IMPLICATIONS OF CLIMATE CHANGE ON AMBIENT AND INDOOR AIR QUALITY

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Changes in climate are generating higher and more sustained concentrations of ambient air pollution, and...

• Generating new impacts on our built environments (stress on the integrity of our structures).

• Placing greater demands on our indoor environments (more time indoors, more protection from hazards)
General patterns and processes we are witnessing…
ALTERED WEATHER PATTERNS THAT DIRECTLY IMPACT AMBIENT AND INDOOR AIR QUALITY

✓ Increased Precipitation (Flooding)
✓ Decreased Precipitation (Drought)
✓ Increased Heat
✓ Increased Wildfires
PRECIPITATION

- Increased incidence of flooding
- Damage to and degradation of building materials; water damage; displacement
- Dampness, mold – microbial contamination; water and vectorborne diseases
DROUGHT

- Increased incidence of drought
- Increased airborne particles from crustal dust and combustion
- Respiratory distress and illness
HEAT

- Increased incidence of higher temperatures
- Increased ozone levels and other pollutants from ozone-initiated chemistry
- Respiratory distress and illness; COPD population directly impacted
WILDFIRES

- Increased incidence, severity and duration of wildfires
- Increased airborne particles, combustion gases and PAHs
- Immunologic, neurologic, respiratory, cardiovascular, carcinogenic, mutagenic impacts
**Ambient Air Quality Impacts Associated with Climate Change:**

- Ozone
- Particulate Matter (PM)
- Ultrafine Particulate Matter
- Carbon Monoxide
- Volatile Organic Compounds (VOC’s)
- Allergens

- High heat
- Wildfires
- Weather changes
INDOOR AIR QUALITY IMPACTS ASSOCIATED WITH CLIMATE CHANGE:

- Microbial Contamination
- Allergen-Induced Illness
- Indoor Ozone
- VOC Emissions
- Particulate Matter
- Carbon Monoxide; Combustion Gases

Flooding
Flooding, Weather
Heat
Wildfires
THE CONSEQUENCES

What these changes mean on a population scale…
Human Health Consequences of Climate Change

1. Asthma, Respiratory Allergies, and Airway Diseases
2. Cancer
3. Cardiovascular Disease and Stroke
4. Foodborne Diseases and Nutrition
5. Heat-Related Morbidity and Mortality
6. Human Developmental Effects
7. Mental Health and Stress-Related Disorders
8. Neurological Diseases and Disorders
9. Vectorborne and Zoonotic Diseases
10. Waterborne Diseases
11. Weather-Related Morbidity and Mortality

Note that three of the top health impacts of climate change have a correlation specifically with air quality.
CHANGES IN ATMOSPHERE, WEATHER, CLIMATE

CHANGES IN SOURCES, PROPERTIES AND CONCENTRATIONS OF AIRBORNE POLLUTANTS

CHANGES IN HEALTH OUTCOMES
Changes in physical activity levels, mental health, well-being, tradition, culture, community structure, and self-sufficiency.

How we are impacted by climate change can’t be measured in clinically-detectable symptoms only.
LOW-COST PROTECTIVE MEASURES

Things you can do with limited budget and resources that will have a measurable impact...
THREE EVIDENCE-BASED MEASURES

1. Education
2. Filtration
3. Collaboration

(…there are many more interventions and approaches)
• **Inform** by helping shift perception of smoke (*emphasis on elders, pregnant women, cardiovascular disease, immune compromised*) to promote adherence to protective measures (e.g., mask, reduced activity, filtration)

• **Engage and empower** with visible tools (Purple Air/low-cost sensors – real-time, local data), Air Matters toolkits, filters
VISUAL TOOLS
Air Quality Alert

Community Health

- Vulnerable Populations via Clinicians, Liaison, CHWs
- Schools & TELA via Nurses, Coordinators
- Community–at-large via Media Channels
- Flag Notification System
- Office & Work Sites, via Building Maintenance Staff

Health & Safety
Example – inform residents about the indoor/outdoor correlation

...Positive correlation usually present between ambient and indoor concentrations.
House with no filter/fan equipment (control)
Black carbon over time, house #1

- Red: Indoors
- Green: Outdoors

Black Carbon (micrograms per cubic meter)

2016

1/11, 1/12, 1/13, 1/14, 1/15, 1/16, 1/17, 1/18, 1/19, 1/20
• **HEPA filtration** – mechanical air cleaners
• **Filter-a-Fan** – low-cost fans coupled with furnace filters
• All households should consider, but particularly those with at-risk individuals due to increased time indoors
Example of filter/fan performance
Black carbon during wildfire smoke event, house #4, windows and doors closed

- Inside
- Outside

Fan turned on

8/11/2017
Increased time spent indoors due to smoke, high heat and extreme weather
COLLABORATION

- **Housing Authorities** – ventilation and filtration improvements as part of energy efficiency or weatherization efforts
- **Cooperative Extensions and Universities** – education resources
- **Research and Non-Profit Organizations** – community-based projects to identify specific needs and approaches unique to your community