoors, when ozone levels are high
- ✓ People with chronic respiratory diseases, such as asthma
- ✓ People with unusual susceptibility to ozone

# Who is Most at Risk from Ozone and Why?

## **Children:**

- Often spend a large part of their summer vacation outdoors, engaged in vigorous physical activities
- Breathe more air than adults proportionally to their body weight
- More likely to have asthma or other respiratory diseases (asthma is the most common chronic diseases for children in the US and may be aggravated by ozone exposure)

# Who is Most at Risk from Ozone and Why?

**Healthy adults of all ages who exercise or work vigorously outdoors, when ozone levels are high:**

- Have a higher level of exposure to ozone than people who are less active outdoors
- Physical activity causes them to breathe faster and more deeply

# Who is Most at Risk from Ozone and Why?

## **People with chronic respiratory disease, such as asthma:**

- Although there is no conclusive evidence that ozone causes asthma or other chronic respiratory diseases, **these diseases do make the lung more vulnerable to the harmful effects of ozone**
- Persons with asthma or other chronic respiratory diseases will **experience harmful effects of ozone earlier and at lower levels than less sensitive individuals**

# Who is Most at Risk from Ozone and Why?

## **People with unusual susceptibility to ozone:**

- Although we do not know why, **some people are more sensitive to ozone than others**; these more sensitive people may experience more health problems from ozone than the average person.
- **Elderly people**, like other adults, may be more sensitive to ozone if they suffer from respiratory disease, are active outdoors when ozone levels are high, or are unusually sensitive to ozone for other unknown reasons.

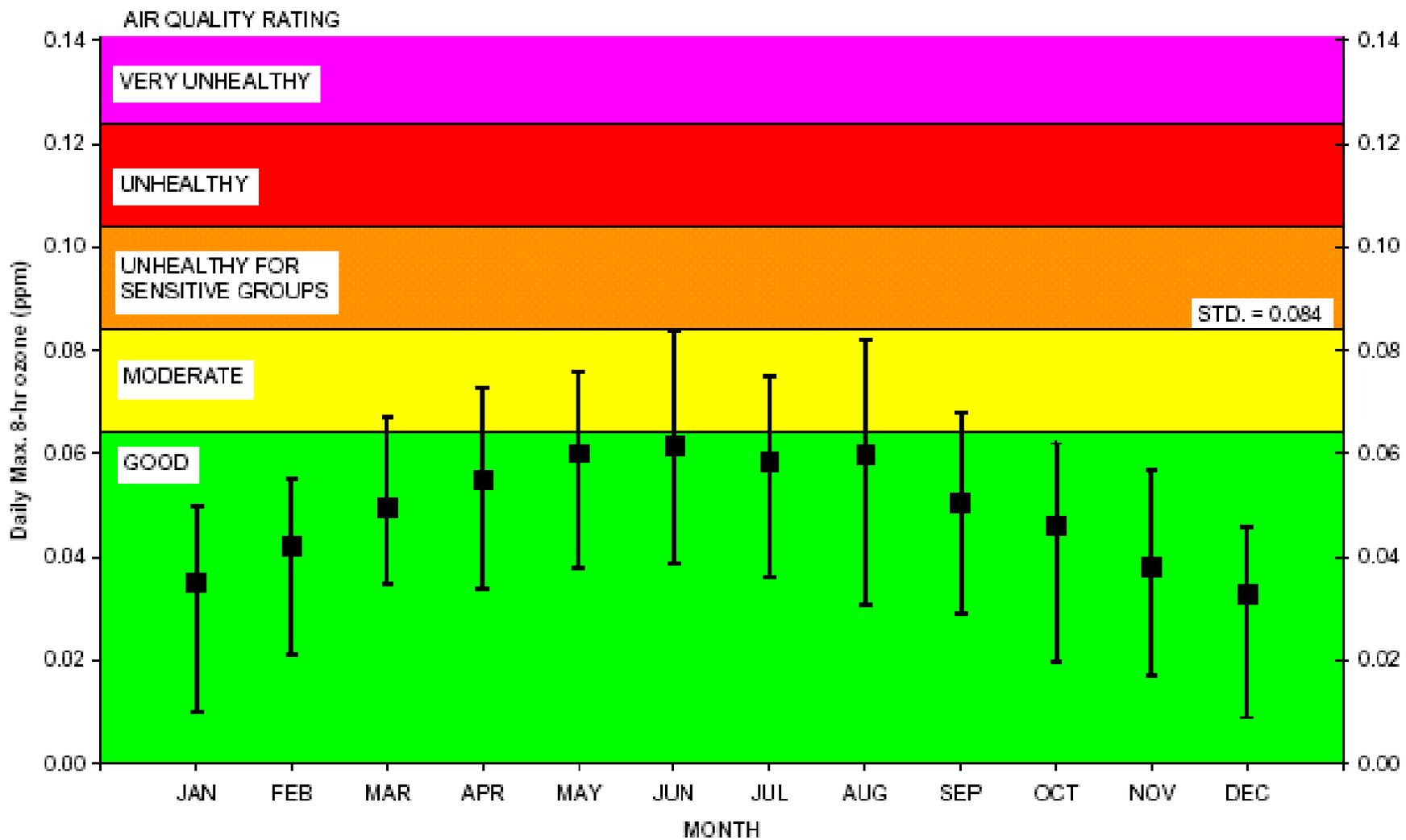
# What is to be Covered Today?

- What is Ozone?
- Kinds of health effects ozone can cause
- Who should be concerned
- *What we can do to avoid dangerous exposures*
- Asthma and Ozone Exposure

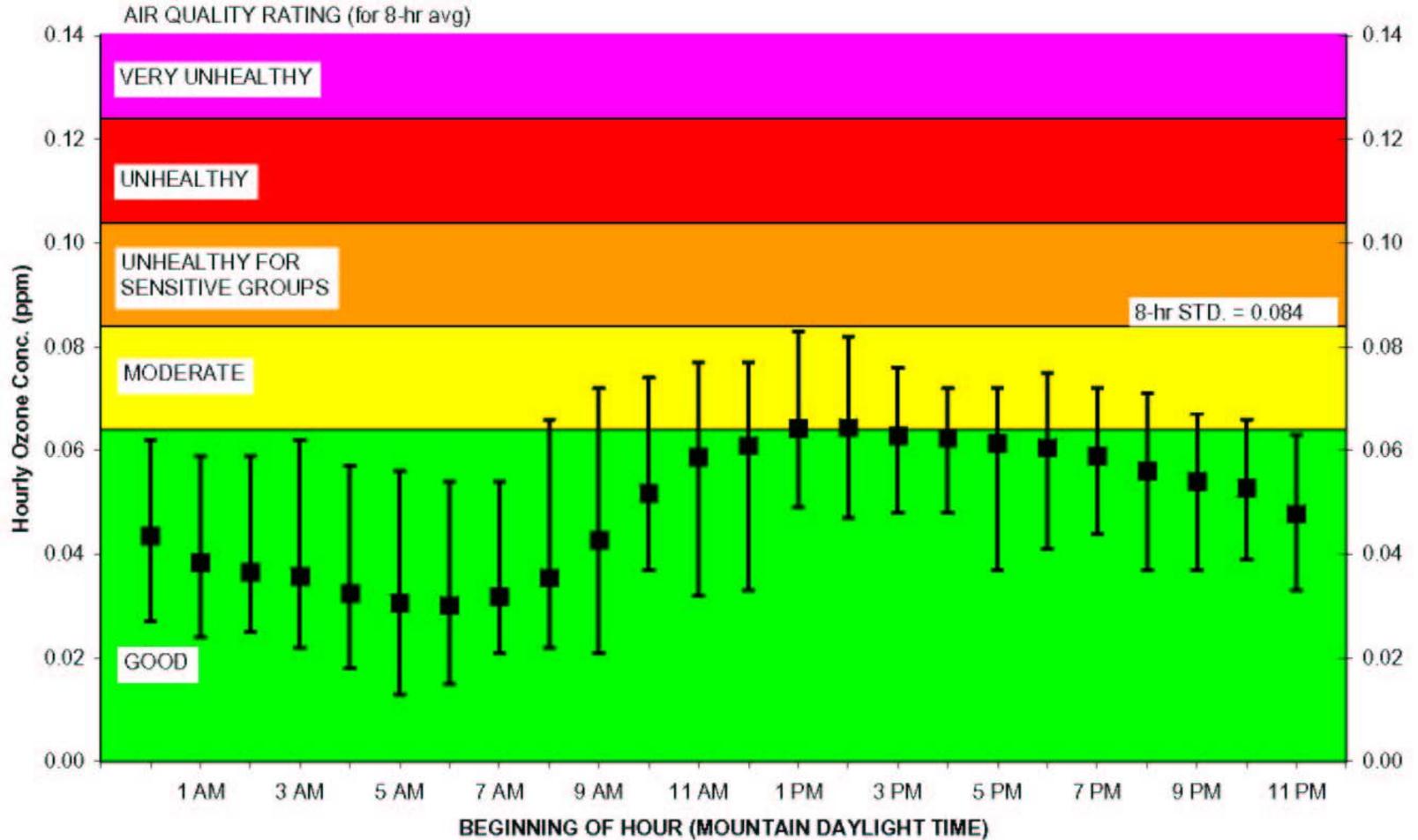
# How Can We Avoid Unhealthy Exposure to Ozone?

1. Find out *when ozone levels are elevated* in your area.
2. When ozone levels are higher than normal (usually during summer, afternoon hours), *reduce the time spent outdoors*, or at least reduce the level of usual outdoor activity, *until ozone levels decline*.
3. Plan *outdoor activities when ozone levels are lower*, usually in the early morning or evening.

San Juan Co. (Substation site) Daily Maximum 8-hr Ozone  
Monthly Average, Minimum and Maximum (2000-2002)



San Juan Co. (Substation site) Hourly Ozone, June 2001  
Average, Minimum and Maximum for each hour during month



# What is to be Covered Today?

- What is Ozone?
- Kinds of health effects ozone can cause
- Who should be concerned
- What we can do to avoid dangerous exposures
- *Asthma and Ozone Exposure*

➤ What is Asthma?

➤ Asthma Symptoms

➤ What May Cause Asthma Exacerbations?

➤ Studies Linking Asthma and Ozone

➤ Next Steps

# What is Asthma?

- A Serious Chronic Disease of the Airways characterized by
  - Chronic lung Inflammation
  - Variable airflow obstruction
  - Airway hypersensitivity to asthma triggers
- Little is known about what causes the development of asthma

# Asthma Symptoms

- Wheezing
- Breathlessness/Shortness of Breath
- Coughing
- Rapid Breathing
- Chest Pain or Tightness

# What May Cause Asthma Exacerbations?

- **Allergens** such as
  - Pollen, house dust mite, animal dander, mold, cockroach, food, etc.
- **Occupational exposures** such as
  - Chemical irritants, flour, wood, textile dust, etc.
- **Viral respiratory tract infections**

# What May Cause Asthma Exacerbations?

## ➤ **Exercise**

## ➤ **Emotions** such as

- Anxiety, stress, hard laughter or crying, etc.

## ➤ **Exposure to irritants** such as

- Strong odors, chemicals, fumes, etc.

# What May Cause Asthma Exacerbations?

- **Environmental exposures** such as
  - Weather changes, cold air, sulfur dioxide, cigarette smoke, ozone, etc.
- **Some medications** such as
  - Aspirin and other non-steroidal anti-inflammatory drugs
  - Medications (or foods) that contain tartrazine, sulfites, and other preservatives

# Asthma Exacerbations and Exposure to Ozone

- Ozone may trigger asthma exacerbations at levels much lower than the federal ambient air quality standards
  - (8-hour average = 0.084 ppm and 1-hour average = 0.12 ppm).
- For this reason, asthmatics are considered sensitive to ozone exposure.

# Effects of Ozone on Hospital Admissions, ER Visits and Medications Use

- Increased **hospital admissions** occur a day after an increase in ozone levels
- Increase in **ER visits** is associated with an increase in ozone levels
- Increased need for **medications use** is associated with an increase in ozone levels

# *1996 Summer Olympics Asthma Study*

*(Friedman et al., 2001)*

- Study on childhood asthma before, during, and after the Games in Atlanta, GA showed
  - Efforts to reduce traffic congestion during the Games resulted in decreased traffic density which was associated with prolonged reduction in ozone pollution and
  - significantly lower rates of asthma hospitalizations, ER , and urgent care visits

# The Children's Health Study

- 10 year study; Began in 1992
- Funded by the CA EPA's Air Resources Board and conducted by USC
- Large, long-term study of health effects of children's chronic exposures to S. CA air pollution
- 12 communities chosen because they have different patterns of high and low levels of O<sub>3</sub>, NO<sub>2</sub>, Acid Vapor and PM

# Results of The Children's Health Study About Ozone

- Children living in high O<sub>3</sub> communities who actively participate in several sports, are more likely to develop asthma than children in these communities not participating in sports
- Days with higher O<sub>3</sub> concentration resulted in significantly higher school absences due to respiratory illness

# Next Steps

## **Near Term:**

- Plan to Study Effect of Ozone on Asthma in San Juan County
  - Effect of ozone exposure on asthma hospitalizations, ER visits, and medication use
- Barriers and Timeline

## **Eventually:**

- Present Results at a Future Public Meeting
- Publish Report

# High Hospital Admit Dates

## Denver-Boulder Area

*(Gallegos et al., 2002)*

<b>SUMMARY TABLE</b>			
Twice Std. Dev Dates			
Denver-Boulder Area.			
<u>Year</u>	<u>June</u>	<u>July</u>	<u>August</u>
1990	4,6		13
1991	5	2,15	
1992	10	27	
1993	7	15	30
1994		28	
1995	8	26	
1996			6,23
1997	2	21	29
1998	24		25
1999	7	27	
2000	7	31	21

# Who We Are

*Barbara Malczewska-Toth, Ph.D., D.A.B.T.*

Environmental Health Epidemiologist

New Mexico Department of Health

Office of Epidemiology

(505)476-3028

[Btoth@doh.state.nm.us](mailto:Btoth@doh.state.nm.us)

*Glenda Hubbard, RN, MPH*

Asthma Epidemiologist

New Mexico Department of Health

Office of Epidemiology

(505)476-3577

[Glendah@doh.state.nm.us](mailto:Glendah@doh.state.nm.us)