Asthma and Ambient Air Quality in Utah

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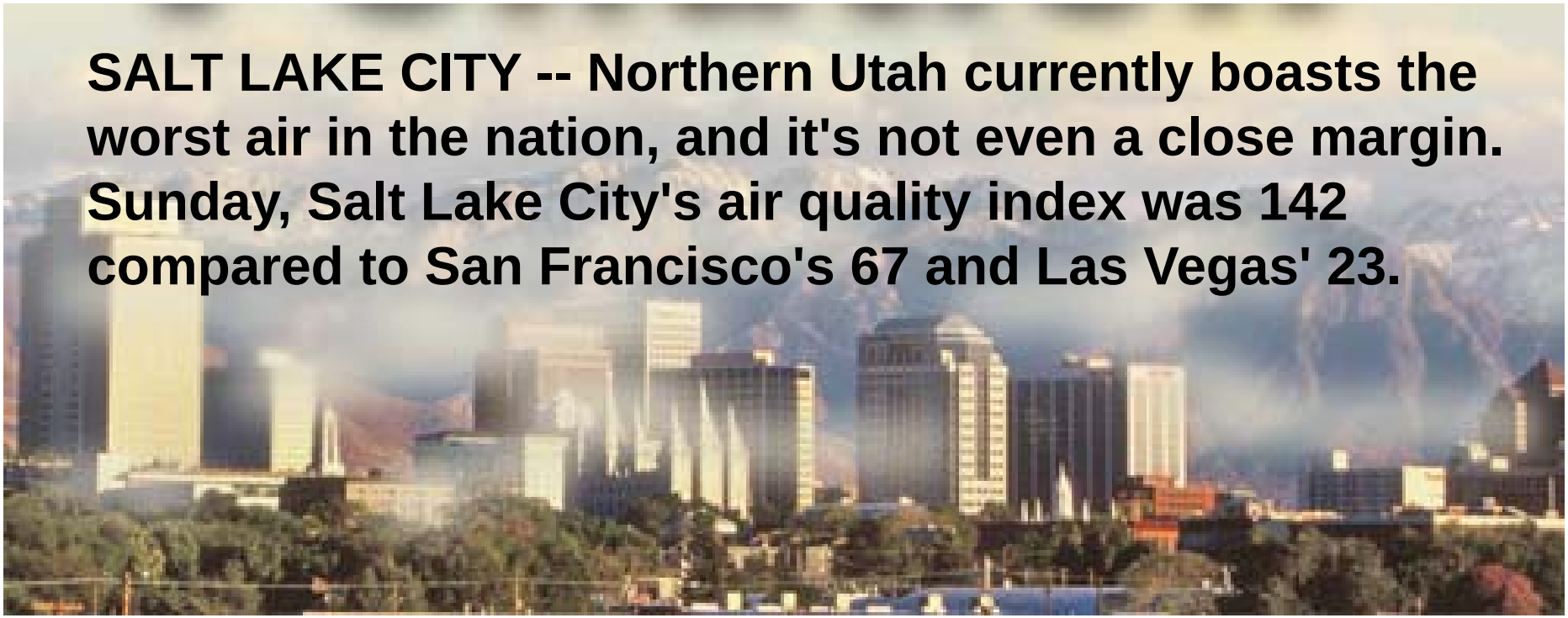
University of Utah

Northern Utah's Air Worst in Nation



Source: ksl.com, January 11th, 2010 @ 4:41pm

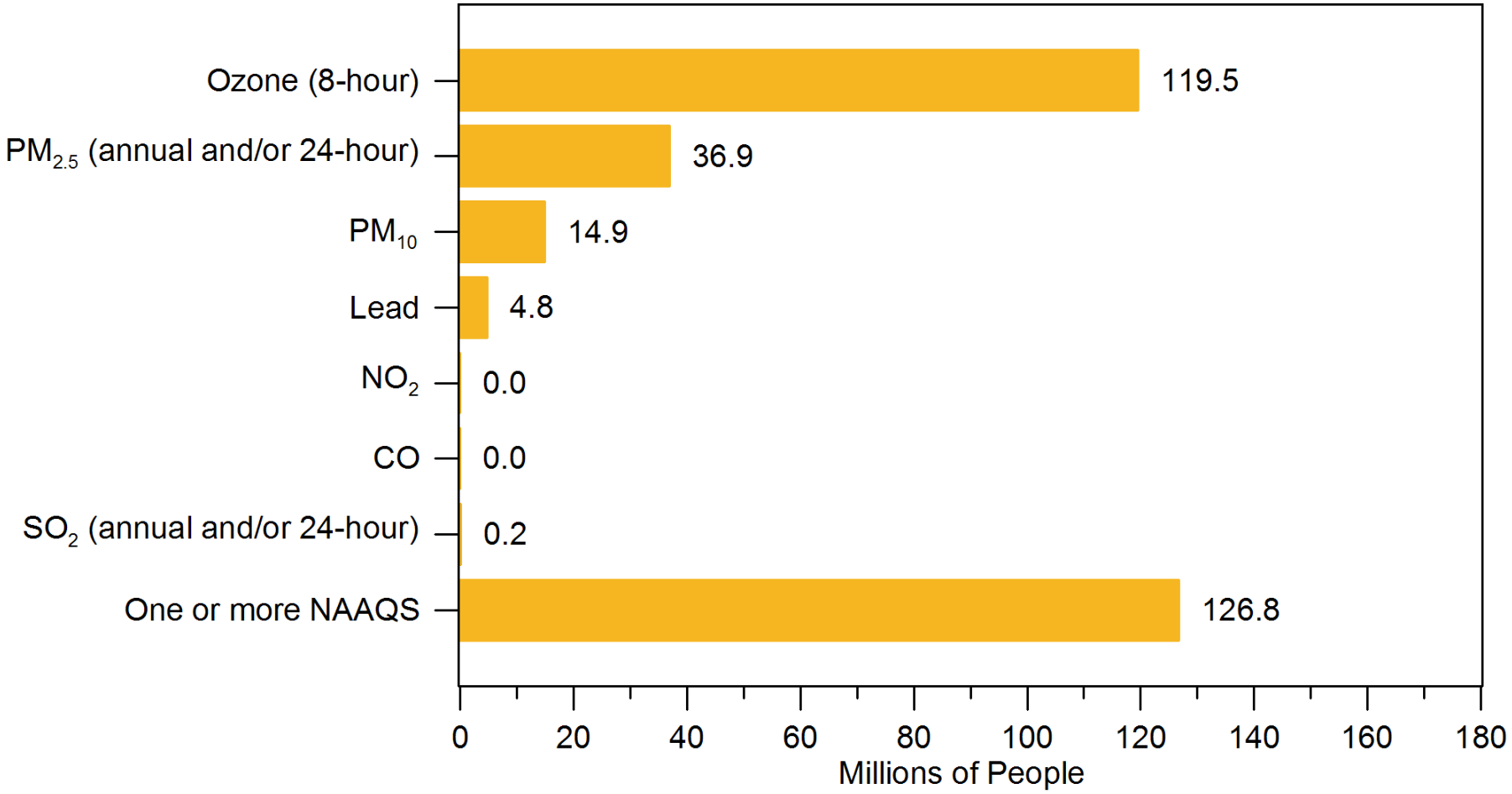
Objectives

- Explain the types of outdoor air pollution and how they impact asthma.
- Describe the role of air pollutants as pro-inflammatory mediators in the pathogenesis of asthma.
- Describe and quantify outdoor air pollution in Utah and evaluate how Utah compares nationally.
- Explain how outdoor air pollution is monitored and reported in Utah and nationally.
- Provide health care professionals with a tool to help identify environmental triggers of asthma in their routine practice.
- Describe how to use the hourly reporting of air quality data to better understand the predictable nature of air pollution.
- Teach health care professionals how to easily incorporate the predictability of air pollution episodes into asthma management.

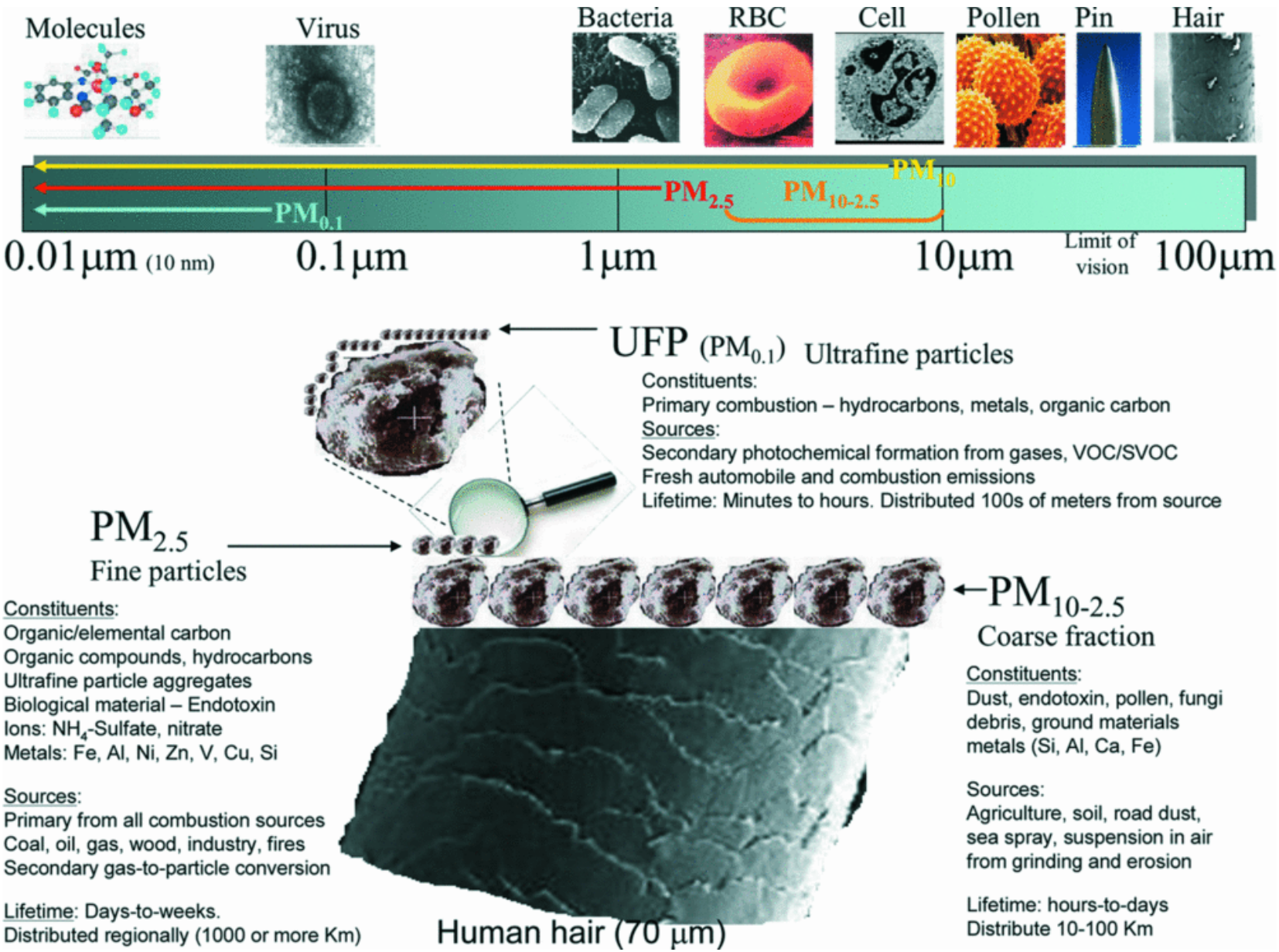
Key Air Pollutants of Significant Health Concern

- National Ambient Air Quality Standards (NAAQS) for 6 air pollutants
  - Particulate Matter
  - Ozone
  - Carbon monoxide
  - Sulfur oxides
  - Nitrogen oxides
  - Lead
- Hazardous Air Pollutants (HAPs)

Millions are Exposed to Unhealthy Levels of Air Pollution

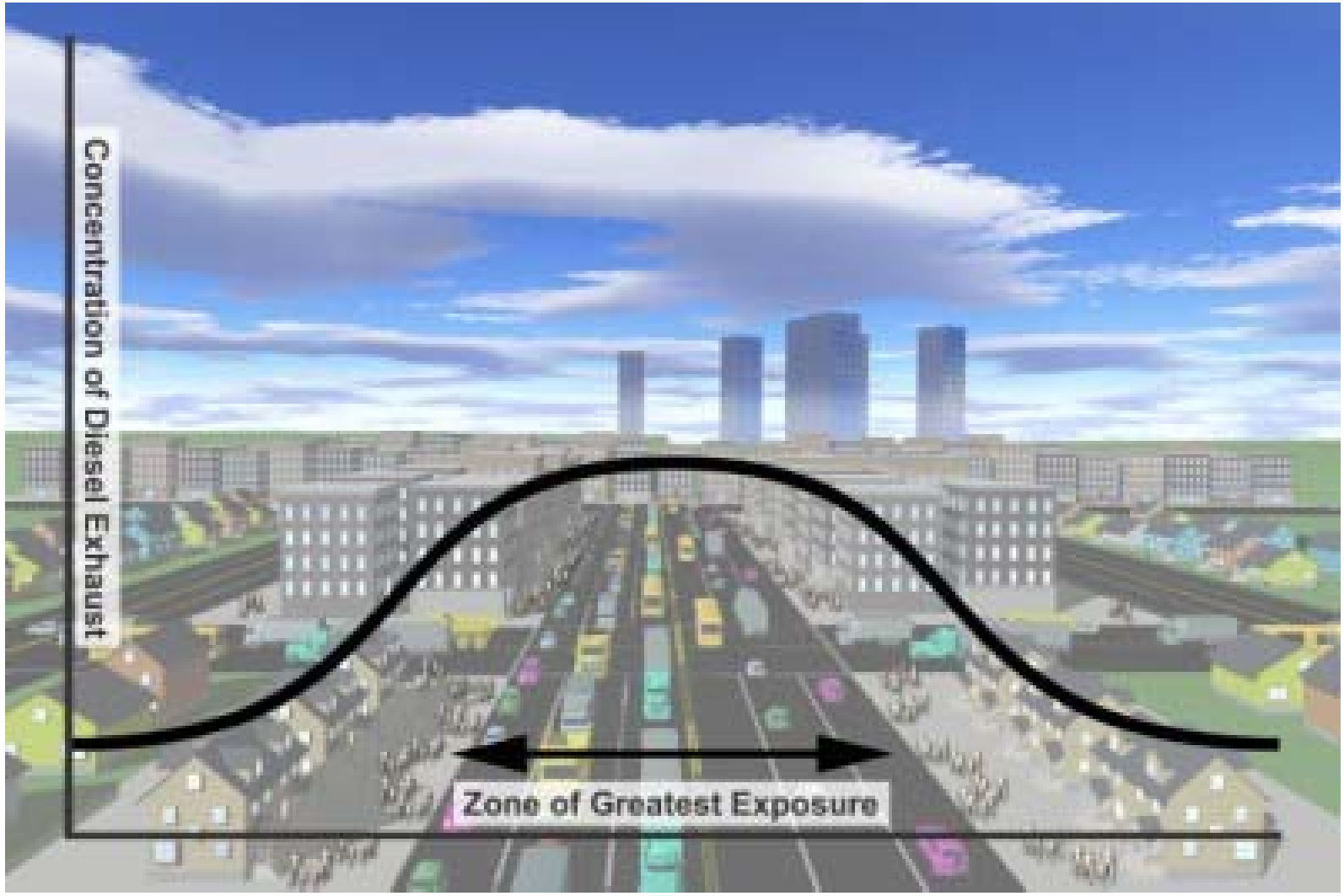


Source: EPA Our Nation's Air: Status and Trends Through 2008

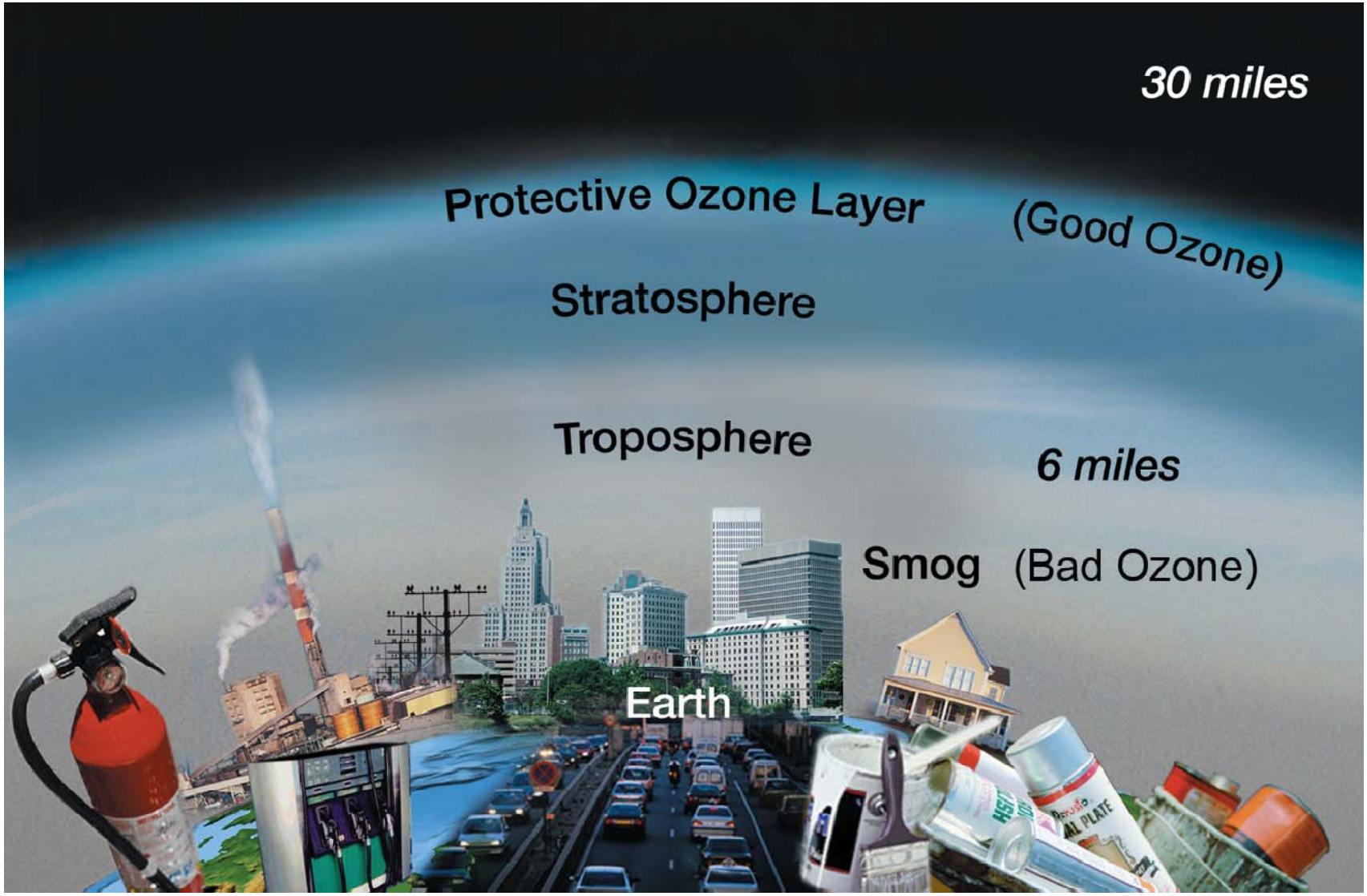


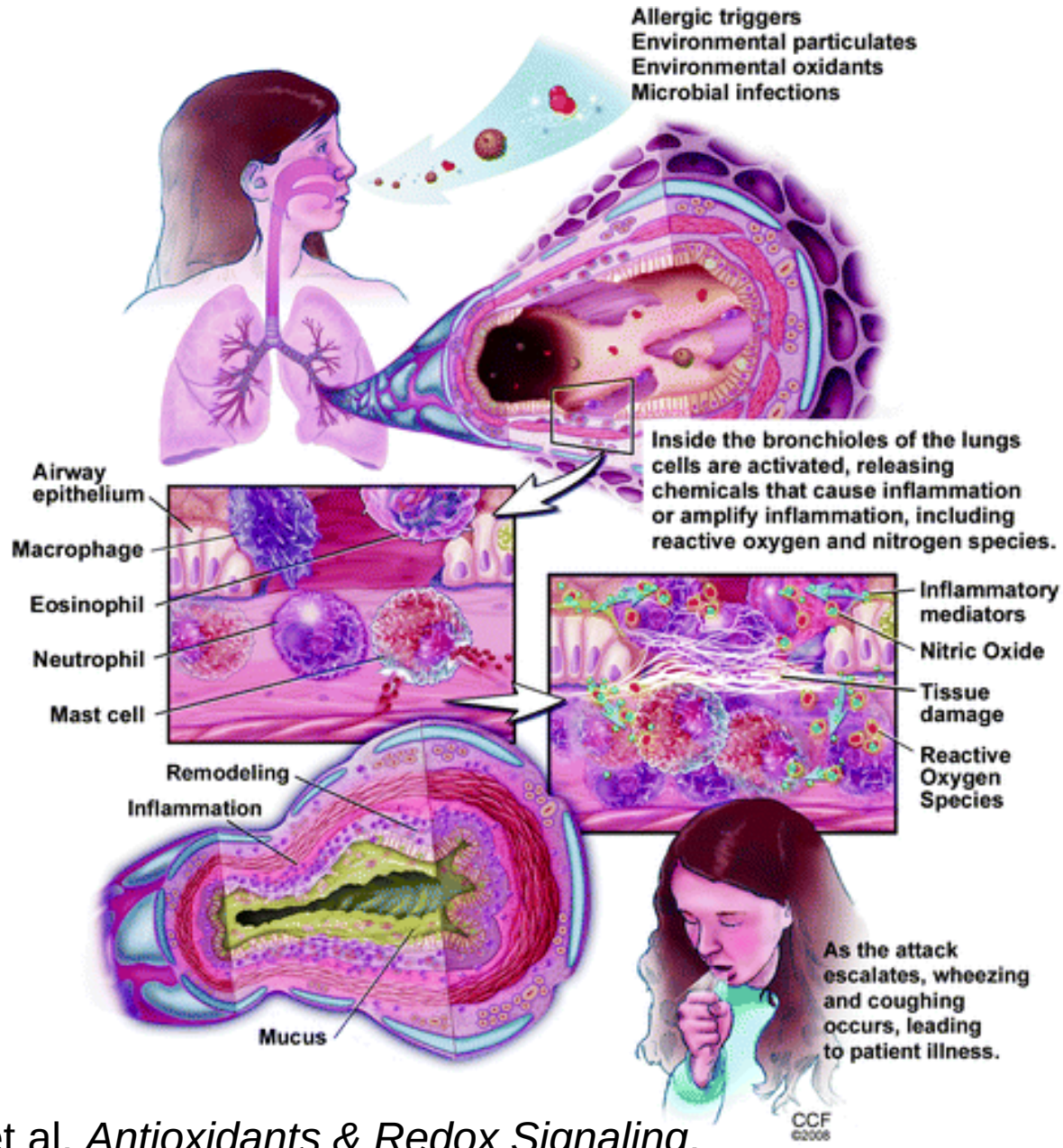
Clin Sci (2008) 115, 175-187.

Diesel Exhaust Particles

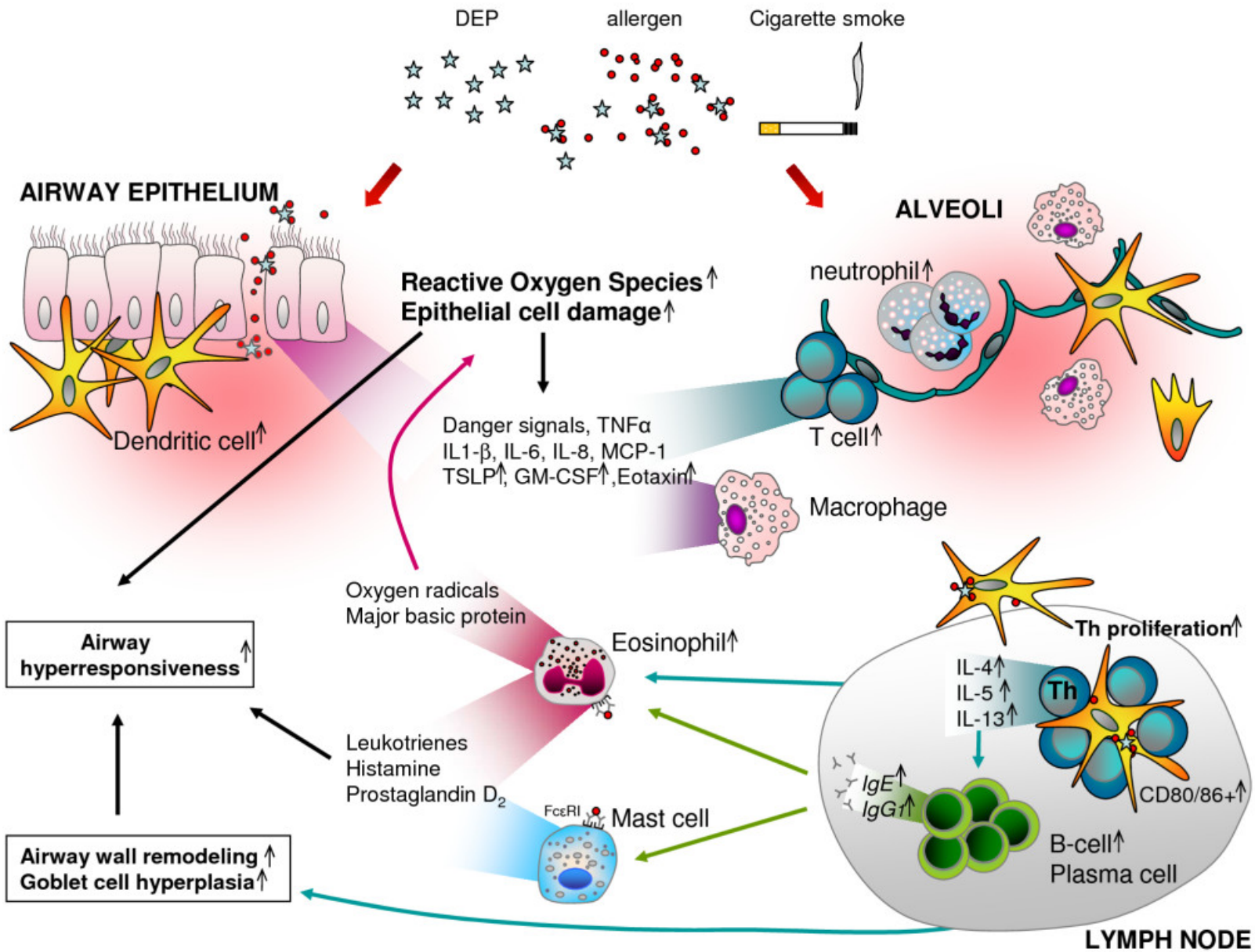


Ozone

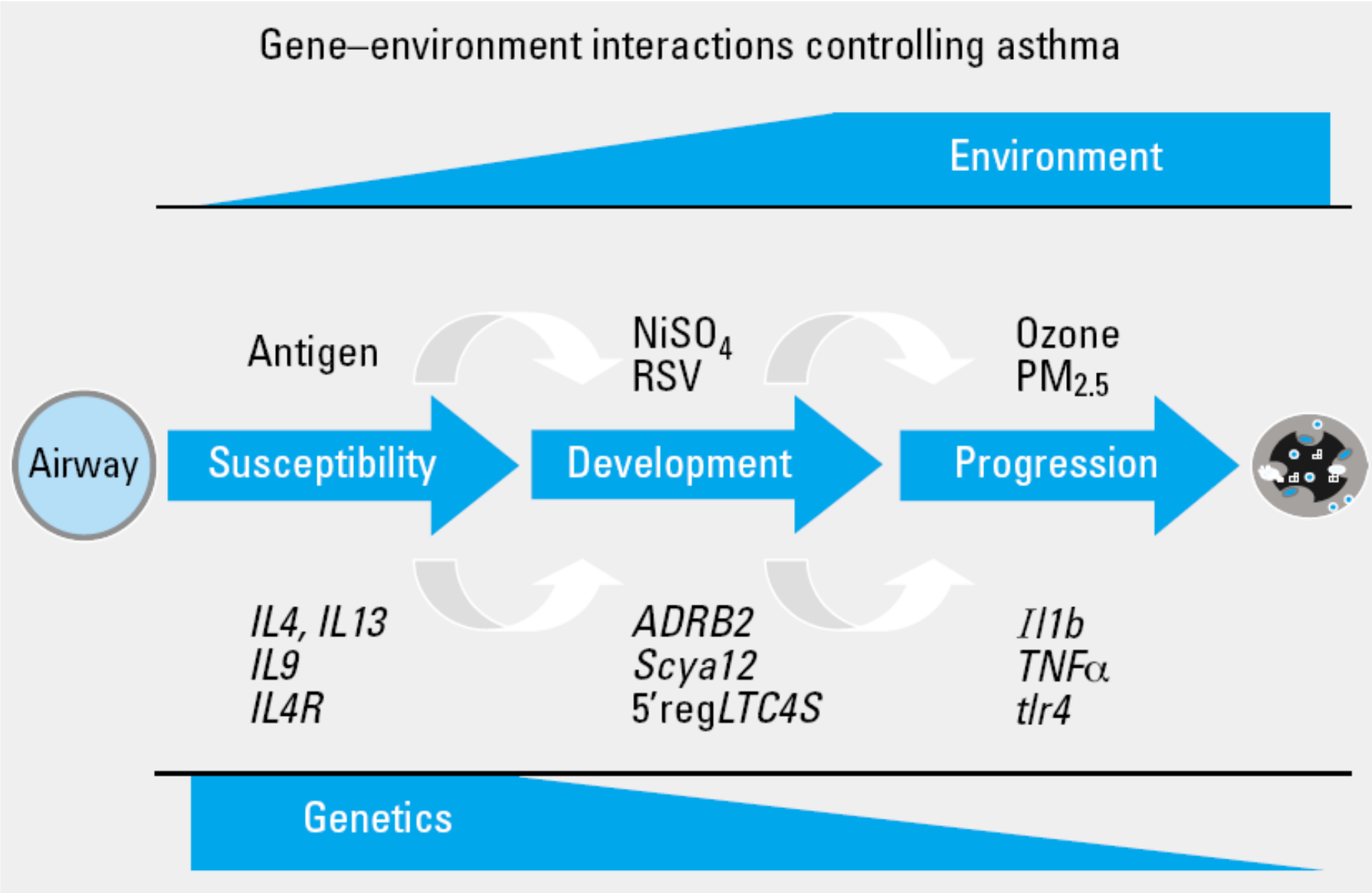

30 miles
Protective Ozone Layer
(Good Ozone)
Stratosphere
Troposphere
6 miles
Smog
(Bad Ozone)
Earth



Comhair SA, et al. *Antioxidants & Redox Signaling*. January 1, 2010, 12(1): 93-124.

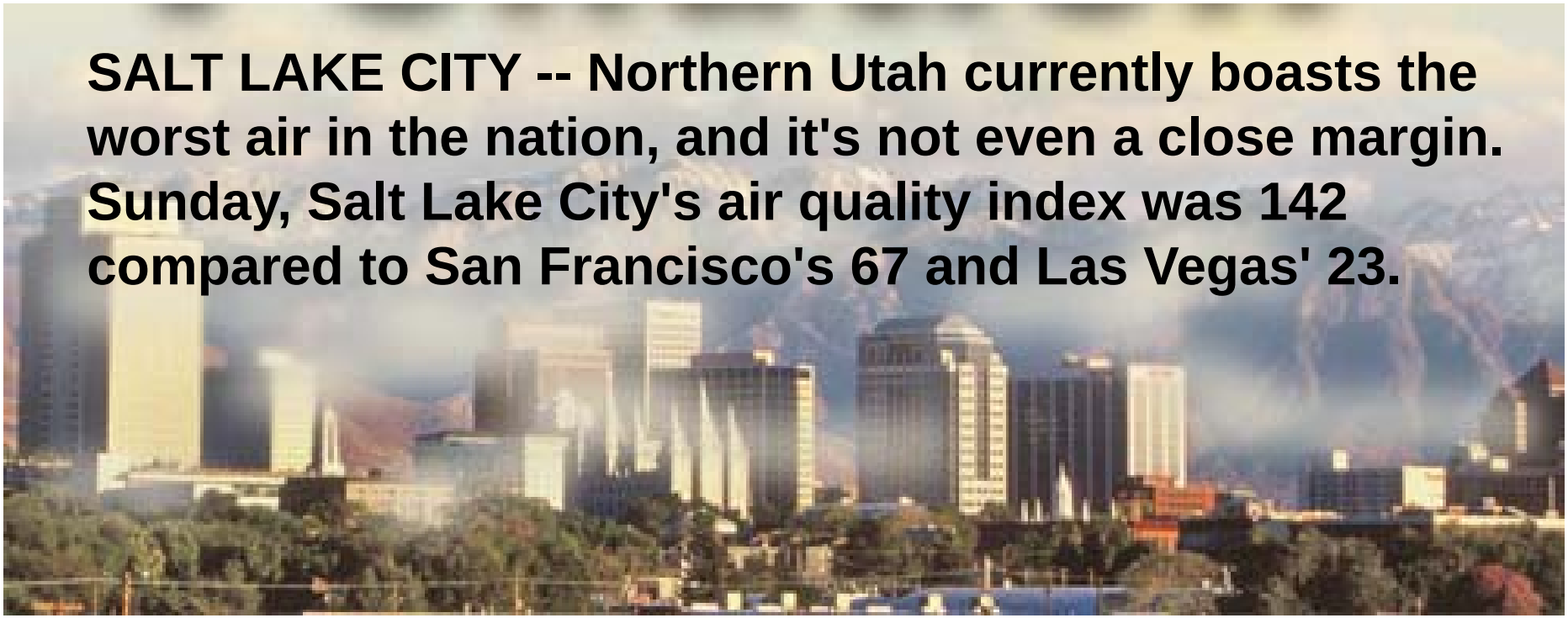


Maes et al. *Respiratory Research* 2010 11:7



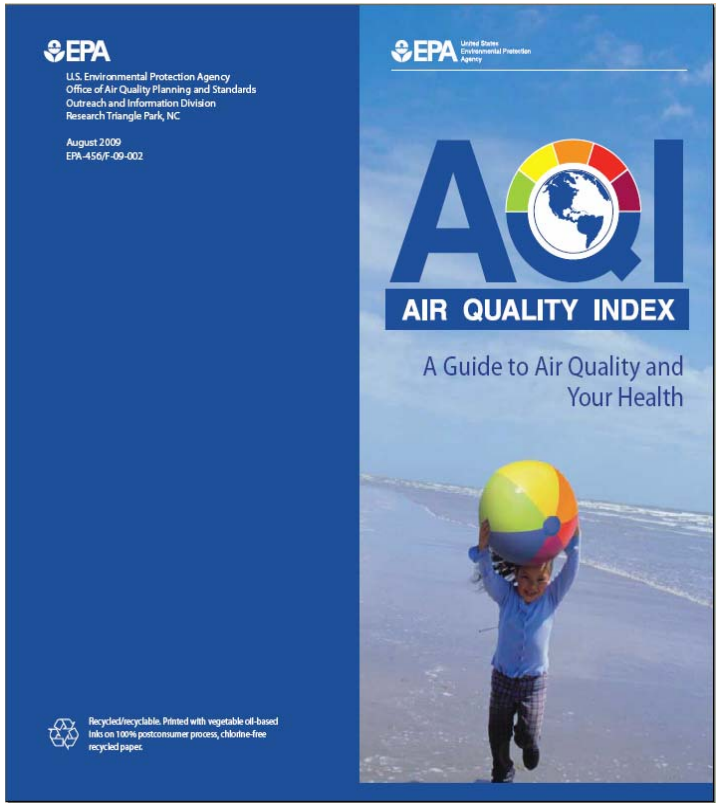
Leikauf G. Hazardous Air Pollutants and Asthma. EHP, Aug 2002, 110(4):505-526.

Northern Utah's Air Worst in Nation



Source: ksl.com, January 11th, 2010 @ 4:41pm

What does an Air Quality Index of 142 mean?



Air Quality Index (AQI) Values)	Levels of Health Concern
When the AQI is in this range:	*...air quality conditions are:*
0-50	Good
51-100	Moderate
101-150	Unhealthy for Sensitive Groups
151 to 200	Unhealthy
201 to 300	Very Unhealthy
301 to 500	Hazardous

The purpose of the AQI is to help you understand what local air quality means to your health. To make it easier to understand, the AQI is divided into 6 categories. Source: Air Now Air Quality Index (AQI)

What does an Air Quality Index of 142 mean?

AQI	AQI Health Advisory Category	PM10 ug/m3	PM 2.5 (ug/m3)	8-hr O3 ppmv	Division of Air Quality Red Day
0	Good	0	0	0	Green
•		•	•	•	
50		54	15.4	0.059	
51	Moderate	55	15.5	0.06	
•		•	•	•	
•		•	25.4	0.067	
•		•	25.5	0.068	Yellow Action
•		•	•	•	
100		254	35.4	0.075	
101	Unhealthy for Sensitive Groups Advisory A	255	35.5	0.076	Red
•		•	•	•	•
150		354	55.4	0.095	•
151	Unhealthy Advisory B	355	55.5	0.096	•
•		•	•	•	•
200		424	150.4	0.115	Alert
201	Very Unhealthy	425	150.5	0.116	•
•		•	•	•	•
300		604	250.4	0.374	•
>300	Hazardous	>604	>250.5	>.375	•
					Red
		1000			
		2000			
		3000			
		4000			
Cigarette	SUGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, and May Complicate Pregnancy	4876			

The *Air Quality Index* (**AQI)** is a normalized scale based on monitored air pollution levels.

What does an Air Quality Index of 142 mean?

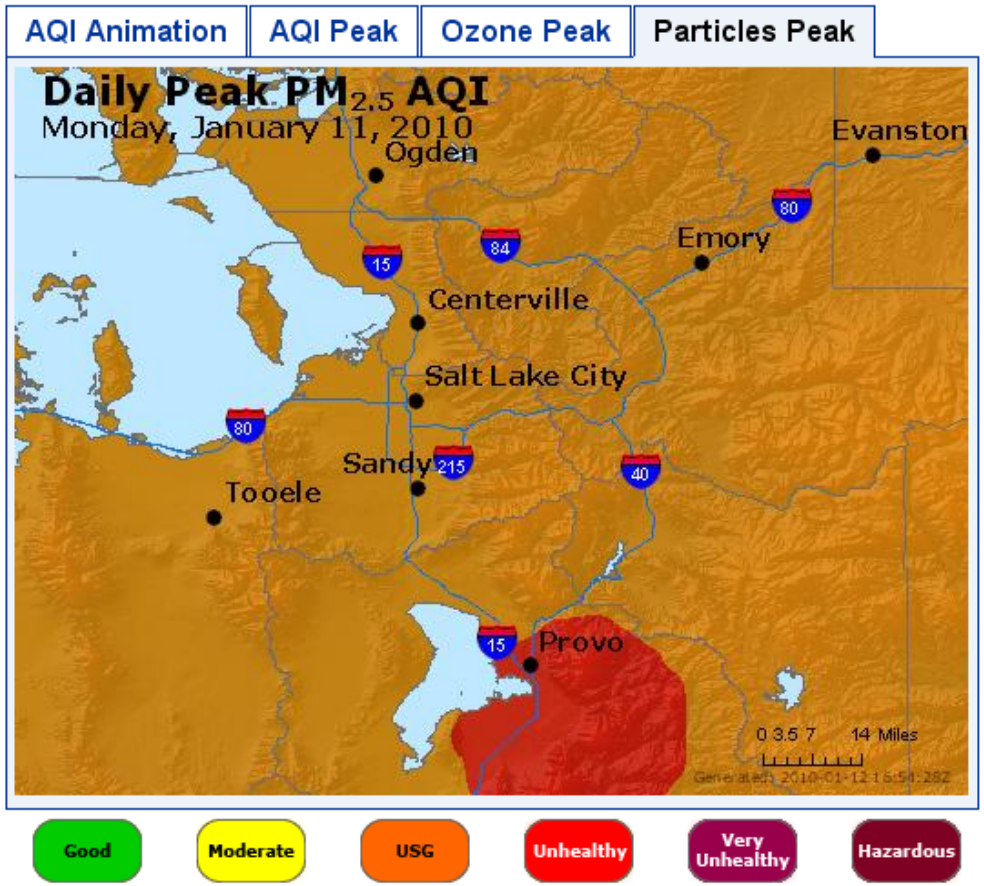
Air Quality Index (AQI): Particle Pollution

Index Values	Levels of Health Concern	Cautionary Statements
0 - 50	Good	None
51 - 100*	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.
101 - 150	Unhealthy for Sensitive Groups	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.
151 - 200	Unhealthy	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
201 - 300	Very Unhealthy	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.
301 - 500	Hazardous	People with heart or lung disease, older adults, and children should remain indoors and keep activity levels low. Everyone else should avoid all physical activity outdoors.

Air Quality Index (AQI): Ozone

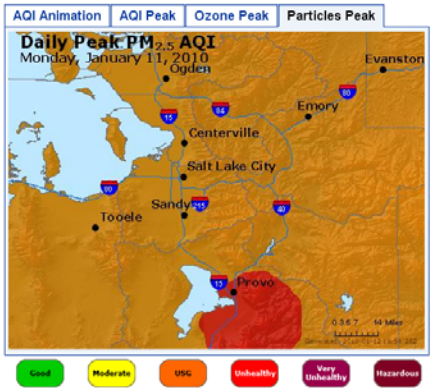
Index Values	Levels of Health Concern	Cautionary Statements
0 - 50	Good	None
51 - 100*	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion outdoors.
101 - 150	Unhealthy for Sensitive Groups	Active children and adults, and people with lung disease, such as asthma, should reduce prolonged or heavy exertion outdoors.
151 - 200	Unhealthy	Active children and adults, and people with lung disease, such as asthma, should avoid prolonged or heavy exertion outdoors. Everyone else, especially children, should reduce prolonged or heavy exertion outdoors.
201 - 300	Very Unhealthy	Active children and adults, and people with lung disease, such as asthma, should avoid all outdoor exertion. Everyone else, especially children, should avoid prolonged or heavy exertion outdoors.
301 - 500	Hazardous	Everyone should avoid all physical activity outdoors.

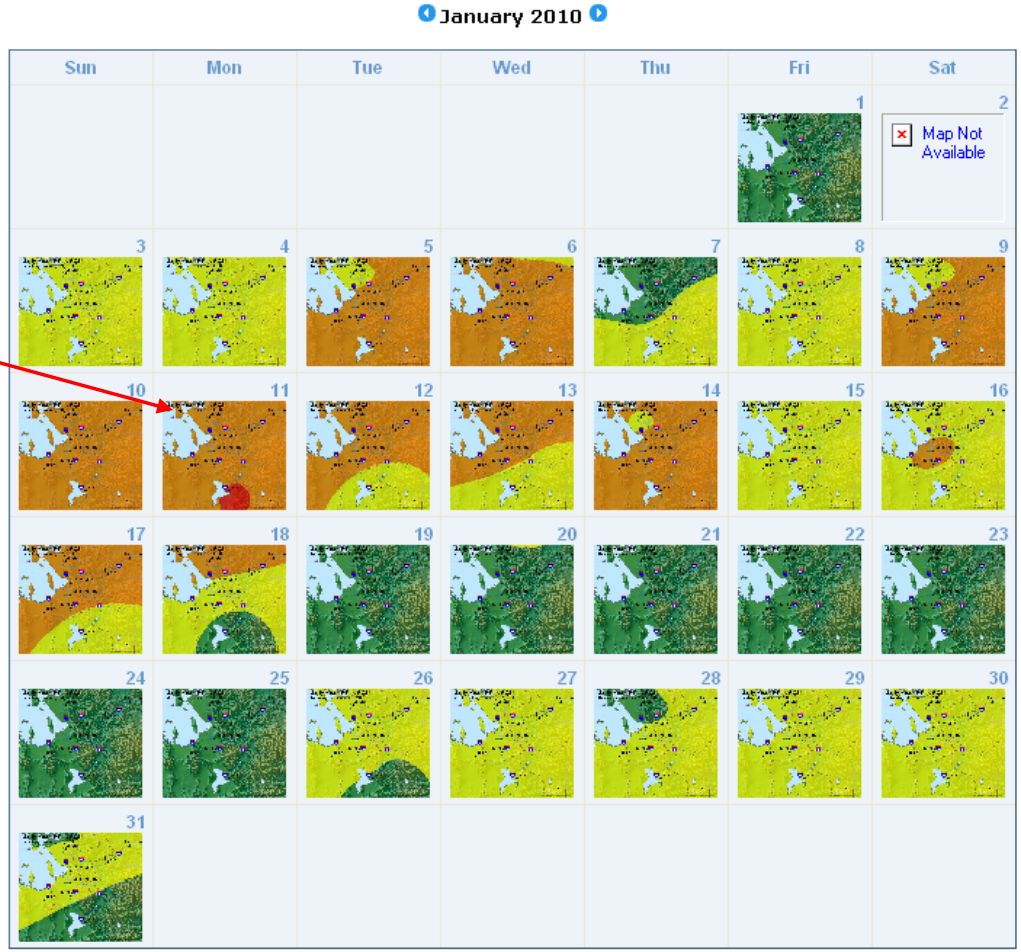
Northern Utah Air on January 11, 2010



Source: http://www.airnow.gov/index.cfm?action=airnow.mapsarchivedetail&domainid=47&mapdate=20100111&tab=3

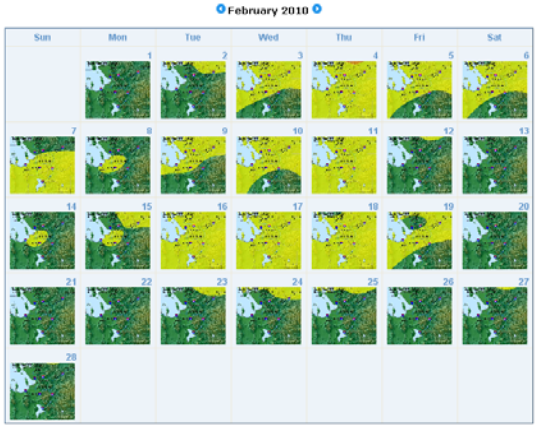
How Bad was the Air in Utah in January?

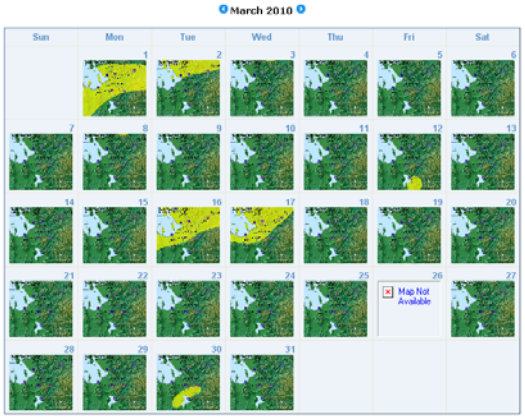


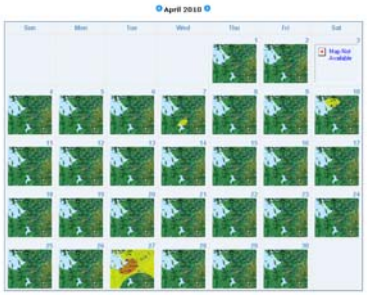


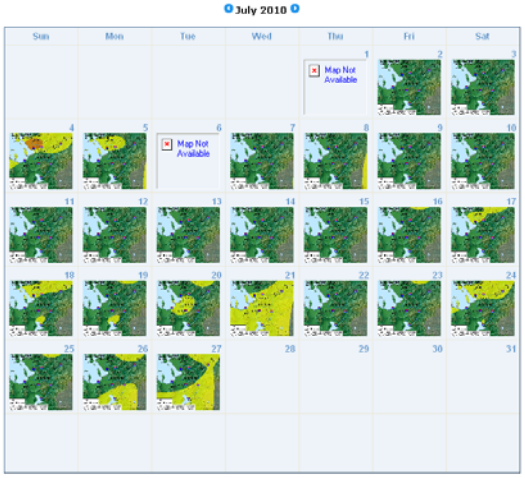
Source: Air Now Air Quality Maps Archives

How bad has the air been in Utah so far this year?





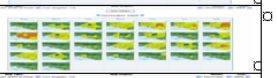
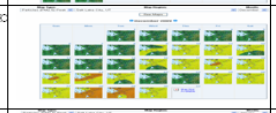
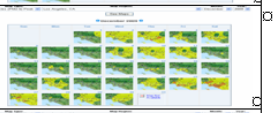
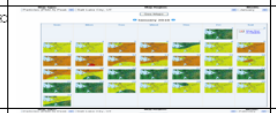
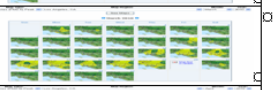
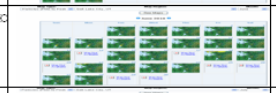




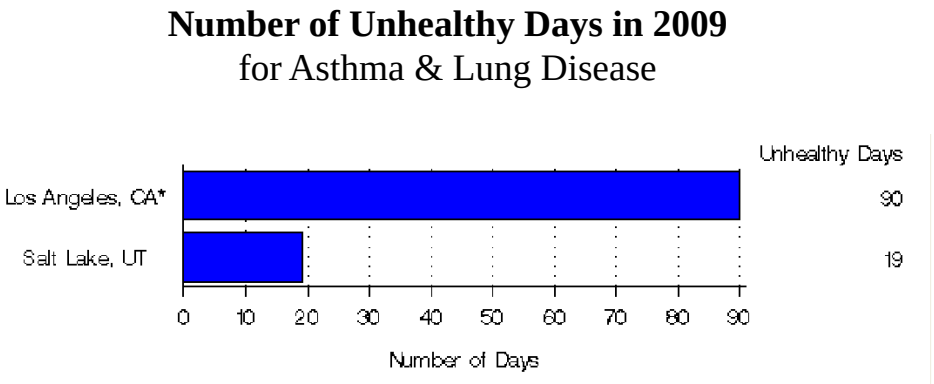
Source: Air Now Air Quality Maps Archives

How does Salt Lake City compare with Los Angeles?

PM2.5
Air Quality Comparison

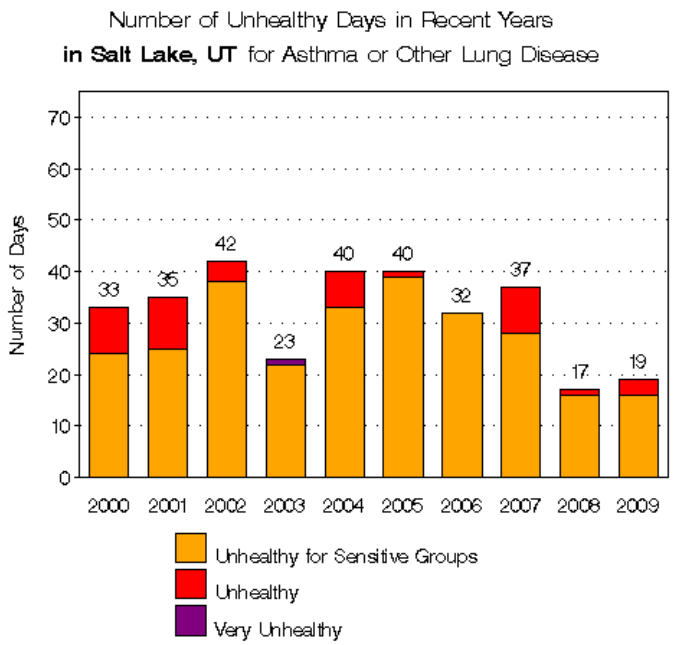
Month	Salt Lake City	Los Angeles
October		
November		
December		
January		
February		
March		
April		
May		
June		
July		
Health Concern	Unhealthy days (2009)	Unhealthy days (2009)
Active Outdoors	7	85

Source: Air Now Air Quality Maps Archives



Source: Air Now Air Comparison/County Comparisons

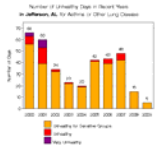
Historical unhealthy days for Salt Lake City and other cities of similar population (Growth rate %)



(16.66%)

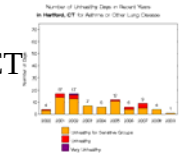
Birmingham. AL

7.49%



Hartford, CT

4.12%



Memphis. TN

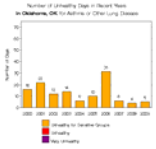
8.27%

Jacksonville, FL

18.29%

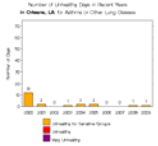
Oklahoma, OK

12.04%



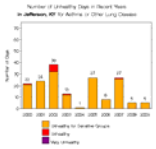
N. Orleans, LA

-9.61%



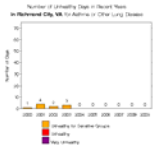
Louisville, KY

8.31%



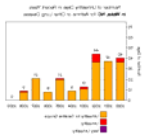
Richmond, VA

12.87%



Raleigh, NC

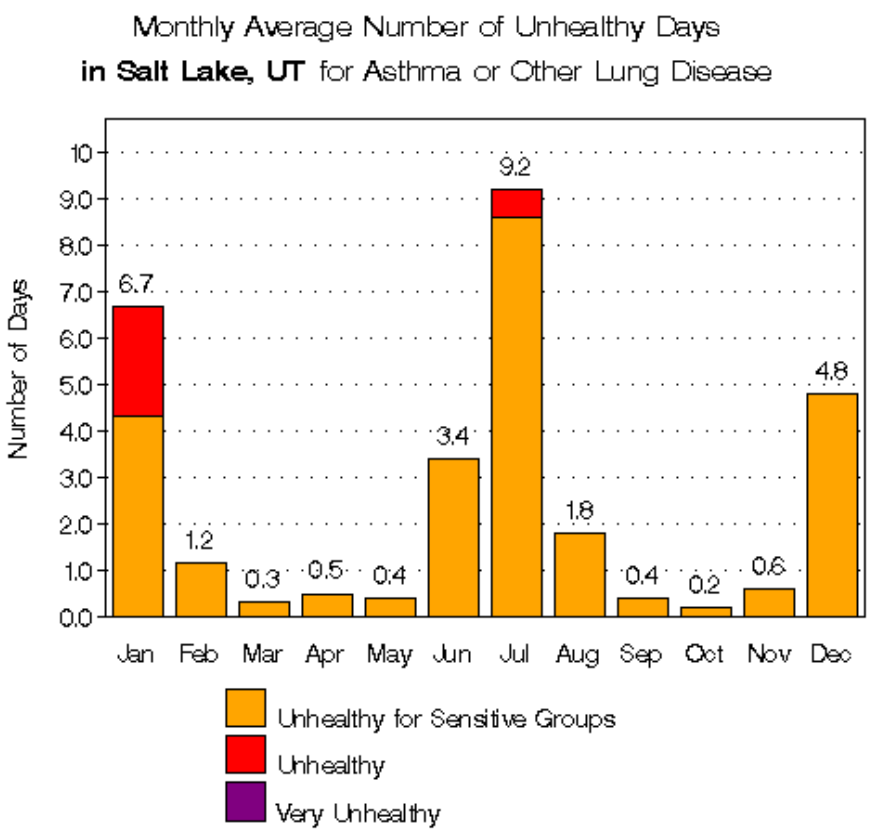
41.25%



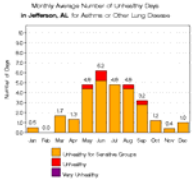
Source: Air Now Air Comparison/County Comparisons

Monthly Average Unhealthy Days

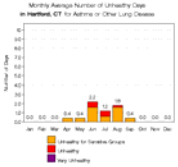
2000 - 2009



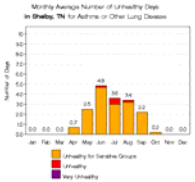
Birmingham. AL



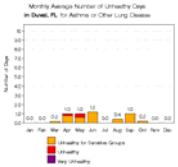
Hartford, CT



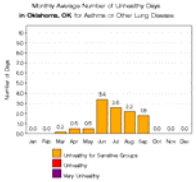
Memphis. TN



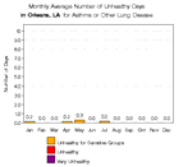
Jacksonville, FL



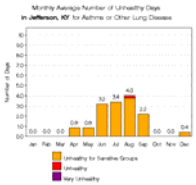
Oklahoma, OK



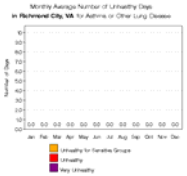
N. Orleans, LA



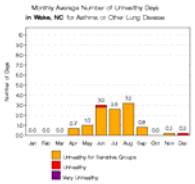
Louisville, KY



Richmond, VA

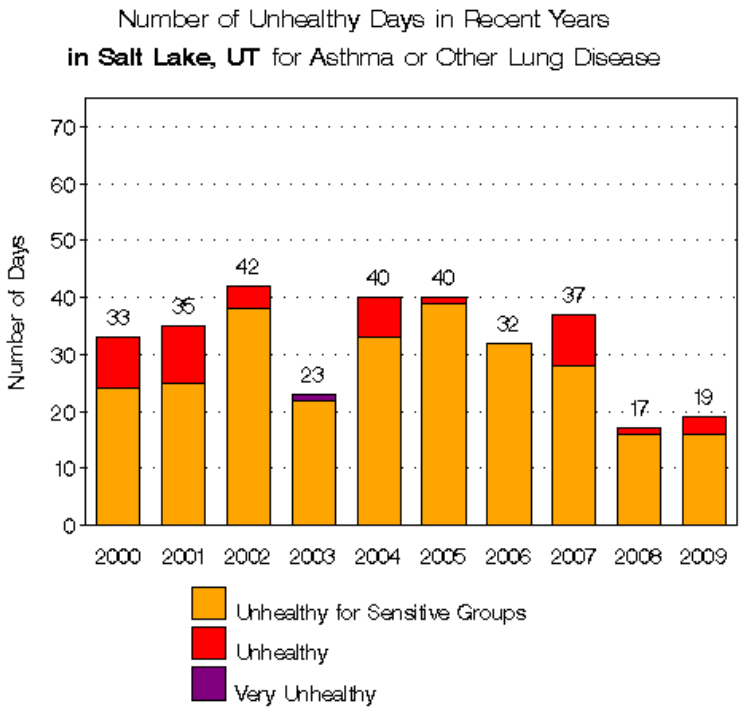


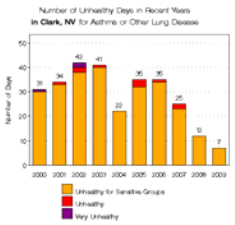
Raleigh, NC



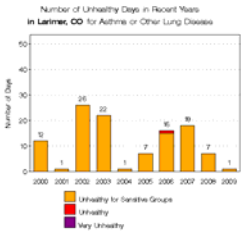
Source: Air Now Air Comparison/County Comparisons

Historical unhealthy days for Salt Lake City and other Intermountain Urban Areas

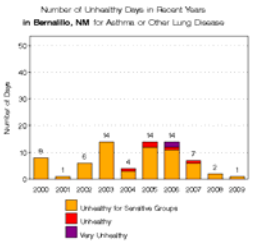




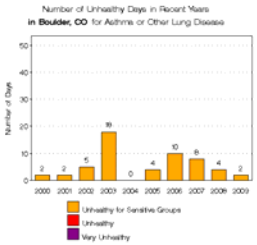
Las Vegas, NV



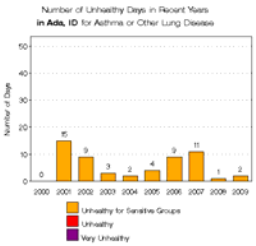
Fort Collins, CO



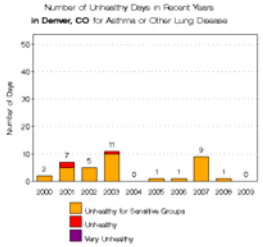
Albuquerque, NM



Boulder, CO



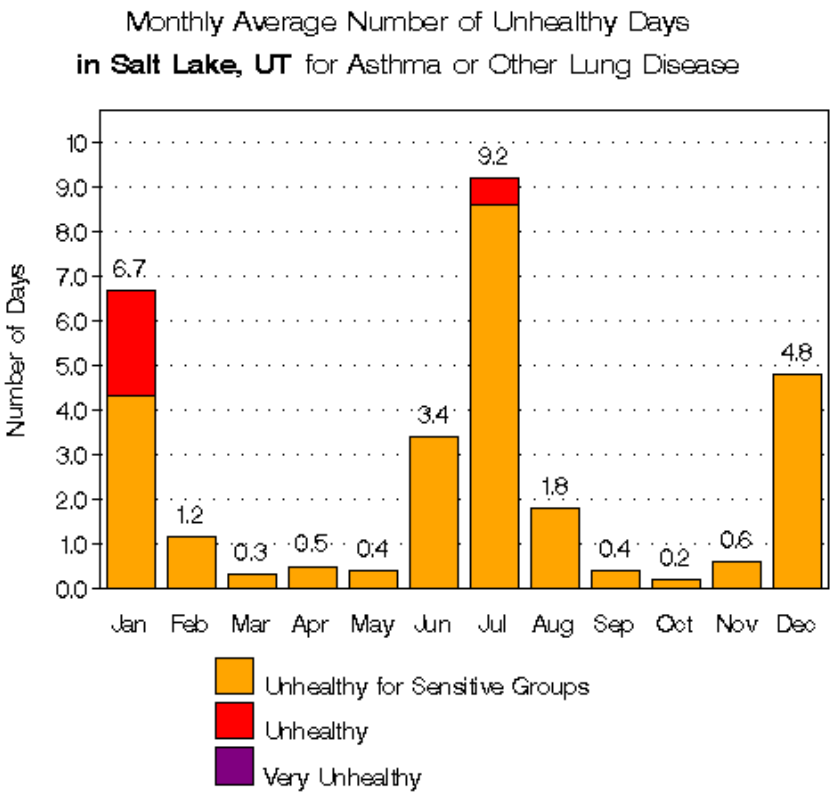
Boise, ID

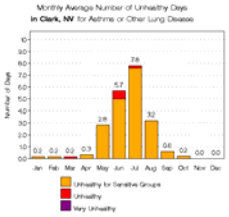


Denver, CO

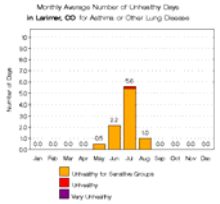
Monthly Average Unhealthy Days

2000 – 2009 Intermountain Urban Areas

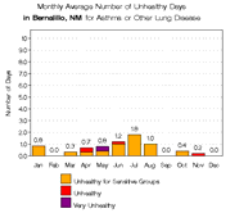




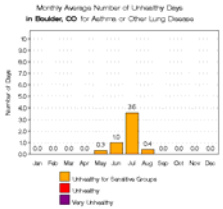
Las Vegas, NV



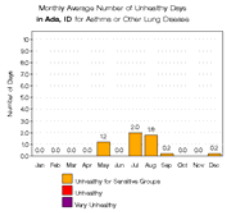
Fort Collins, CO



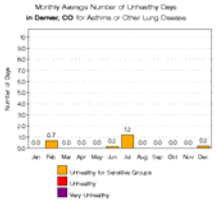
Albuquerque, NM



Boulder, CO

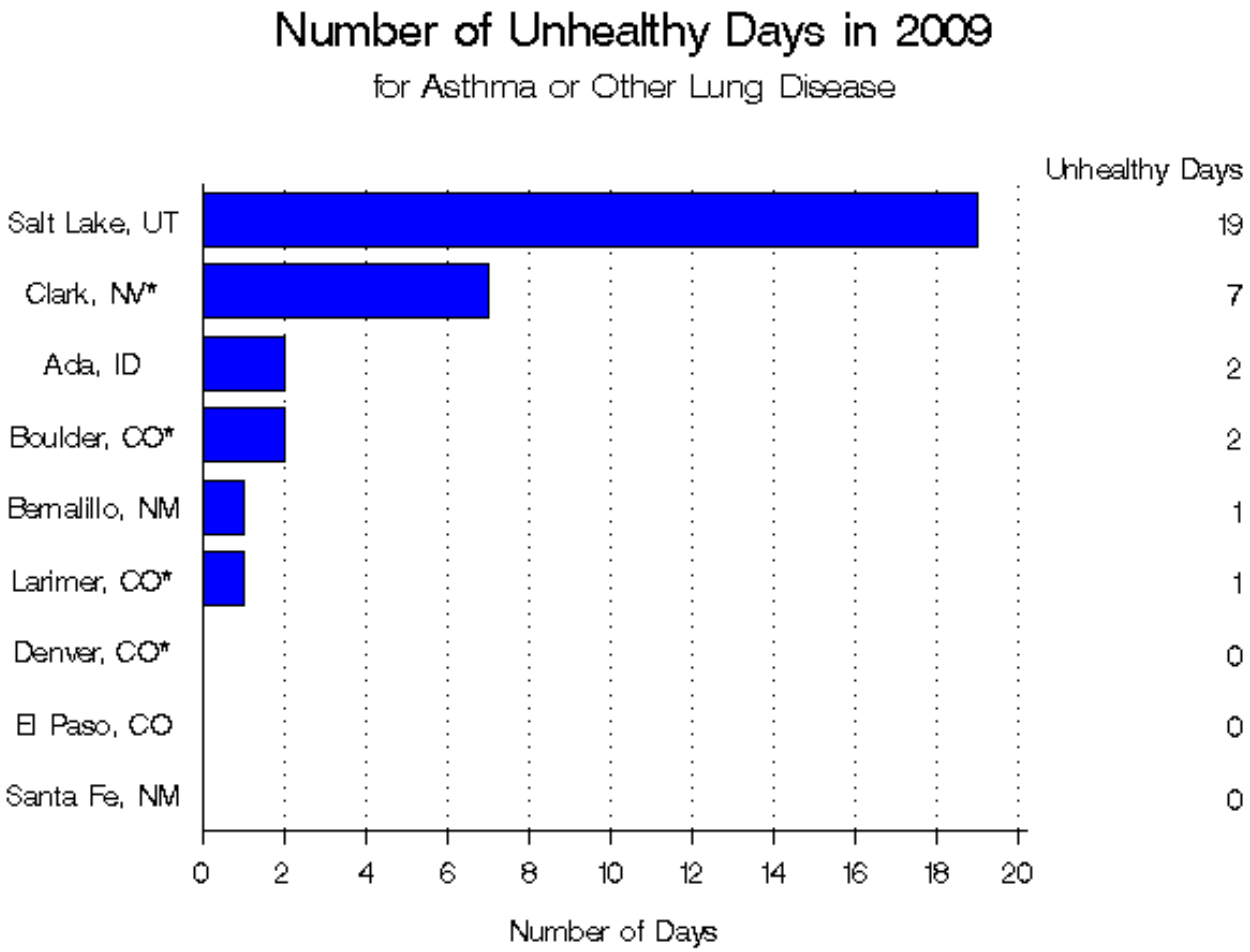


Boise, ID



Denver, CO

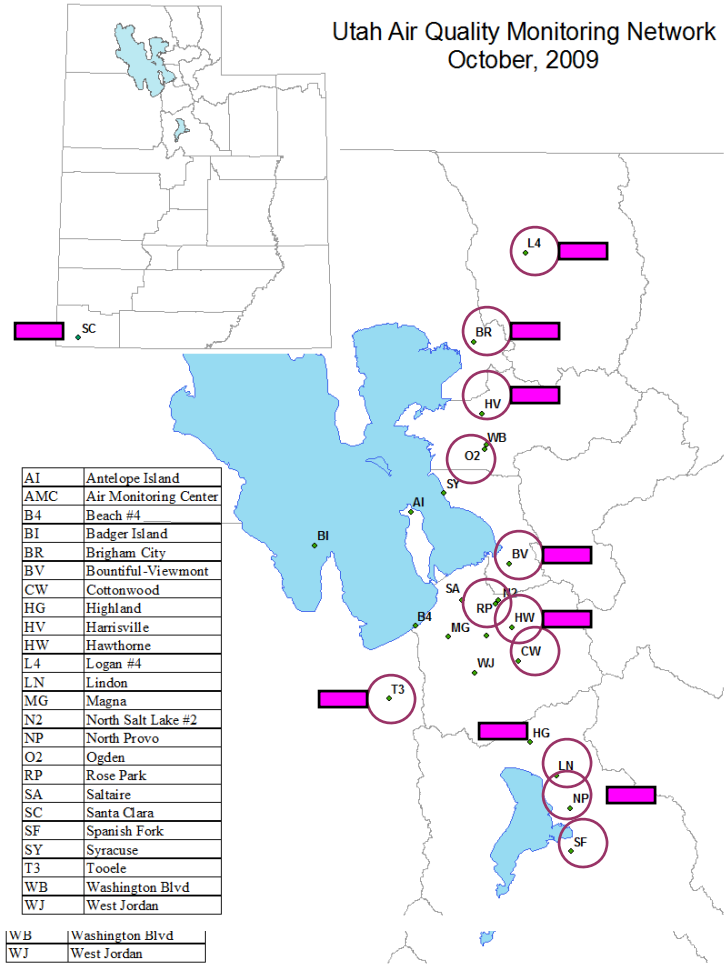
Salt Lake City compared with urban areas in surrounding States



So…how does Utah really compare?

- Utah has had one of the worst air quality days in the nation this year.
- Salt Lake City's daily air quality is not as bad as Los Angeles.
- Salt Lake City has more "unhealthy days" than most cities of comparable population.
- The patterns of average unhealthy days per month across cities suggest non-anthropomorphic influences, like geography and weather, on daily pollution levels

Monitoring air pollution levels in Utah



AI	Antelope Island
AMC	Air Monitoring Center
B4	Beach #4
BI	Badger Island
BR	Brigham City
BV	Bountiful-Viewmont
CW	Cottonwood
HG	Highland
HV	Harrisville
HW	Hawthorne
L4	Logan #4
LN	Lindon
MG	Magna
N2	North Salt Lake #2
NP	North Provo
O2	Ogden
RP	Rose Park
SA	Saltaire
SC	Santa Clara
SF	Spanish Fork
SY	Syracuse
T3	Tooele
WB	Washington Blvd
WJ	West Jordan

WB	Washington Blvd
WJ	West Jordan

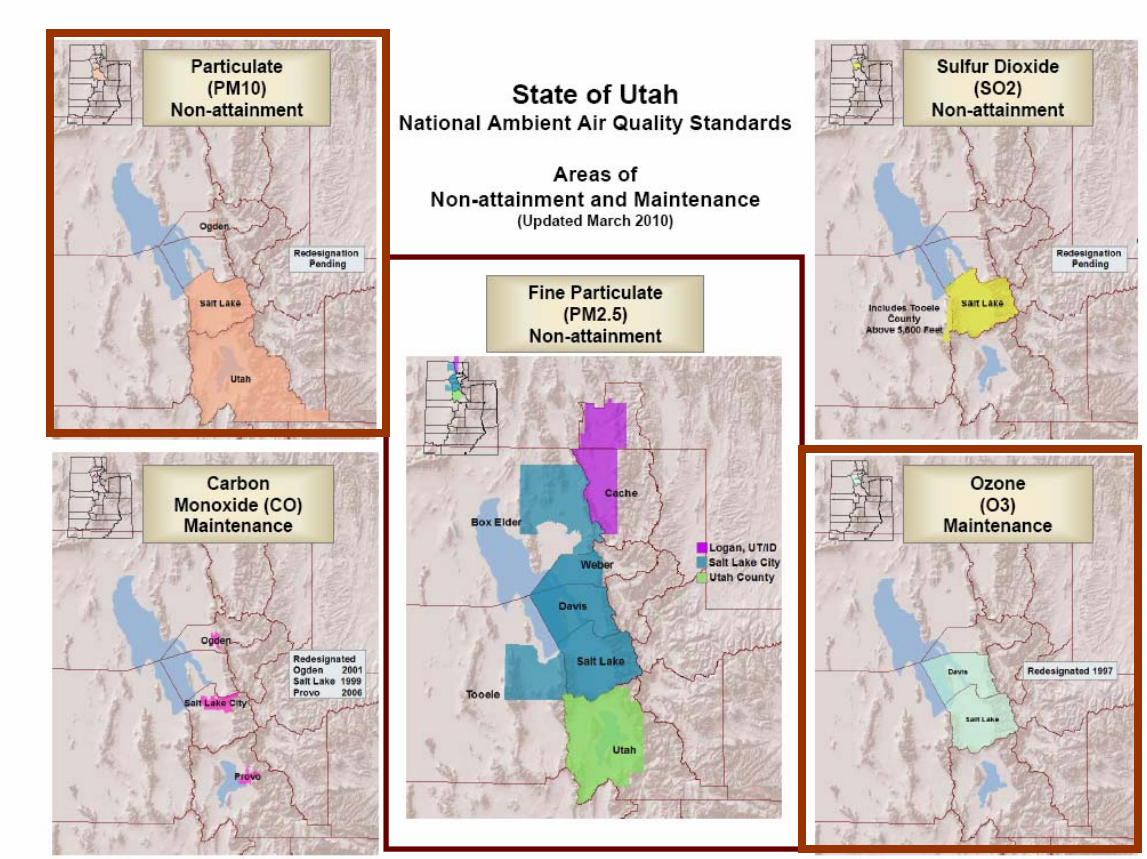
PM2.5 Monitors

1. L4 – Logan, Cache
2. BR – Brigham City, Box Elder
3. HV – Harrisville, Weber
4. O2 – Ogden, Weber
5. BV – Bountiful, Davis
6. HW – Hawthorne, Salt Lake
7. CW – Cottonwood, Salt Lake
8. RP – Rose Park, Salt Lake
9. T3 - Tooele
10. LN – Linden, Utah
11. NP – North Provo, Utah
12. SF – Spanish Fork, Utah

Ozone (O3) Monitors

1. L4 – Logan, Cache
2. BR – Brigham City, Box Elder
3. HW – Harrisville, Weber
4. BV – Bountiful, Davis
5. HW – Hawthorne, Salt Lake
6. HG – Highland, Utah
7. NP – North Provo, Utah
8. SF – Spanish Fork, Utah
9. T3 – Tooele
10. SC – Santa Clara, Washington

Areas in Utah that exceed the National Ambient Air Quality Standards



Source: http://www.airquality.utah.gov/images/Maps/NONATTAINMENT_MAP.pdf

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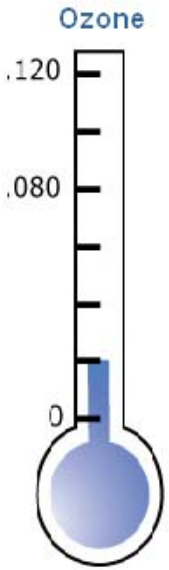
Salt Lake / Davis County Current 1-Hour Conditions

Wednesday July 28, 08:00 AM



PM2.5	Ozone
7.7 µg/m³	.018 ppm
Temperature	**Wind**
73° F	S 2 mph

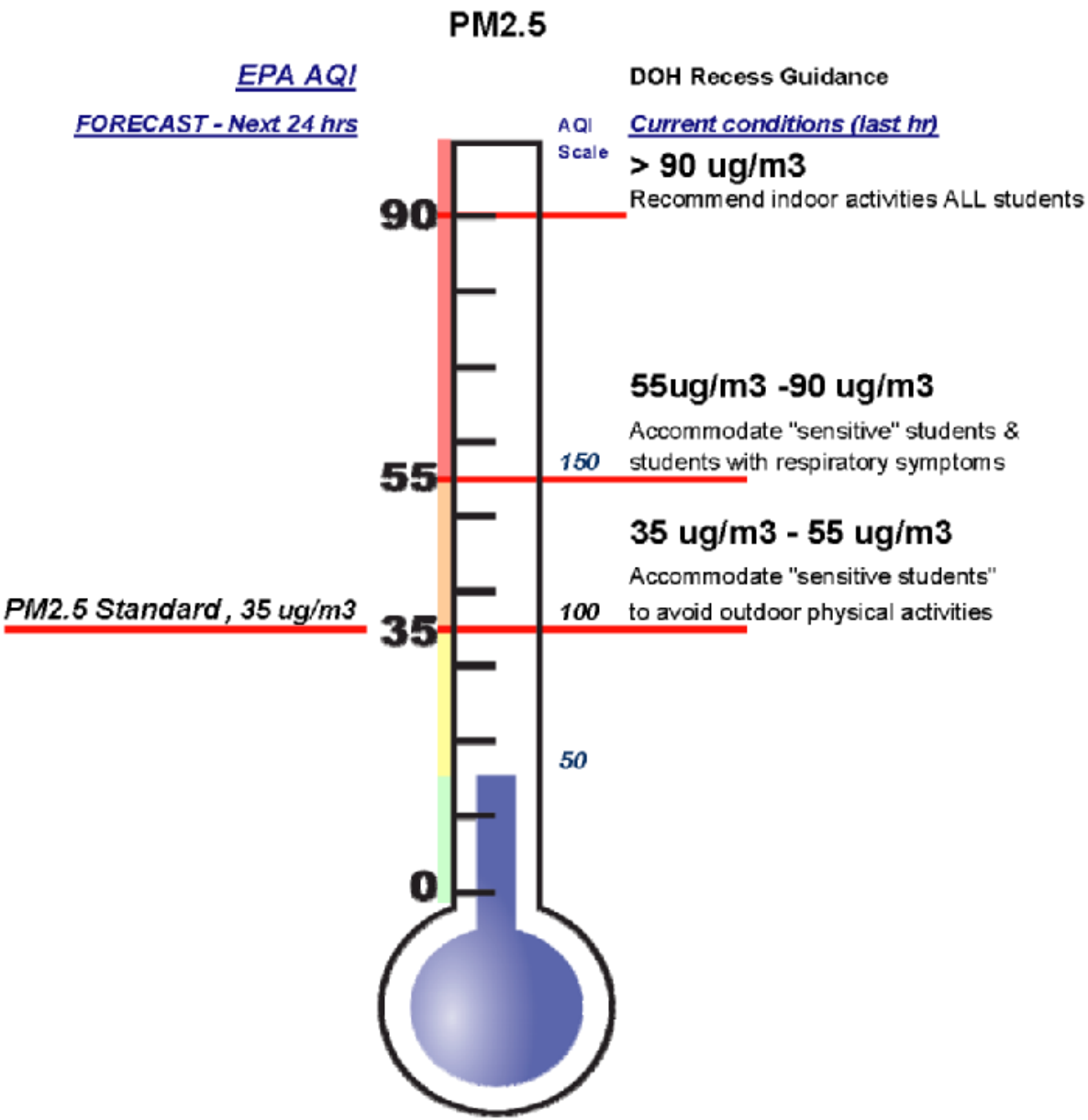
As with temperature, air pollution varies throughout the day.

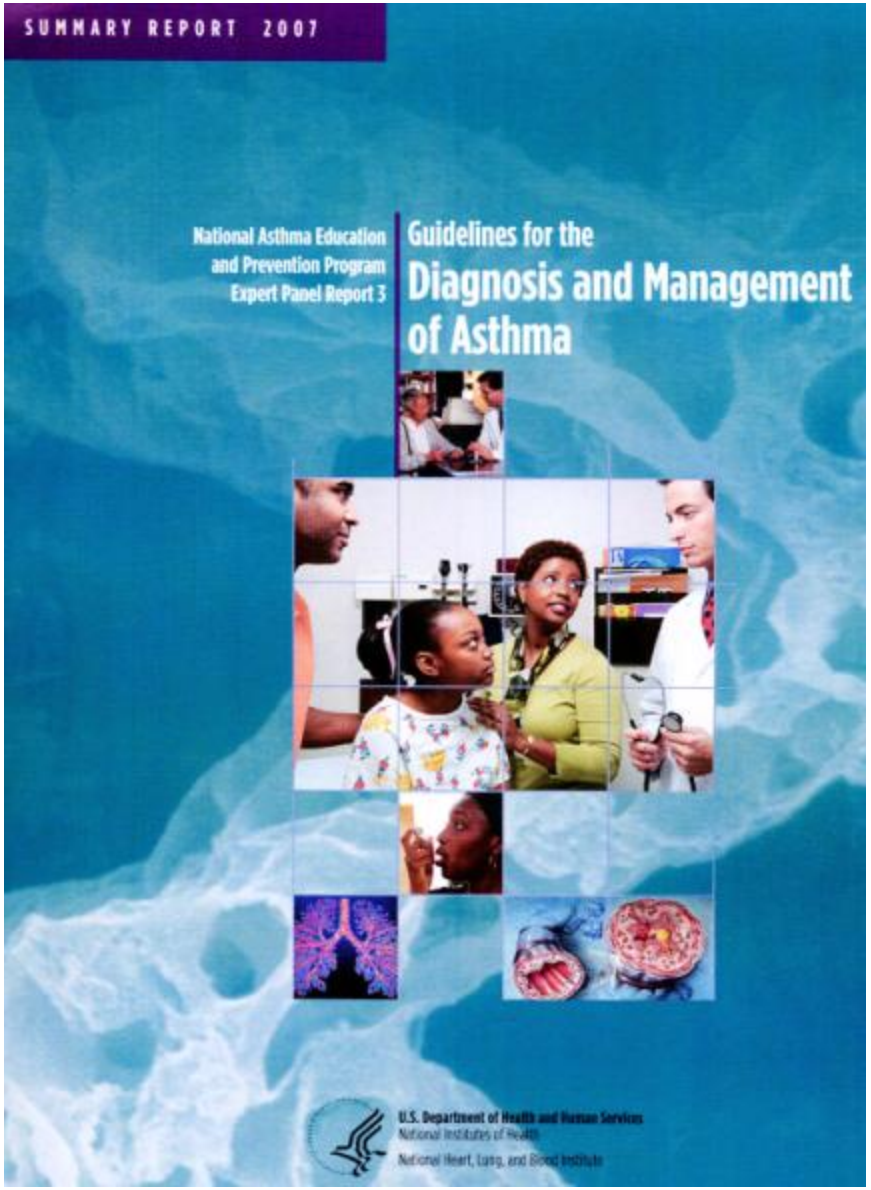
Web cam courtesy of the University of Utah / TimeScience

Forecast | Trend Charts

For any problems or questions on this website please contact: pjacob@utah.gov

Utah Department of Environmental Quality

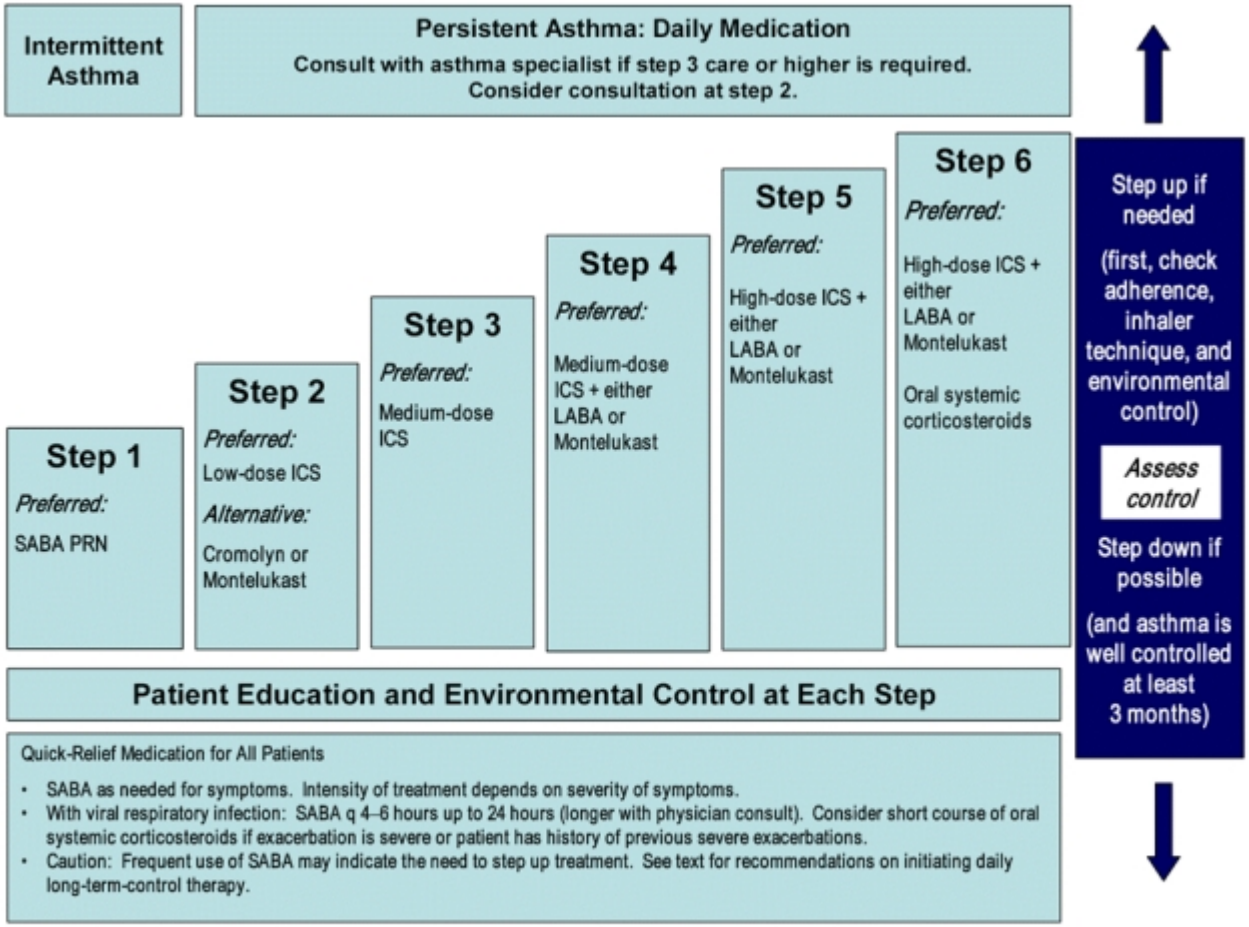

PM2.5
EPA AQI
FORECAST - Next 24 hrs
DOH Recess Guidance
AQI Scale
Current conditions (last hr)
> 90 ug/m3
Recommend indoor activities ALL students
90
55ug/m3 -90 ug/m3
Accommodate "sensitive" students & students with respiratory symptoms
150
55
35 ug/m3 - 55 ug/m3
Accommodate "sensitive students" to avoid outdoor physical activities
PM2.5 Standard , 35 ug/m3
100
35
50
0



National Asthma Education and Prevention Program

Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma

Stepwise Approach to Asthma Management



Key: **Alphabetical order is used when more than one treatment option is listed within either preferred or alternative therapy.** ICS, inhaled corticosteroid; LABA, inhaled long-acting beta$_2$-agonist; SABA, inhaled short-acting beta$_2$-agonist

Outdoor Air Pollution

The Expert Panel recommends:

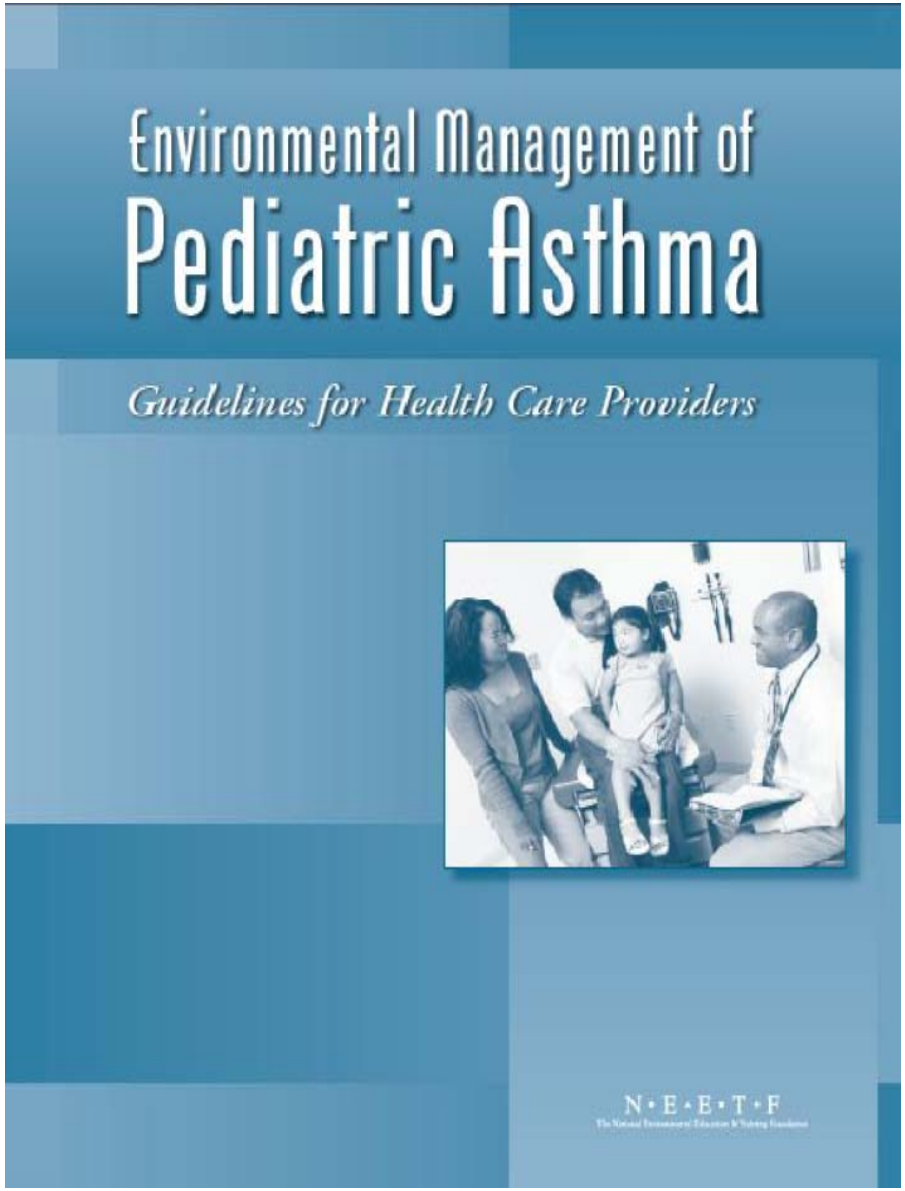
Clinicians advise patients to avoid, to the extent possible, exertion or exercise outside when levels of air pollution are high

Six Key Messages

- Inhaled corticosteroids are the most effective anti-inflammatory medication for long term management of persistent asthma

All patients should receive:

- Written asthma action plan
- Initial assessment of asthma severity
- Review of the level of asthma control (impairment and risk) at all follow up visits
- Periodic, follow up visits (at least every 6 months)
- Assessment of exposure and sensitivity to [environmental] allergens and irritants and recommendation to reduce relevant exposures



National Environmental Education Foundation

Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers

Components of Program

- Educational competencies
- Environmental history form
- Environmental intervention guidelines
- Sample Patient Flyers and References
- Supplemented by online list of resources with web-links
  - http://www.neefusa.org/health/asthma/asthma_resources.htm
- Available in English and Spanish online, in hard copy, and on CD-ROM
  - http://www.neefusa.org/health/asthma/asthmaguidelines.htm

Environmental History Form

- Quick intake form
- Administered by health care provider
- Available online as PDF and Word document
- Can be pasted or re-copied into electronic medical record template
- Questions are in yes/no format
  - Follow up yes answer with in-depth questions on Intervention Guidelines fact sheets
- Designed to capture major trigger areas
  - Once identified as a problem, (i.e. dust mites) the intervention she provides additional questions

Environmental History Form for Pediatric Asthma Patient

Specify that questions related to the child's home also apply to other indoor environments where the child spends time, including school, daycare, car, school bus, work, and recreational facilities.

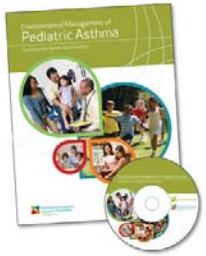
		Follow up/ Notes
Is your child's asthma worse at night?	❑ Yes ❑ No ❑ Not sure	
Is your child's asthma worse at specific locations? If so, where? _____	❑ Yes ❑ No ❑ Not sure	
Is your child's asthma worse during a particular season? If so, which one? _____	❑ Yes ❑ No ❑ Not sure	
Is your child's asthma worse with a particular change in climate? If so, which? _____	❑ Yes ❑ No ❑ Not sure	
Can you identify any specific trigger(s) that makes your child's asthma worse? If so, what? _____	❑ Yes ❑ No ❑ Not sure	
Have you noticed whether dust exposure makes your child's asthma worse?	❑ Yes ❑ No ❑ Not sure	
Does your child sleep with stuffed animals?	❑ Yes ❑ No ❑ Not sure	
Is there wall-to-wall carpet in your child's bedroom?	❑ Yes ❑ No ❑ Not sure	
Have you used any means for dust mite control? If so, which ones? _____	❑ Yes ❑ No ❑ Not sure	
Do you have any furry pets?	❑ Yes ❑ No ❑ Not sure	
Do you see evidence of rats or mice in your home weekly?	❑ Yes ❑ No ❑ Not sure	
Do you see cockroaches in your home daily?	❑ Yes ❑ No ❑ Not sure	
Do any family members, caregivers or friends smoke?	❑ Yes ❑ No ❑ Not sure	
Does this person(s) have an interest or desire to quit?	❑ Yes ❑ No ❑ Not sure	
Does your child/teenager smoke?	❑ Yes ❑ No ❑ Not sure	
Do you see or smell mold/mildew in your home?	❑ Yes ❑ No ❑ Not sure	
Is there evidence of water damage in your home?	❑ Yes ❑ No ❑ Not sure	
Do you use a humidifier or swamp cooler?	❑ Yes ❑ No ❑ Not sure	
Have you had new carpets, paint, floor refinishing, or other changes at your house in the past year?	❑ Yes ❑ No ❑ Not sure	
Does your child or another family member have a hobby that uses materials that are toxic or give off fumes?	❑ Yes ❑ No ❑ Not sure	
Has outdoor air pollution ever made your child's asthma worse?	❑ Yes ❑ No ❑ Not sure	
Does your child limit outdoor activities during a Code Orange or Code Red air quality alert for ozone or particle pollution?	❑ Yes ❑ No ❑ Not sure	
Do you use a wood burning fireplace or stove?	❑ Yes ❑ No ❑ Not sure	
Do you use unvented appliances such as a gas stove for heating your home?	❑ Yes ❑ No ❑ Not sure	
Does your child have contact with other irritants (e.g., perfumes, cleaning agents, or sprays)?	❑ Yes ❑ No ❑ Not sure	

What other concerns do you have regarding your child's asthma that have not yet been discussed?

_____

_____

4301 Connecticut Avenue, Suite 160 • Washington, DC 20008 • Tel. (202) 261-6475 • health@neefusa.org • http://www.neefusa.org



Air Pollution

Possible Indoor Air Interventions

- **Eliminate tobacco smoke**
  - Keep home and car smoke free
  - Encourage & support to quit smoking
  - Recommend aids such as nicotine gum/patch
  - Medication from physician to assist in quitting
  - Choose smoke free social settings
  - At the very least, do not smoke around your child or in the car!
- **Install exhaust fan close to source of contaminants**
- **Ventilate room if fuel burning appliance used**
- **Avoid use of products emitting irritants**
- **Control of dust mites and animal allergens**

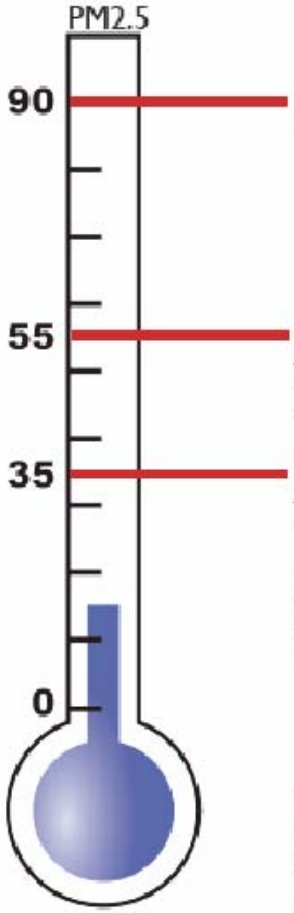
Air Pollution

Possible Outdoor Air Interventions

- Monitor air quality levels for ozone and PM2.5
  - Reduce outdoor activities if unhealthy
    - Orange AQI of 101-150 (unhealthy for sensitive groups)
    - Red AQI of 151-199 (unhealthy for all)
    - Better yet…follow hourly ozone and PM2.5 concentrations on DAQ website and learn more about your patient's own sensitivity patterns
- Contact health care provider if more albuterol is needed day of or after air pollution levels are high
- Consider stepping up ICS therapy during inversion and ozone seasons if identified as triggers
- Refer patients to readily available local tools developed by the Utah Asthma Task Force

Recess Guidance for Schools:

When to schedule indoor recess rather than outdoor recess based on the air quality in your communities.



When the Particulate Matter (PM2.5) is above 90 ug/m^3:
Recommend indoor physical activities for all students.

When the Particulate Matter (PM2.5) is 55.5 ug/m^3 - 90 ug/m^3:
Accommodate sensitive students and students experiencing respiratory symptoms. Symptoms may include coughing, wheezing, shortness of breath, and chest tightness.

When the Particulate Matter (PM2.5) is 35.5 ug/m^3 - 55.4 ug/m^3:
Accommodate "sensitive students" to avoid outdoor physical activities.

"Sensitive students" may include those with:
Significant or poorly controlled asthma, cystic fibrosis, chronic lung disease, congenital heart disease, compromised immune systems, or other respiratory problems.

Please Note:
Parents, with the advice of their health care provider, should inform their school if they believe their child is part of a "sensitive" group who should have limited outdoor physical activity when the air quality is poor. Visit www.health.utah.gov/asthma for a sample letter for parents.

To check the current PM2.5 levels, visit www.airquality.utah.gov and click on "current conditions."

Updated January 8, 2008

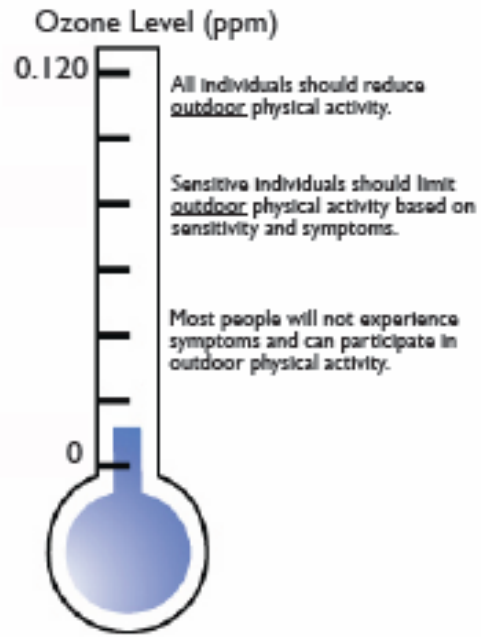
UTAH DEPARTMENT OF HEALTH

Recommendations for Outdoor Physical Activity During Ozone Season (May-September)

Regular physical activity is important for the health of all adults and children. There are health risks associated with physical activity outdoors when ozone levels are high. Physical activity causes people to breathe faster and more deeply, allowing more ozone to be inhaled. You can protect your health by planning your physical activities according to the following recommendations:

Recommendations for Outdoor Physical Activity During Ozone Season

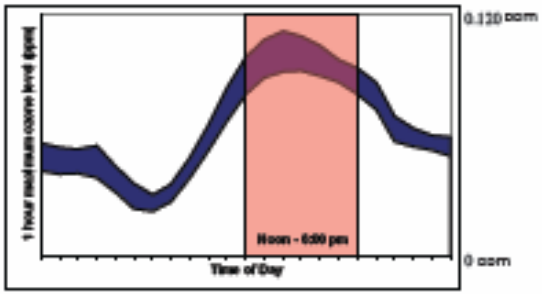
- The best time for outdoor summer physical activity is before noon or after 6:00 pm.
- If you are physically active between noon and 6:00 pm:
  - Consider light to moderate activity (i.e., walking instead of running),
  - Consider indoor activities.
- Discuss physical activities with your doctor, especially if you have a lung disease or heart condition.



To check current ozone levels visit www.airquality.utah.gov and click "current conditions."

Ozone is created by the sun's heat and light acting upon gases and pollution in the atmosphere. The ozone molecule is the same in ozone air pollution and in the ozone layer, but the ozone layer is 6 to 30 miles above the surface of the earth.

Ozone levels are higher:
- In the summer - especially hot sunny days,
- In the afternoon, and
- Outside



Ozone levels are predictable throughout the day. This chart shows typical summer day ozone level patterns. The best time for outdoor physical activity is before noon or after 6:00 pm.

Recommendations for Outdoor Physical Activity During Ozone Season (May-September)

Populations at Higher Risk of Ozone Sensitivity

- People with lung diseases like asthma
- People with heart conditions
- Children
- Seniors
- People with allergies
- People who work outdoors
- People who exercise outdoors

Know Your Ozone Level

Track ozone levels and your symptoms to plan physical activity. A tracking sheet with instructions is available at www.health.utah.gov/asthma. Current ozone levels are available at www.airquality.utah.gov (click on "current conditions").

Symptoms from Ozone Exposure

Symptoms can be felt immediately or one or more days after ozone exposure, and can include:

- Difficulty breathing
- Chest tightness or coughing
- Eye, nose, or throat irritation
- Increased allergy symptoms
- Increased asthma symptoms

Long-term Health Effects from Repeated Ozone Exposure

Ozone causes inflammation and damage to the cells that line your lungs. Repeated ozone exposure could lead to the following:

- Development of chronic obstructive pulmonary diseases (COPD)
- Development of asthma
- More severe respiratory infections
- Decreased lung function

For More Information:

Current Air Quality Conditions: www.airquality.utah.gov

Ideas on Reducing Ozone Pollution: www.cleanair.utah.gov

Sign Up for Air Quality Alerts: www.cleanair.utah.gov

Utah Ozone Data: ibis.health.utah.gov/indicator click on "Ozone"

Environmental Protection Agency: www.epa.gov/Ozone/

Asthma and Air Quality: www.health.utah.gov/asthma

Physical Activity Recommendations: www.healthfinder.gov/prevention click on "Get Active"

Utah Department of Health

Summary

- Outdoor air pollution exacerbates existing asthma and may play a role in development of disease
- Control of asthma triggers is an important part of the overall management of asthma
  - Environmental management should supplement good medical care
- Practical guidelines and tools are available to assist clinicians, public health workers, and families
  - Written asthma action plans
  - Ask about environmental exposures and seek ways to intervene
  - Locally available tools developed by Utah Departments of Health and Environmental Quality
- When trigger avoidance is not possible, based on the pro-inflammatory properties of air pollutants, step up therapy with ICS to improve asthma control