

Potential Health Effects of Marcellus Shale Activities: The Need for Public Health Surveillance

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My Background

- Board certified: Internal Medicine, Hematology, Toxicology
- Founding Director, Environmental and Occupational Health Sciences Institute, Rutgers University and UMDNJ
- USEPA Asst Administrator for R&D, 1983-85
- Elected Member, National Academies of Science Institute of Medicine: currently member of Roundtables on Environmental Health, and on Sustainability. Current chair, Committee on Sustainability at EPA.
- Chair or member of advisory committees, multiple international, national, state and local government, NGO and business organizations.

Community Health Concerns and the Marcellus Shale

- In our six years of responding to community environmental and health issues, CHEC has never experienced the breadth and depth of concern that exists about Marcellus Shale

THE ONLY TWO CERTAINTIES

1) Surprises

Every location where natural gas is extracted is different. Pennsylvania differs from other heavily extracted regions in its geology; surface and subsurface water flows; past subsurface perturbations; weather; ecosystems; population density and demography, etc. Extraction procedures are evolving; and the sensitivity of analytical techniques to detect contaminants is increasing.

We can be certain that unforeseen threats to human health will be detected.

THE ONLY TWO CERTAINTIES

2) Disease Clusters and Law Suits

It is certain that in a community with Marcellus Shale activity there will be a highly publicized statistically significant increase in a disease. This will result in worried community members, loss of property values and law suits. The concern will spread to other Marcellus Shale communities

When this occurs Health Department or university epidemiologists will be asked to help determine whether the observed increase in disease incidence is a result of Marcellus Shale activity. This will require retrospective reconstruction of exposure to various chemicals. At best there will be a high degree of uncertainty in the exposure assessment that will complicate determination of cause and effect relationships

A THIRD CERTAINTY

3) Reducing emissions is a money saver

In virtually every similar situation, industry has eventually realized that it saves money to decrease emissions. In addition to the costs of health and environmental impacts, and the litigation and clean-up expenses, it is more profitable to sell product than to release it to the environment.

Implications of the Gulf Oil Spill to Marcellus Shale Activities

- Environmental and human health are closely linked.
- Worker health and environmental health are linked by the culture of the workplace
- Independent governmental oversight is necessary: and costs money that should be paid by the industry
- Regulatory reform is required to better balance the protection of the environment and public health with business needs

COREXIT 9500 MSDS: NALCO

(edited)

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous:

<u>Hazardous Substance(s)</u>	<u>(w/w)</u>
- Distillates, petroleum, hydrotreated light	10.0 - 30.0%
- Propylene Glycol	1.0 - 5.0%
- Organic sulfonic acid salt (Proprietary)	10.0 - 30.0%

Implications of the Gulf Oil Spill to Marcellus Shale Activities

- Psychosocial health impacts of energy extraction can be as important as direct health effects.
- It is in everyone's best interest to determine the potential environmental and human health impacts of energy extraction prospectively, rather than retrospectively.
- Over time it is virtually certain that all the nation's oil and gas sources will be tapped.
 - So what's the rush?

Pathways to Adverse Health Impacts of Marcellus Shale Operations

- Worker health and safety
- Air pollution
- Water pollution
- Soil pollution
- Noise pollution
- Community safety: traffic, explosions, fires;
crimes
- Psychosocial disruption
- Sustainability
- Global climate change

Questions Include

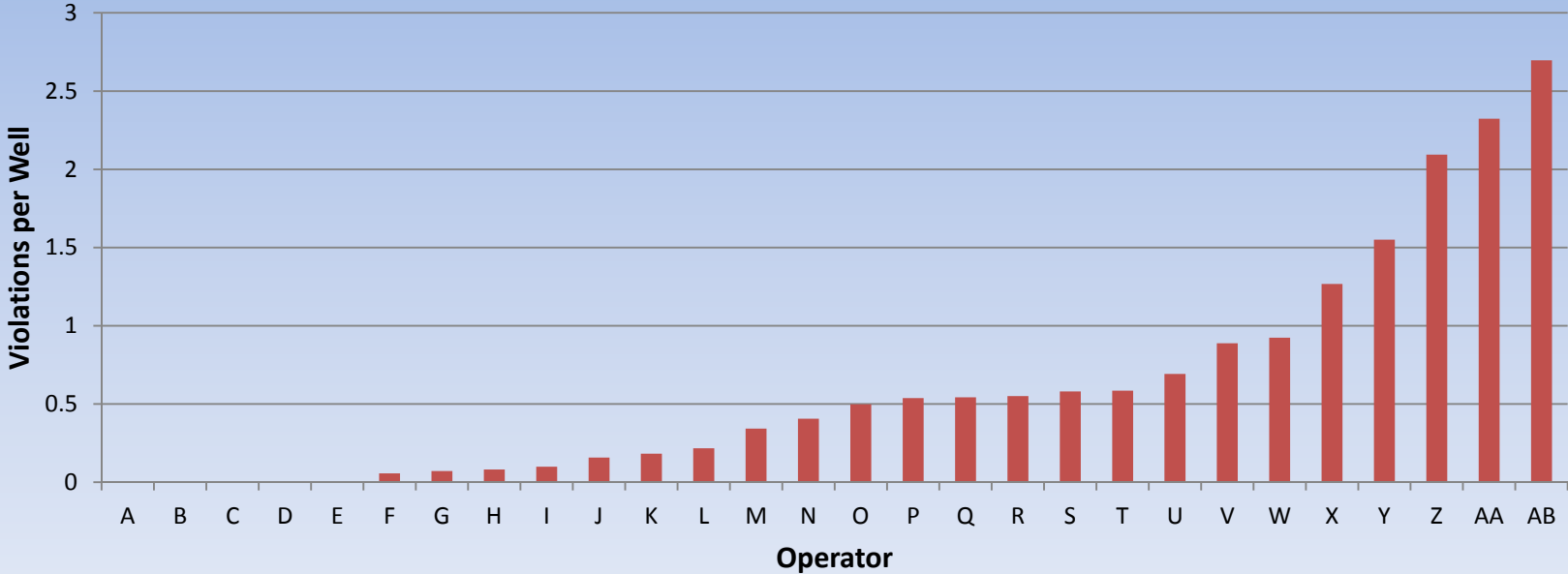
1. How is flow back and produced water disposed of?
2. Is the disposal of water affecting ground water or municipal and/or private drinking water supplies?
3. Water withdrawal and management?
4. Is there an additional burden to already compromised air quality in Southwestern, PA?
5. Movement of radionuclides?
6. What kind of stress and health issues are related to people living in communities where gas extraction and development activities are taking place?
7. How will pipelines and heavy road traffic affect the infrastructure of communities?
8. How long do well-casing last with corrosive fluids running through them?
9. What are the plans for emergency response?

Key Policy Issues Related to Human Health

- The need for vigorous governmental oversight
- Aggregate sources vs a single source (air sheds and water sheds)
- Individual risk vs community risk vs population risk
- Sustainability

2010 Marcellus Shale Violations per Well

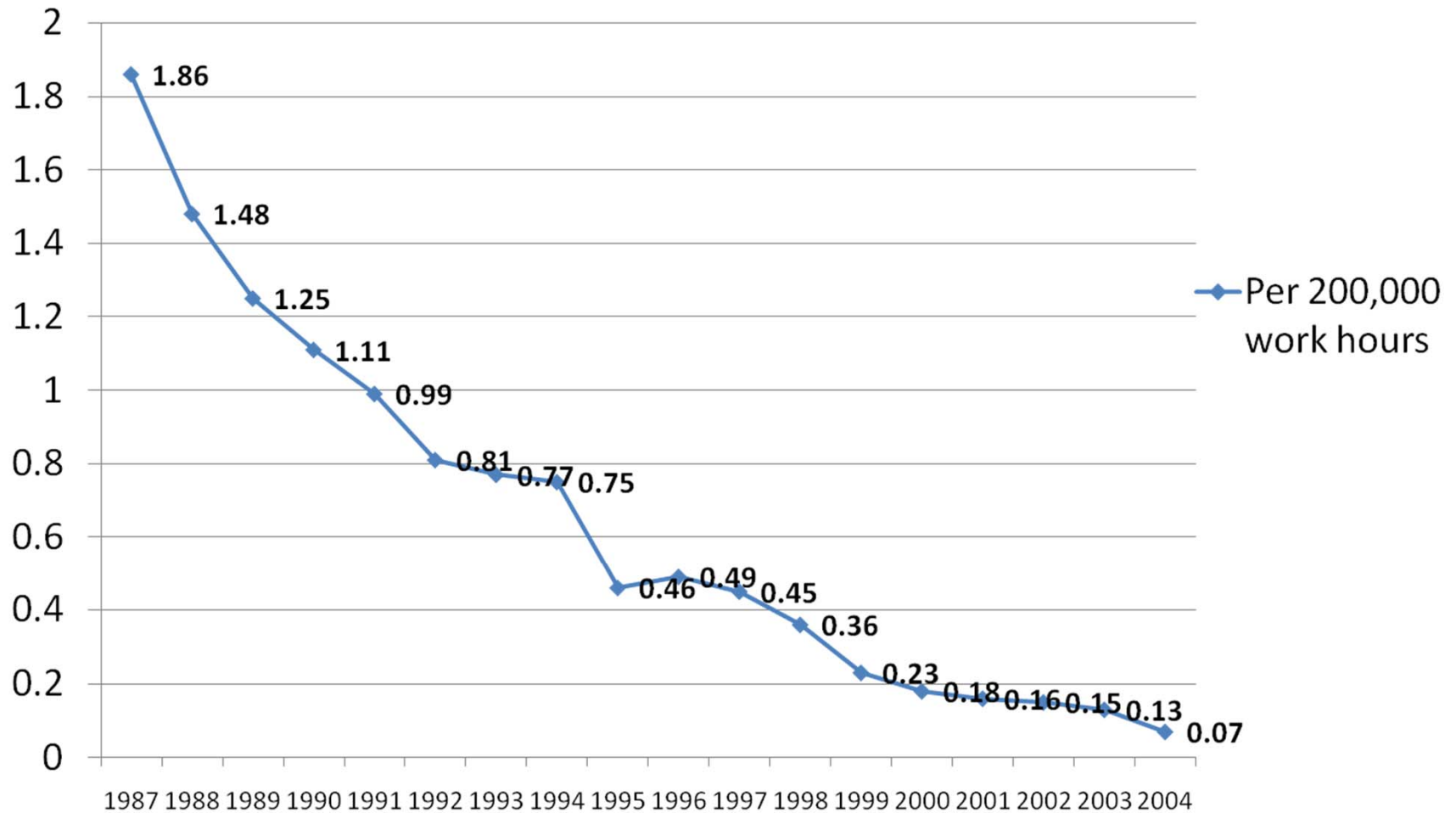
By Operator with 10 or More Total Marcellus Shale Wells



Implications of the CHEC evidence of a diverse safety culture within the Marcellus Shale industry

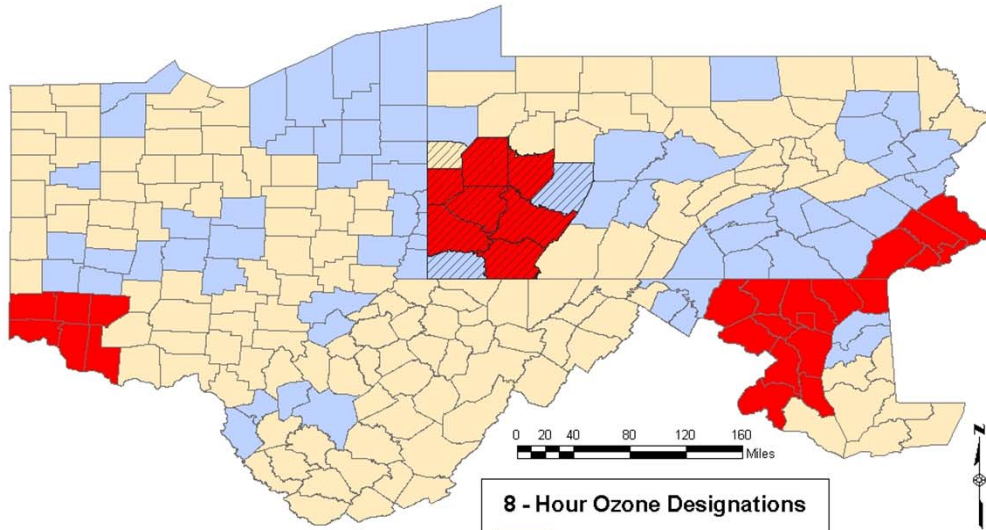
- Vigorous oversight and enforcement is necessary, including heavy fines and loss of permit for repeat offenders.
- Weeding out of those with an inadequate safety culture is in the best interest of the industry as well as the public.
- Perhaps some companies think of fines for violations as just part of their business costs.

Alcoa Lost Workday Performance 1987-2004

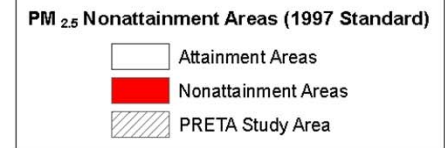
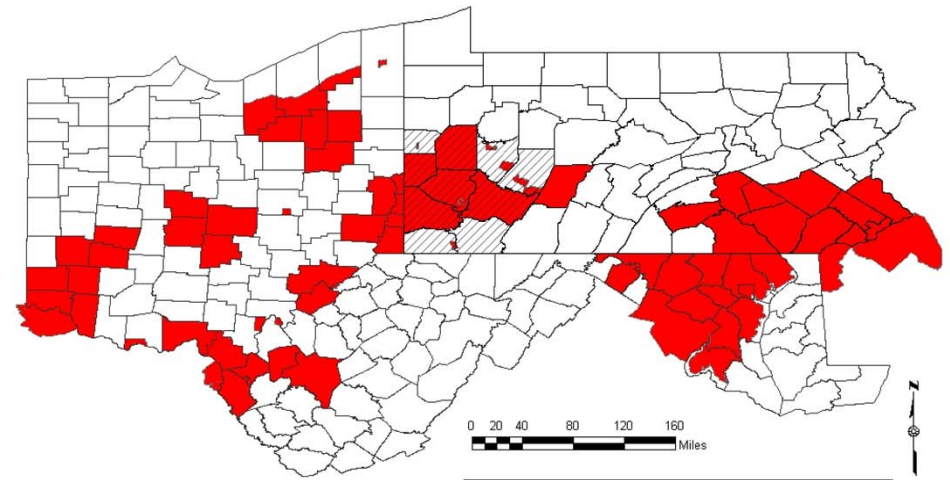
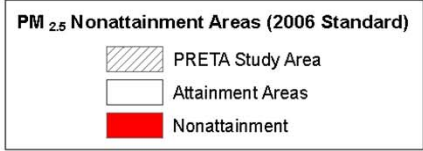
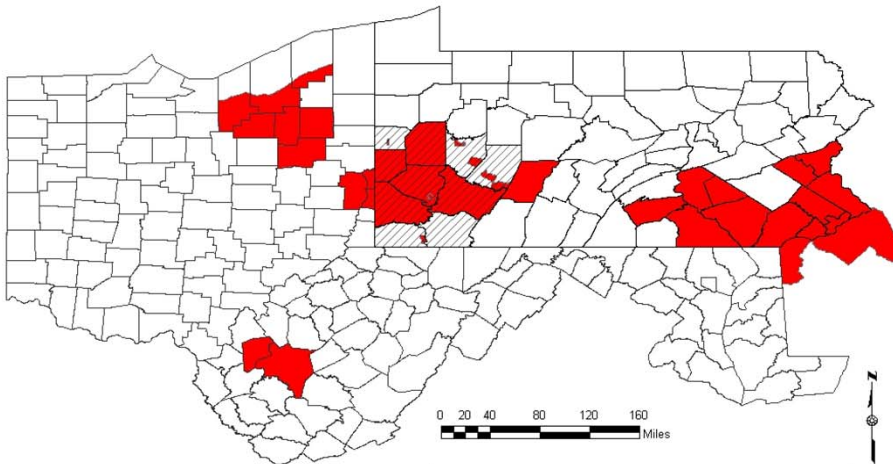
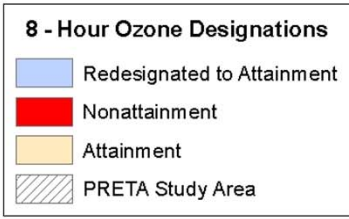


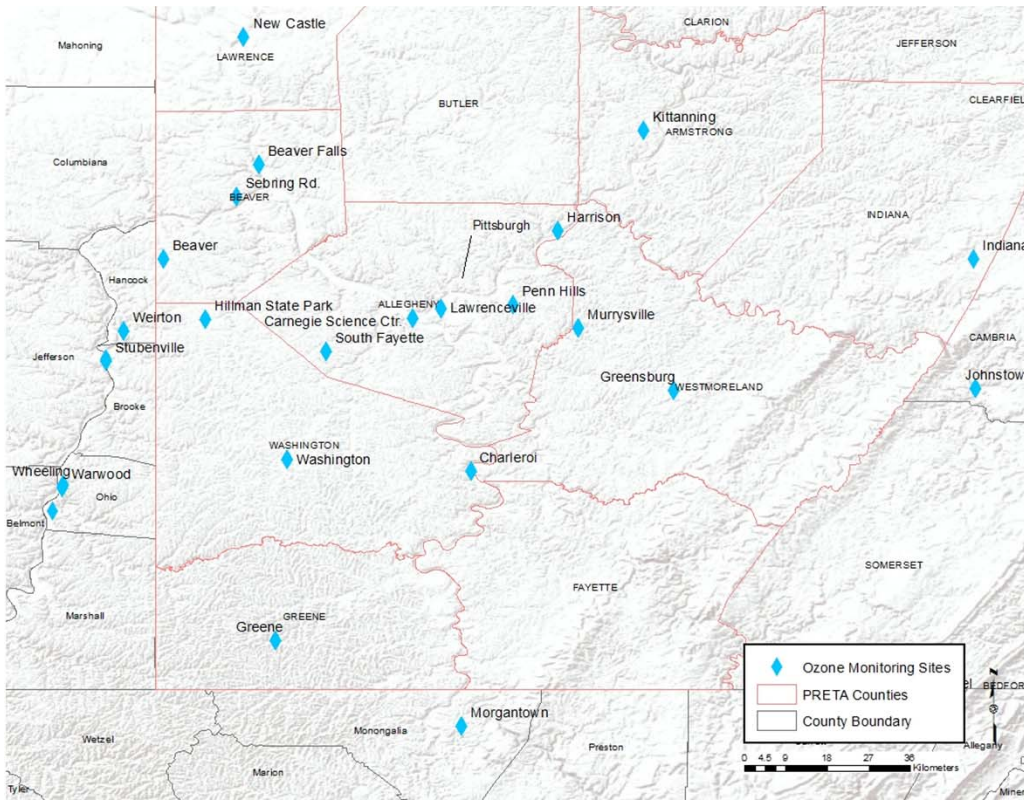
Point Sources as Non-Point Sources

- Allowable emissions from the thousands or tens of thousands of Marcellus Shale sources easily exceed that of a major new point source (e.g., an oil refinery)
- Classically, non-point sources do not pose immediate risks in their neighborhood (e.g., nitrogen runoff from individual farms), but do so in aggregate (e.g., the dead zones of Chesapeake Bay or Gulf of Mexico)
- Marcellus Shale activities pose both local and aggregate risk
- They are being regulated solely as individual local point sources



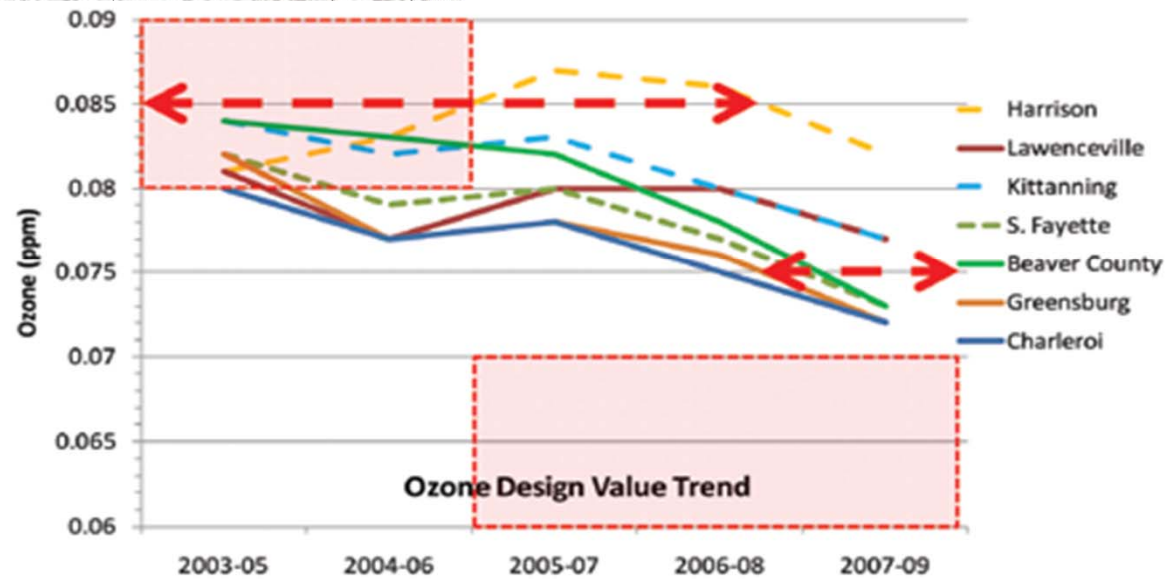
NAAQS designations throughout PA, OH, MD, and WV



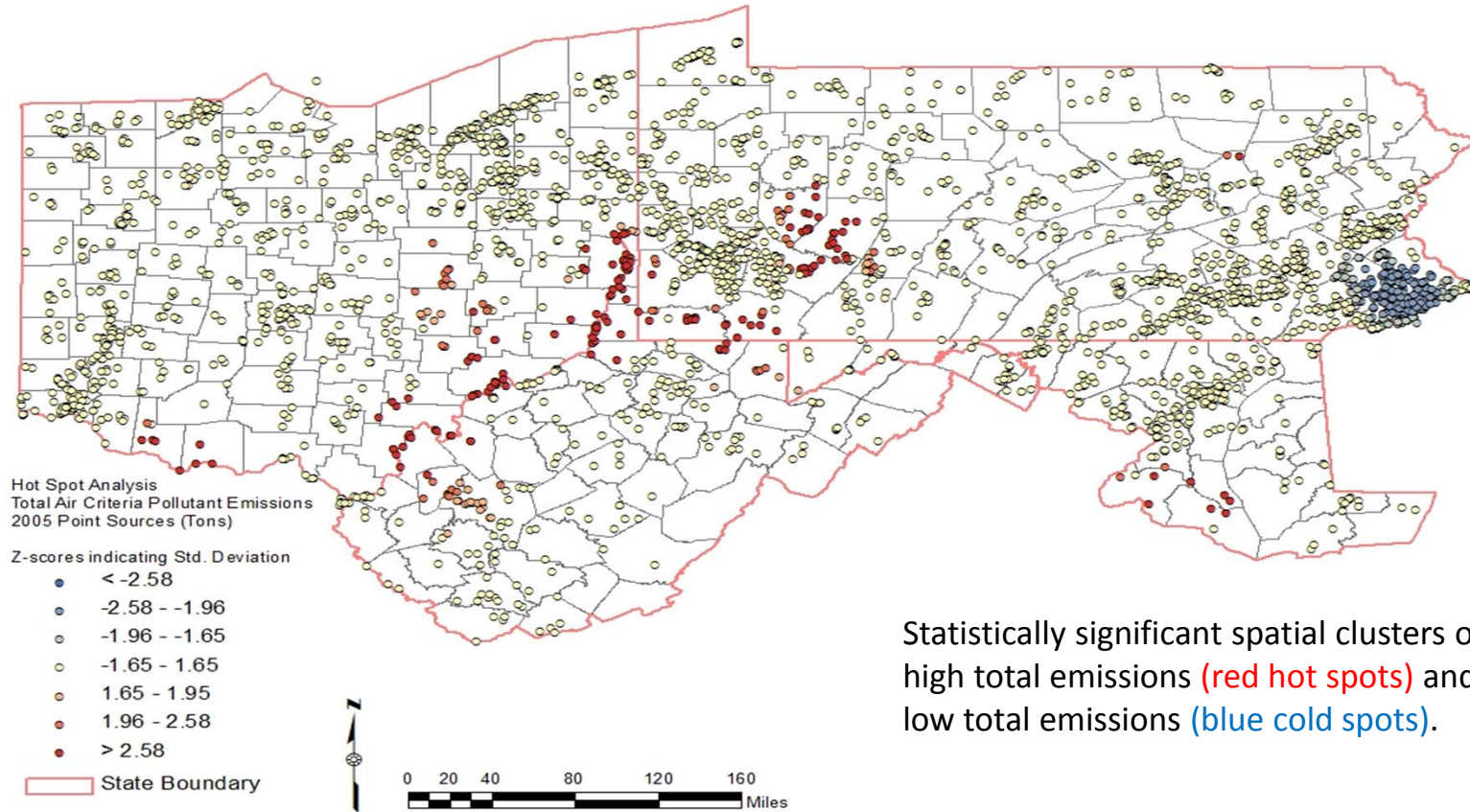


Ozone monitoring locations throughout 1999 – 2011

Ozone design value trend with current NAAQS (from Graham, 2011)

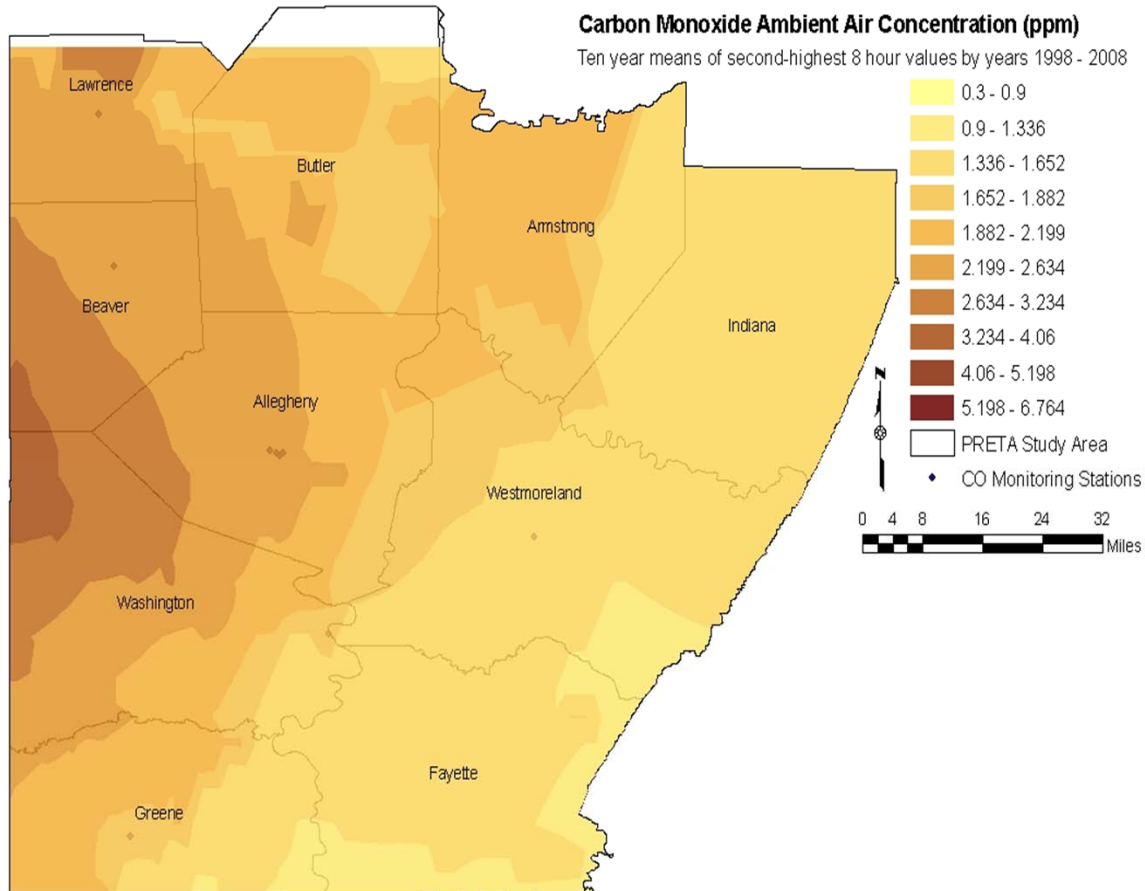


Hot Spot Analysis of Total Air Criteria Emissions, 2005

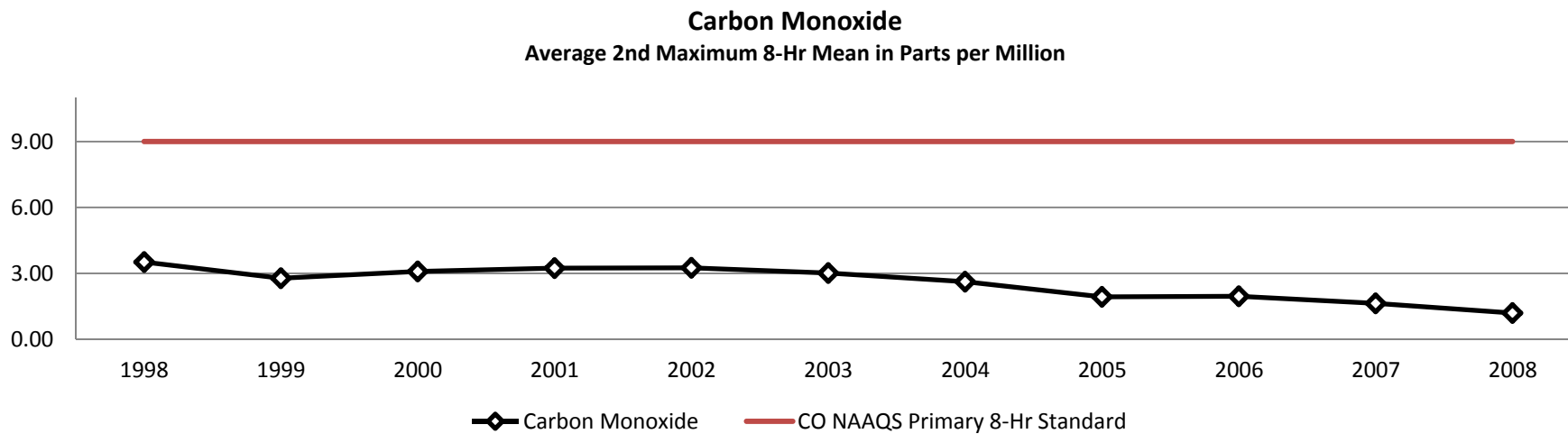


Statistically significant spatial clusters of high total emissions (red hot spots) and low total emissions (blue cold spots).

The analysis of the four state areas indicates three major areas of clustering. 1) Within the Philadelphia greater city limits, statistical significant low emitting sources ($p < 0.01$) appear to be spatially clustered. 2) Along the Ohio River valley, large emitting sources exist ($p < 0.01$) beginning south between Gallia County, Ohio and Mason County, West Virginia, near Gallipolis, West Virginia, traversing the Ohio River northeast to Hancock County, West Virginia (bordering Beaver County, Pennsylvania). 3) Surrounding Allegheny County, Pennsylvania and the Greater Pittsburgh Area on all sides, excluding directly north of Allegheny County in Butler County. From this analysis, it can be concluded that large emitting sources persist in patterned clusters along the Ohio River Valley and surrounding Allegheny County, Pennsylvania to the west, south and east based on the total air pollutant emissions sources within the defined neighborhood (PA, OH, MD, WV).



Carbon monoxide estimated concentrations (ppm), ten year means of second-highest 8 hour values by year (1998 – 2008)
 Annual NAAQS = 9 ppm



Limitations of DEP Air Studies

“... between these two studies, DEP has conducted monitoring at only 8 natural gas sites, never monitored at any one site for more than 4 days, and ignored the risks of long-term exposure to these pollutants.”

Group Against Smog and Pollution

Joe Osborne

DEP Natural Gas Air Studies

“... The newspaper headlines characterizing DEP’s monitoring efforts as proof Marcellus-related air emissions are “OK” or “safe” or “no health threat” are reaching conclusions the DEP’s data simply doesn’t justify.

These DEP studies are not the final word on air emissions from Marcellus Shale activity; they’re part of a long a conversation that’s just getting started.”

Group Against Smog and Pollution
Joe Osborne

Drinking Water Health Issues

- Contaminants of concern to drinking water include:
 - Fracturing fluid chemicals
 - Degradation products
 - Naturally occurring materials in the geologic formation (e.g. metals, radionuclides) that are mobilized and brought to the surface during the hydraulic fracturing process

Watch out for TE-NORM

Technologically-Enhanced Naturally Occurring Radiation

- Naturally occurring radioactivity is not infrequently associated with oil and gas deposits
- Working these deposits can lead to the unanticipated concentration or displacement of radioactivity (e.g., will there be more radioactivity in drinking water? Will more radon be off-gassed into the basements of homes near a drill site?)

Crime and Police Response – PA

- **"More and more, it seems the police reports coming out of the northern tier include arrests because of drug use and trafficking, fights involving rig workers, DUIs, and weapons being brought into the state and not registered properly," said the commissioner. "We've even encountered situations where drilling company employees who have been convicted of a sexual assault in another state come here to work and do not register with our Megan's Law website. Each of these issues is unacceptable and places an even greater burden on our law enforcement and local social programs meant to help those in need." (State Police Commissioner Frank Pawlowski)**
- State and local governments need additional resources to address the problems that have accompanied the arrival of drilling companies to Pennsylvania.

Community Health Concerns and the Marcellus Shale

- Even if it were true that Marcellus Shale activities present no health risk, and we do not believe it is true, it is unreasonable to expect that communities will be reassured by statements from industry asserting that their activities are safe.
- Safety statements from industry or government are particularly problematic given well-publicized Marcellus Shale incidents indicating an inability to fully contain the processes at all times

Community Health Concerns and the Marcellus Shale

- The absence of thorough ongoing health studies, with community engagement, is compromising the ability of state government to be viewed as a knowledgeable source of information concerned about protecting public health
- The apparent failure to involve the PA Department of Health compounds the concern; as does the absence of health expertise on the Marcellus Shale Commission

Public Health Functions

- Information to health care providers
- Response to concerned individual and public, including elected representatives.
- Establishment of targeted public health surveillance activities

Public Health Surveillance

- Public health surveillance is the continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice.
- Such surveillance can:
 - serve as an early warning system for impending public health emergencies;
 - document the impact of an intervention, or track progress towards specified goals; and
 - monitor and clarify the epidemiology of health problems, to allow priorities to be set and to inform public health policy and strategies.

Public Health in Pennsylvania

- **In size of public health workforce per capita, we ranked lowest, 51st among the 50 states and District of Columbia (Gebbie et al, HRSA, 2000)**
- **If we quadrupled the size of our public health workforce (37/100,000) we would still be below the regional average (158/100,000)**
- **Only 6/67 counties and four additional cities have local health departments.**
- **We have two of the nation's 42 accredited schools of public health (Pitt; Drexel)**
- **We are headquarters for two major national public health accrediting bodies: the National Commission for Health Education Credentialing (Allentown) and the National Board of Public Health Examiners (Pittsburgh).**

See: M.A. Potter: Public Health in Pennsylvania: Where do we go from here? Commonwealth 14: 1, 2008

Community Engagement

- Any attempt to understand and respond to the potential adverse health consequences of Marcellus Shale activities will fail unless the community is involved.
 - Causally related health impacts will be missed
 - Negative findings will be dismissed

The Three Rules of Interacting with the Community.

1) Trust must be earned

2) Never pretend to give the community options when you have already made up your mind

3) Every community and every situation is different. But transparency, openness and sympathetic understanding are central

Sustainability

- **Requires transdisciplinary approaches to complex environmental issues.**
- **Approaches must include a comprehensive evaluation of environmental, economic and social/health issues.** (e.g., in considering preventing on-site problems by trucking waste elsewhere, the diesel emissions of the trucks, impact on roads and dust generation, auto and pedestrian fatalities, etc need to be considered)
- **Multigenerational equity is central.** What happens to the community when the gas runs out?

Selected Recommendations (1)

- **A comprehensive prospective health and exposure study of those potentially affected by Marcellus Shale activities should begin immediately in cooperation with the community**
- **Improving public health surveillance and increasing the public health workforce is in the best interests of the Commonwealth. New consideration should be given to regional multi-county health departments**
- **Marcellus shale sources of environmental pollution should be regulated both individually and collectively.**

Selected Recommendations (2)

- **The Commonwealth should recognize the wide range of safety cultures within industry and establish severe penalties for bad actors**
- **Confidential business secrets concerning the composition of fracking materials or other Marcellus Shale industry activities should not be allowed when the public's health and welfare is at stake**
- **Sustainability should be central to the Commonwealth's approach to development of its Marcellus Shale resources – including the use of life cycle analysis and other methods that permit holistic decision making, and the consideration of longer term issues.**

Center for Healthy Environments and Communities

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This presentation is solely the responsibility of Bernard D. Goldstein, MD