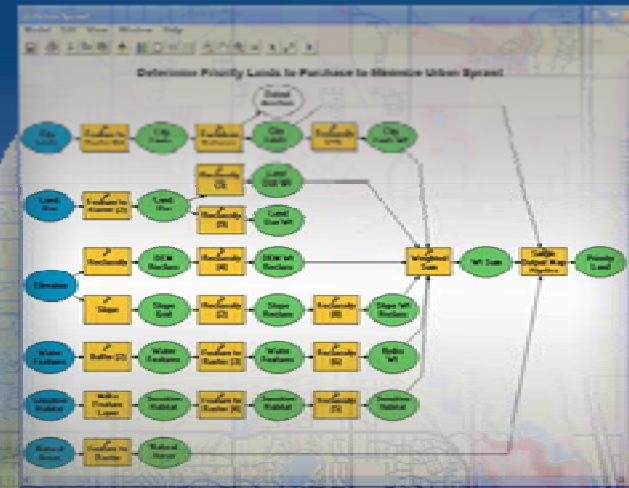


# Geomedicine



**Genetics + Lifestyle + Environment = Health Risk**

# Working definitions of geomedicine...

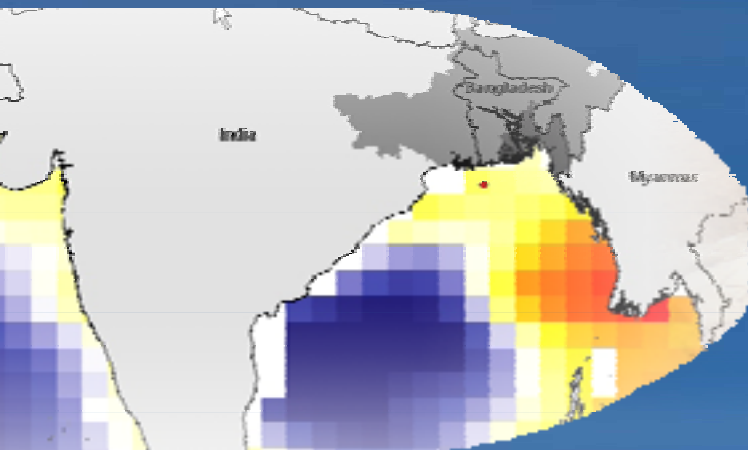
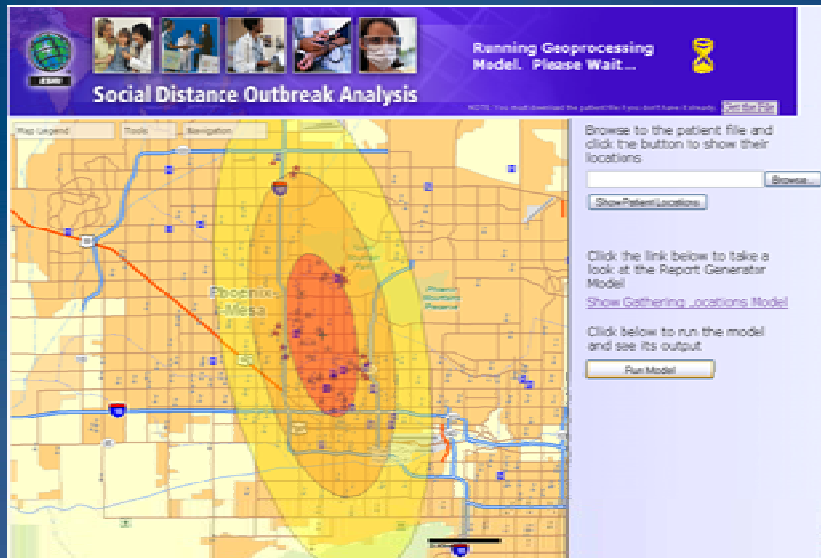
- A inter-disciplinary academic approach that bridges knowledge between the natural (geologic) and man-made (as built) environment and human health and disease.
- A information integration approach linking specific health impacts to specific geographical locations.
- Can also include other fields of academic study such as medical geography and population health.



Health and well-being usually begins here...



# Health then continues at home...





**Built environments can make people sick...**



**Behaviors can make some people sick...**





Freeways can make some children sick...

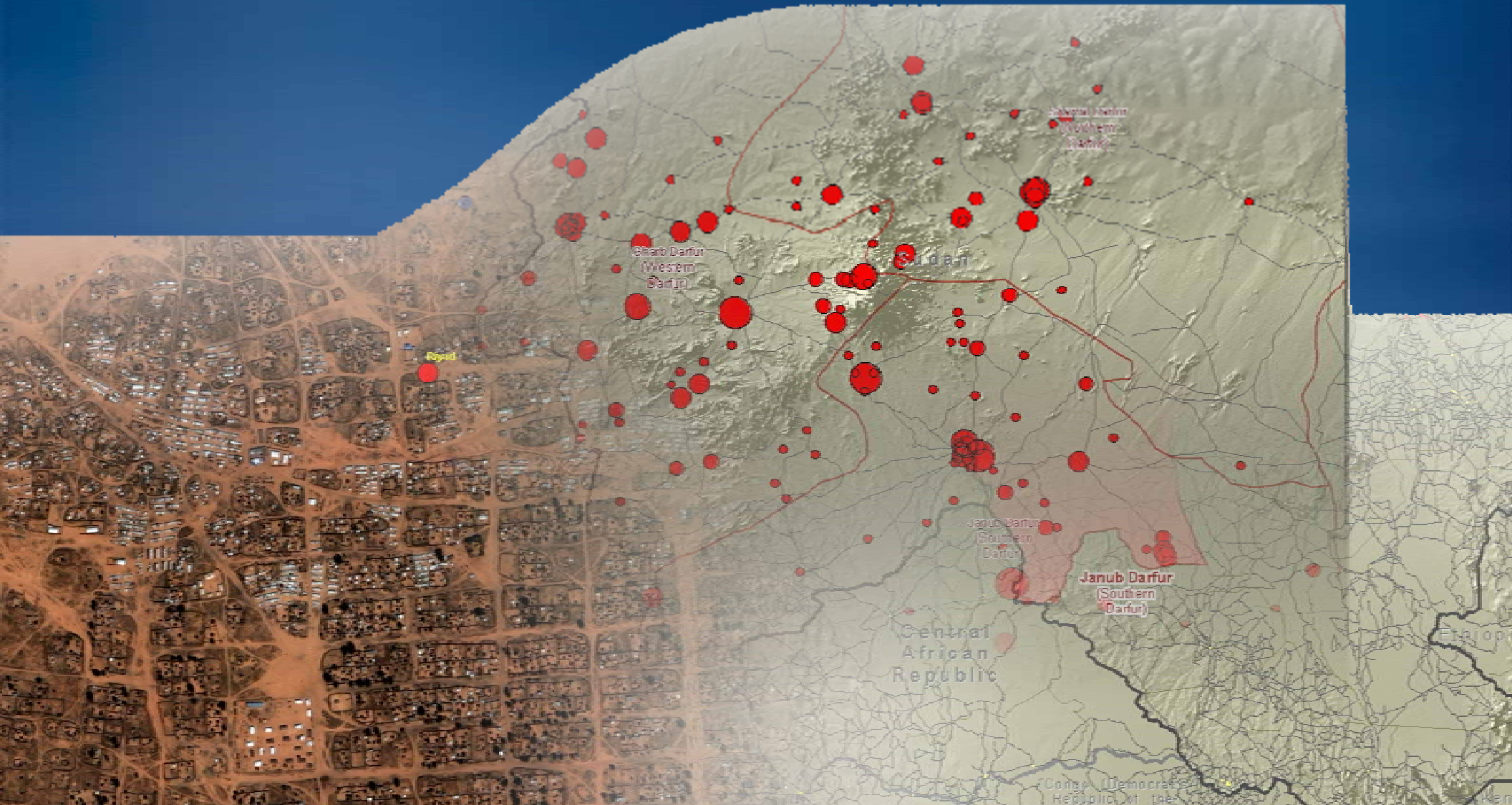


**Dirty drinking water can make some people sick....**





# Human waste can make some people sick...

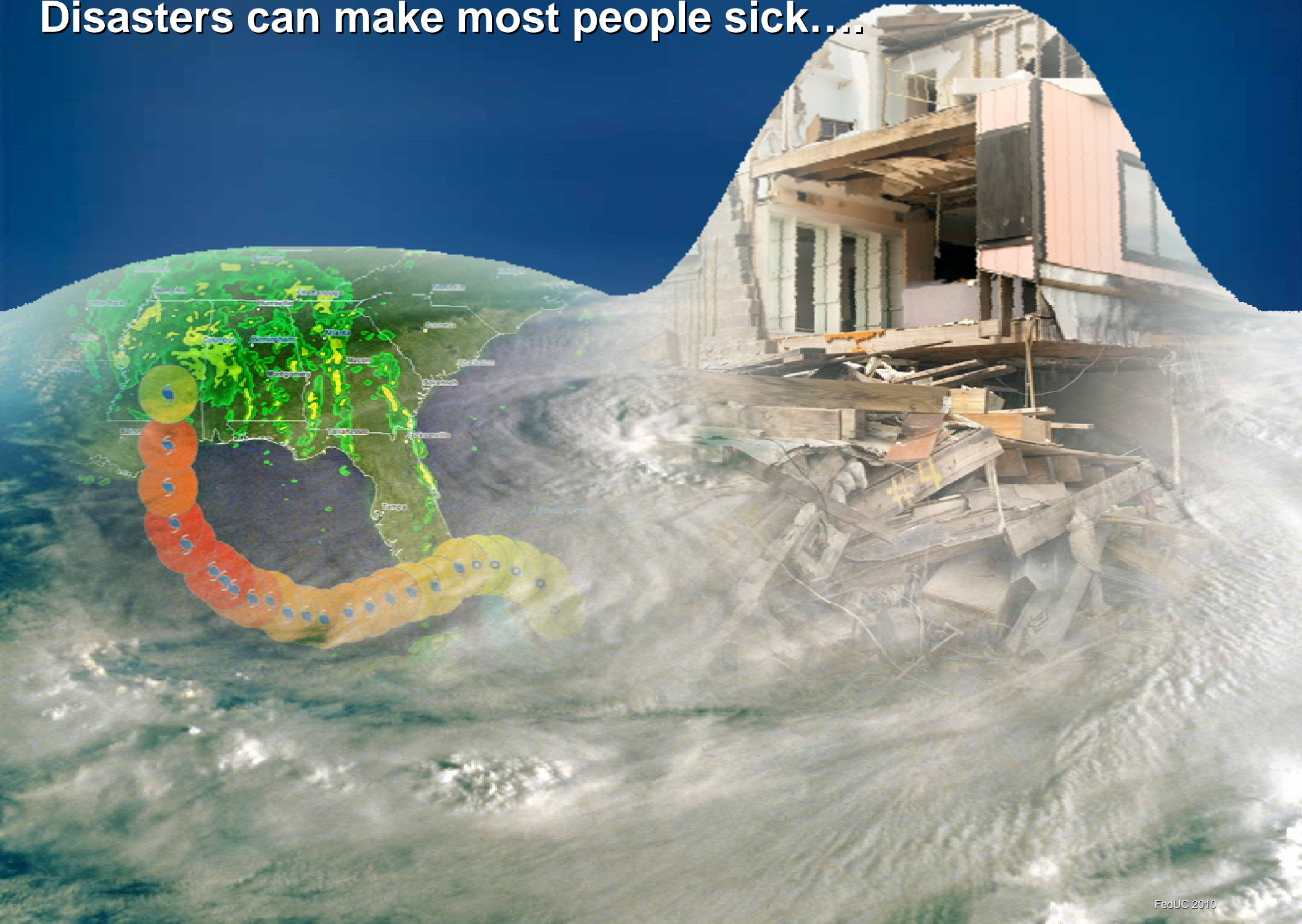


Nature can make some people sick...

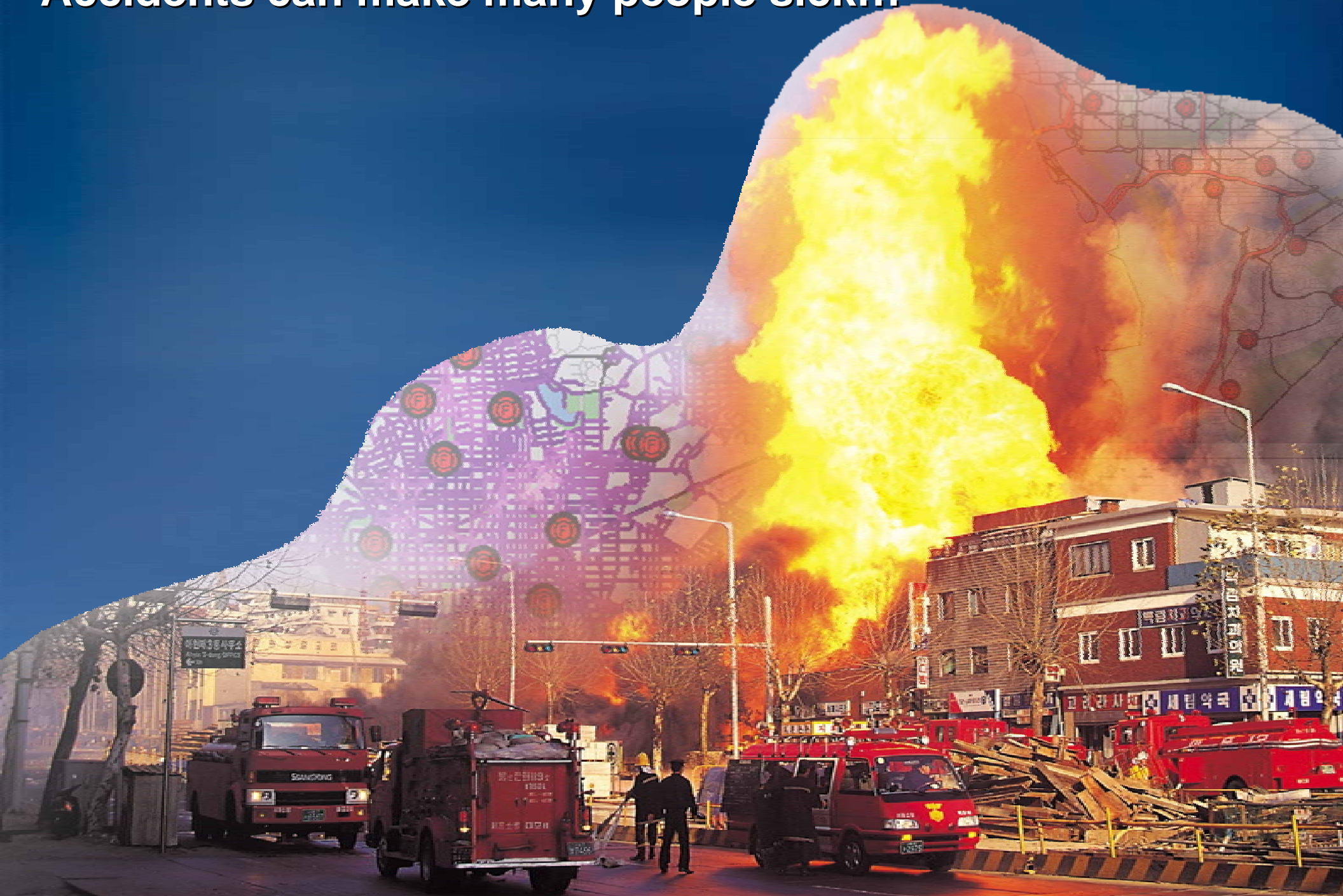




Disasters can make most people sick...



Accidents can make many people sick...





# The evidence is growing and convincing...

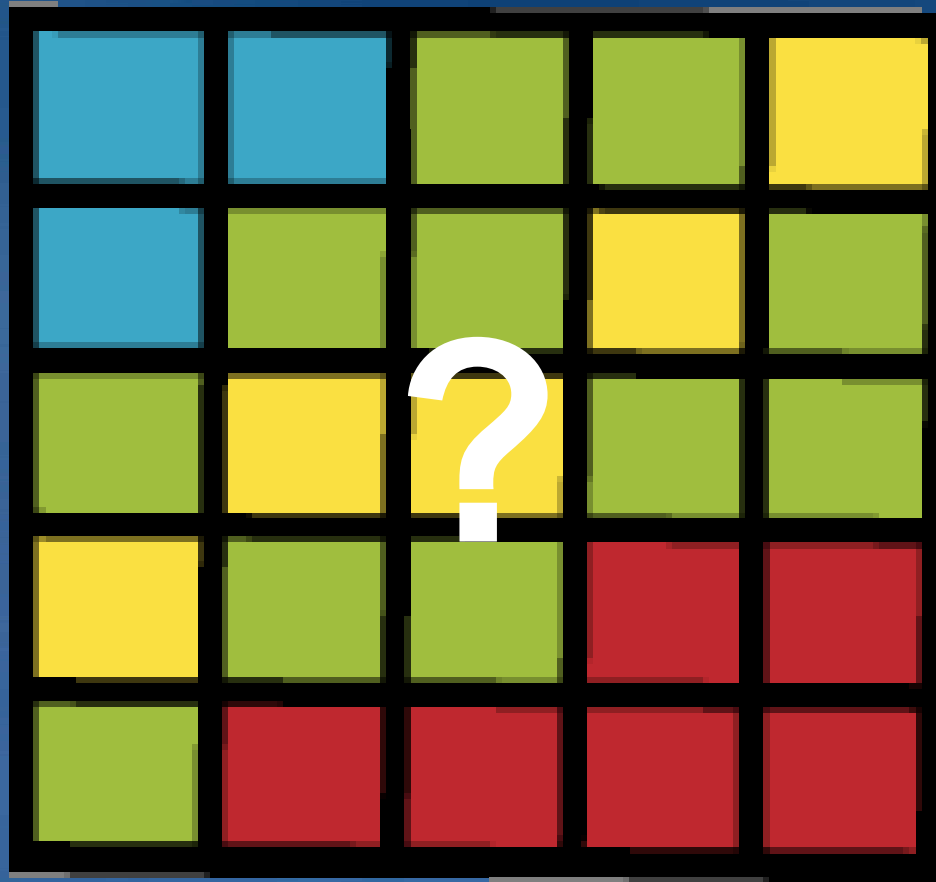
*... geography is linked to human health and social well-being*

- Air
- Soil
- Food
- Water
- Nature
- Culture
- Animals
- Distance
- Buildings
- Accidents
- Chemicals
- Healthcare
- Demographics



*... understanding the nature of complex relationships*

# The Geography of Health and Well-being...



When geography matters



# Scope of place

- 36.8 trillion acres of land
- 9.1 trillion acres of water
- 304 million lakes
- 2.3 million cities and communities
- 6.7 billion “personal spaces”
- 2.1 billion households
- 420 million commercial buildings

*...managing our environmental inventories*

# Scope of conditions

- Carcinogens (cancer)
- Teratogens (birth defects)
- Developmental (reproductive)
- Endocrine disruptors (hormonal)
- Chronic conditions
- Infectious diseases
- Accidental death and injuries

*...managing our exposures*



# Scope of analysis

- Physical proximity to toxic materials
- Known impacts (80,000/15,000 tested)
- Measuring exposures (time/duration)
- Determining relative susceptibility
- Determining lifetime burden
- Symptom self-reporting

*...how will we do this accurately?*

# Som... Orlando homes built on top of bombs

by Travis Reed  
The Associated Press

ORLANDO — When residents of several neighborhoods near Orlando International Airport go to bed, they wonder what most homeowners don't: Is there a bomb under my house? They recently learned their 10-year-old developments were built on a World War II bombing range that wasn't

thoroughly cleared. Now they're scared for their lives and investments, and angry at developers and local governments that residents say shouldn't have allowed the homes in the first place. "This is the only home I have," Esperanza Hernandez says. "Nobody wants to buy a house in this community."

There are hundreds of former bombing and artillery training ranges across the

USA, but few have 2,000 homes sitting on top of them.

Since the Army Corps of Engineers began sweeping the Orlando neighborhoods a year ago, workers have found more than 200 munitions.

Most were recovered on the grounds of a middle school, including one lodged beneath the landing pit for the long jump.

The corps says it's extremely unlikely any of the

buried munitions would detonate, but that has done little to calm nerves. Some homeowners involved in class-action lawsuits over the site say banks have told them their properties aren't worth anything to lend against.

"This has been a failure of the government," said Ron Cumello, head of a local homeowners association.

The homebuilders, developers, the Army Corps and lo-

cal government that zoned the land blame one another. The former Pinecastle Jeep Range is one of about 9,000 "Formerly Used Defense Sites" the Army Corps oversees.

The corps' top priority is Spring Valley in Washington, D.C., where residents are above ground polluted by World War I chemical weapons testing and unexploded munitions.

## GROWING AIR POLLUTION IN DHAKA CITY

# Old, junk vehicles causing environmental hazards

BSS, Dhaka

Thick black smoke emitted by nearly 1.5 lakh old and junk vehicles is causing serious environmental hazards for Dhaka.

Nearly 50 percent of vehicles plying the roads in the capital do not have fitness certificates, a senior official of Bangladesh Road Transport Authority (BRTA) told BSS.

The owners of unfit vehicles manage

Air pollution levels in Dhaka are considerably higher than the limit mentioned in the World Health Organisation (WHO) guidelines for residential areas.

According to a study of WHO, blood lead level above 10 g/dl (microgram per deciliter) is considered to be a case of lead poison.

However, the lead level in the country's urban children was 5.8 to 21.6 g/dl, and the urban slum children's lead level

tory tract infections.

Other physical impacts of air pollution include damages to crops and ecosystems, degraded visibility, soiling of buildings, and damage to water quality through deposition of lead and other pollutants.

These effects on the ecosystem impair people's livelihood as well as health.

A large number of pedestrians, drivers, passengers, traffic policemen, street



## Life may be shorter in poorer neighborhoods

Tue, Dec 8 2009

By Megan Brooks

NEW YORK (Reuters Health) - Residents of poor neighborhoods may die sooner than residents of wealthier neighborhoods - regardless of what they eat, how active they are, or other individual risk factors, new research suggests.

This finding - that where you live might affect how long you live - comes from a study of more than 565,000 middle aged and older Americans enrolled in the NIH-AARP Diet and Health Study, which collected detailed data on diet, lifestyle, and medical history. Neighborhood characteristics were drawn from U.S. Census data for the year 2000.

"There was an increased risk of death from any cause or cancer in socioeconomically deprived neighborhoods," Dr. Chyke Doubeni told Reuters Health. What's noteworthy, he said, is that this difference "remained even after taking into account differences in dietary patterns and other person-level health risks."

Doubeni, assistant professor  
University of Massachusetts  
Association for Cancer Rese:  
Houston.



### Environmental pollution and degradation causes 40 percent of deaths worldwide, Cornell study finds

FOR RELEASE: Sept. 30, 1998

Contact: Roger Segelken  
Office: (607) 255-9736  
E-Mail: [hrrs2@cornell.edu](mailto:hrrs2@cornell.edu)

ITHACA, N.Y. -- A Cornell University analysis of population trends, climate change, increasing pollution and emerging diseases, as published in the October 1998 journal *BioScience*, points to one inescapable conclusion: Life on Earth is killing us.

**An estimated 40 percent** of world deaths can now be attributed to various environmental factors, especially organic and chemical pollutants, according to a study led by David Pimentel, professor of ecology and agricultural sciences at Cornell.

What's New  
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 Find a Support Group  
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## 2006 ASTHMA CAPITALS ANNOUNCED

**NEW RANKINGS SHOW NO CITY IS SAFE FROM ASTHMA – SCRANTON, RICHMOND, PHILADELPHIA TOP THE 2006 LIST**

*Allergic Asthma Remains a Major Public Health Issue*

**Contact:** [Angel Waldron](#) at 202-466-7643, x248

**WASHINGTON, D.C., February 8, 2006** – Scranton, PA, Richmond, VA, and Philadelphia, PA, are among America's top Asthma Capital based on twelve factors considered in the annual ranking of 100 major metropolitan areas, released today by the Asthma and Allergy Foundation of America (AAFA).

The research, conducted for the third year, shows that no place in America is safe from asthma, and that some cities are worse than others when it comes to risk factors and quality of life for asthma patients.

"There's no  
 won't solve  
 AAFA's D  
 that people  
 where to  
 treatment

# China faces reckoning over lead

Thousands have been sickened in a region where a cluster of factories processed the heavy metal for years.

**BARBARA DEMICK**  
 REPORTING FROM JIYUAN, CHINA

People in their 30s and 40s here complain of unpredictable senior moments: They go to the store and can't remember what they wanted to buy, or they forget the names of old friends.

The children lose so much weight that they look like they're shrinking instead of growing.

The leaves drop from the trees throughout the year — not just autumn — and the corn crop is stunted. Piglets are stillborn.

Now thousands of Chinese



Source: ESRI

MARK HAFER Los Angeles Times

extra money for fresh milk, which is believed helpful in reducing lead levels.



BARBARA DEMICK Los Angeles Times

**AILING:** One-year-old Chenpeng, who lives in Jiyuan, has chronic diarrhea and nosebleeds. His blood lead level tested more than three times the level considered dangerous.

spokesman for Yuguang, a 60-year-old company that trades on the Shanghai stock ex-

a good reputation in Jiyuan, funding public buildings and sports, underwriting a wom-

in Jiyuan also imported ores to be refined into electrolytic lead and exported to the United States and Europe.

"We did the work that developed countries don't want to do, making huge profits from a product that damages the environment," said Li, a 41-year-old lead factory worker from Jiyuan who asked to be quoted only by his surname.

After he got out of the army in 1991, Li started working in the lead industry, first for Yuguang, later for another firm, Wanyang. He says he didn't have much choice because the land in his village had been expropriated for smelters.

"We sort of knew it was dangerous, but the lead factories were the only ones that paid on time and provided stable work," said Li, who made about \$300 a month, almost double the wages at other factories.

He had a key job, separating lead from ore at the smelting

Standing 5-ft weights 130 pounds, Li constantly got forgetting what he

"It is like no work anymore.

But before, the lead in the villages was, it is not a down narrow door a home with flat-screen TVs.

And despite their situation, residents say the villages of rather than for to close.

"They will leave the village and put us to Li said. "Maybe won't want to rest of us are here."

"There is no



**M**EDICINE AND PUBLIC HEALTH HAVE II to trains on parallel tracks, with opposite directions, looking out on the same landscape. As described by Shalala,<sup>1</sup> the passengers on the medical train see the individual trees—differences in size, color, age, and health; and those aboard the public health train see the forest—poorly defined, similar trees, growing together and weathering the same winds. Although the 2 have potentially complementary efforts to improve care as well as personal and population health, these efforts are hampered by lack of communication and coordination between medical and public health professionals and their data systems. Differing perspectives and disconnected efforts also hindered effectiveness of shared efforts between medical professionals and other stakeholders, including community organizations and health plans. Although the synergy between medical care and public health is becoming increasingly apparent, emerging technologies and the urgent need for health care create the opportunity and imperative for them to coordinate their efforts.

Progress toward improving health care quality as in the United States remains slow. Even within a



You are here: [EPA Home](#) [Air & Radiation](#) [Particulate Matter](#) [Health and Environment](#)

The size of particles is directly linked to their potential for causing health problems. Small particles less than 10 micrometers in diameter pose the greatest problems, because they can get deep into your lungs, and some may even get into your bloodstream.

Exposure to such particles can affect both your lungs and your heart. Small particles of concern include "inhalable coarse particles" (such as those found near roadways and dusty industries), which are larger than 2.5 micrometers and smaller than 10 micrometers in diameter; and "fine particles" (such as those found in smoke and haze), which are 2.5 micrometers in diameter and smaller.

The Clean Air Act requires EPA to set air quality standards to protect both public health and the public welfare (e.g. crops and vegetation). Particle pollution affects both.

Particle pollution - especially fine particles - contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing, for example;
- decreased lung function;
- aggravated asthma;
- development of chronic bronchitis;
- irregular heartbeat;
- nonfatal heart attacks; and
- premature death in people with heart or lung disease.

FedUC 2010

Published on Environmental Working Group (<http://www.ewg.org>)

## Rocket Fuel in Drinking Water

New data show widespread nationwide contamination

Published March 3, 2003

## Rocket Fuel in Drinking Water

Drinking water for more than 20 million Americans is contaminated with a toxic legacy of the Cold War; A chemical that interferes with normal thyroid function, may cause cancer and persists indefinitely in the environment, but is currently unregulated by state or federal authorities.

Perchlorate, the explosive main ingredient of rocket and missile fuel, contaminates drinking water supplies, groundwater or soil in hundreds of locations in at least 43 states, according to Environmental Working Group's updated analysis of government data. EWG's analysis of the latest scientific studies, which show harmful health effects from minute doses, argues that a national standard for perchlorate in drinking water is needed.   
Agency curr

**Rocke  
Pollut**

## Dirty air, heat, cold may all trigger heart attacks

Tue Nov 10 12:52:04 UTC 2009

By Anne Harding

NEW YORK (Reuters Health) - Extreme temperatures and heavy air pollution boost heart attack risk, according to a major new study.

And on days when the air is extra dirty and the temperature is unusually hot or cold, the effects are likely to be particularly bad, given that temperature and pollution seem to harm the body in different ways, Dr. Krishnan Bhaskaran of the London School of Hygiene and Tropical Medicine in the UK, the lead author of the research, told Reuters Health.

Several studies have linked changes in temperature to increases in deaths due to any cause, as well as heart disease mortality, Bhaskaran and his team note in their reports. But looking at heart attacks-not just deaths from heart disease-could offer a more accurate picture of the overall health risks of temperature changes and air pollution, they say, and might also offer clues to why they may trigger heart attack in high-risk people.

In two separate reports, the researchers reviewed 19 studies on temperature and heart attack and 26 examining air pollution and heart attack.





Los Angeles Times -  
Friday, November 13, 2009

A22 FRIDAY, NOVEMBER 13, 2009

Los Angeles Times

LATIMES.COM/NATIO

# A radioactive wasteland in Nevada

[Nevada, from Page A1]  
water crisis and a population boom, state officials are taking a new measure of the damage. They have successfully pressured federal officials for a fresh environmental assessment of the 1,375-square-mile test site, a step toward a potential demand for monetary compensation, replacement of the lost water or a massive clean-up.



AOL news

<http://news.aol.com/article/officials-point-to-uranium-mine-as-water/778556?cid=main|html>

## Mine Pollutes Water With Uranium

YERINGTON, Nev. (Nov. 21) — Peggy Pauly lives in a robin-egg blue, two-story house not far from acres of onion fields that make the northern Nevada air smell sweet at harvest time.

But she can look through the window from her kitchen table, just past her backyard with its swingset and pet llama, and see an ominous sign on a neighboring fence: "Danger: Uranium Mine."

For almost a decade, people who make their homes in this rural community in the

contamination has moved off the site," she said. "But what we are happy about is ... they have enough data to now answer our questions."

"Prior to this, we didn't really have an understanding of where water was moving," said Steve Acree, a highly regarded hydrogeologist for the EPA in Oklahoma, who was brought in to examine the test results. "My interpretation at this stage of the process is yes, you now have evidence of mine-impacted groundwater."

# SOME Orlando homes built on top of bombs

by Travis Reed  
The Associated Press

ORLANDO — When residents of several neighborhoods near Orlando International Airport go to bed, they wonder what most homeowners don't: Is there a bomb under my house? They recently learned their new year-old developments were built on a World War II bombing range that wasn't

thoroughly cleared. Now they're scared for their lives and investments, and angry at developers and local governments that residents say shouldn't have allowed the homes in the first place. "This is the only home I have," Esperanza Hernandez says. "Nobody wants to buy a house in this community."

There are hundreds of former bombing and artillery training ranges across the

USA, but few have 2,000 homes sitting on top of them.

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Most were recovered on the grounds of a middle school, including one lodged beneath the landing pit for the long jump.

The corps says it's extremely unlikely any of the

buried munitions would detonate, but that has done little to calm nerves. Some homeowners involved in class-action lawsuits over the site say banks have told them their properties aren't worth anything to lend against.

"This has been a failure of the government," said Ron Cumello, head of a local homeowners association.

The homebuilders, developers, the Army Corps and lo-

cal government that zoned the land blame one another. The former Pinecastle Jeep Range is one of about 9,000 "Formerly Used Defense Sites" the Army Corps oversees.

The corps' top priority is Spring Valley in Washington, D.C., where residents are above ground polluted by World War I chemical weapons testing and unexploded munitions.

Printed from

THE TIMES OF INDIA

## Pesticide exposure raises Parkinson's risk

ANI, 22 April 2009, 08:21pm IST

Online Executive MBA - Earn an Executive MBA Online at the Rochester Institute of Technology : [EmbaOnline.RIT.Edu](http://EmbaOnline.RIT.Edu)

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WASHINGTON: Exposure to pesticides can increase the risk of [Parkinson's disease](#), say researchers. Researchers from University of California, Los Angeles have found that fungicide maneb and herbicide paraquat can have detrimental effects on humans.

In a new epidemiological study of Central Valley residents who have been diagnosed with [Parkinson's disease](#), researchers found that years of exposure to the combination of these two pesticides increased the risk of Parkinson's by 75 percent. Further, for people 60 years old or younger diagnosed with [Parkinson's](#), earlier exposure had increased their risk for the disease by as much as four- to six-fold.

Reporting in the April 15 issue of the American Journal of Epidemiology, Beate Ritz, professor of epidemiology at the UCLA School of Public Health, and Sadie Costello, a former doctoral student at UCLA who is now at the University of California, Berkeley, found that Central Valley residents who lived within 500 meters of fields sprayed between 1974 and 1999 had a 75% increased risk for [Parkinson's](#).

In addition, people who were diagnosed with Parkinson's at age 60 or younger were found to have been at much higher risk because they had been exposed to maneb, paraquat or both in combination between 1974 and 1989, years when they would have been children, teens or young adults.

The researchers enrolled 368 longtime residents diagnosed with Parkinson's and 341 others as a control group.

Text Size |



# Linking Your Health to Your Environment



How does your environment impact your personal health?

At TEDMED 2009, Bill Davenhall shared his search for the missing piece to his own personal health story. Discover why he believes physicians should ask about the geographic information contained within our own place histories in addition to the standard questions regarding genetics and lifestyle. Then, compare your health to where you live by creating your own report.

What environmental exposures do you personally experience?

Would any of this geographically rich information be useful at your next physician visit?

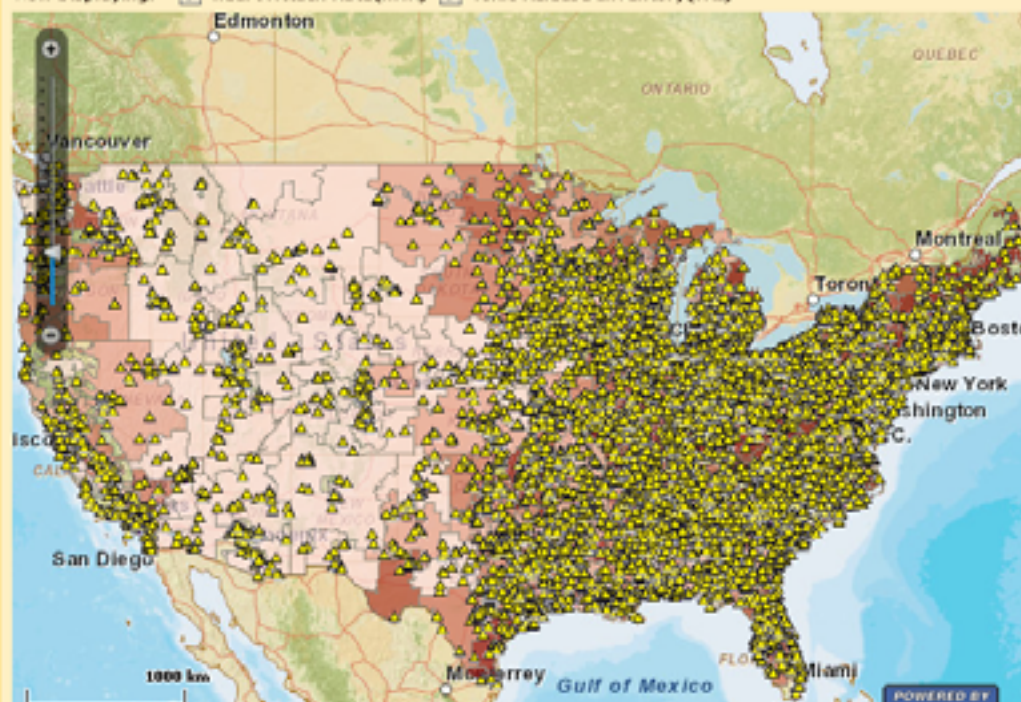


**Bill Davenhall**

Global Marketing Manager, Health and Human Services Solutions, ESRI  
Hear about my personal health "train wreck" and the underlying environmental factors in my place history that may have contributed to it.

## Explore Your Place History

Now Displaying: ☒ Heart Attack Rate(HAR) ☒ Toxic Release Inventory(TRI)



### 1 Where have you lived?

Enter a location

LOCATE

Enter an address, city or ZIP CODE where you have lived for two or more years

### 2 Place Histories


CREATE REPORT

SHARE YOUR MAP

Map Legend





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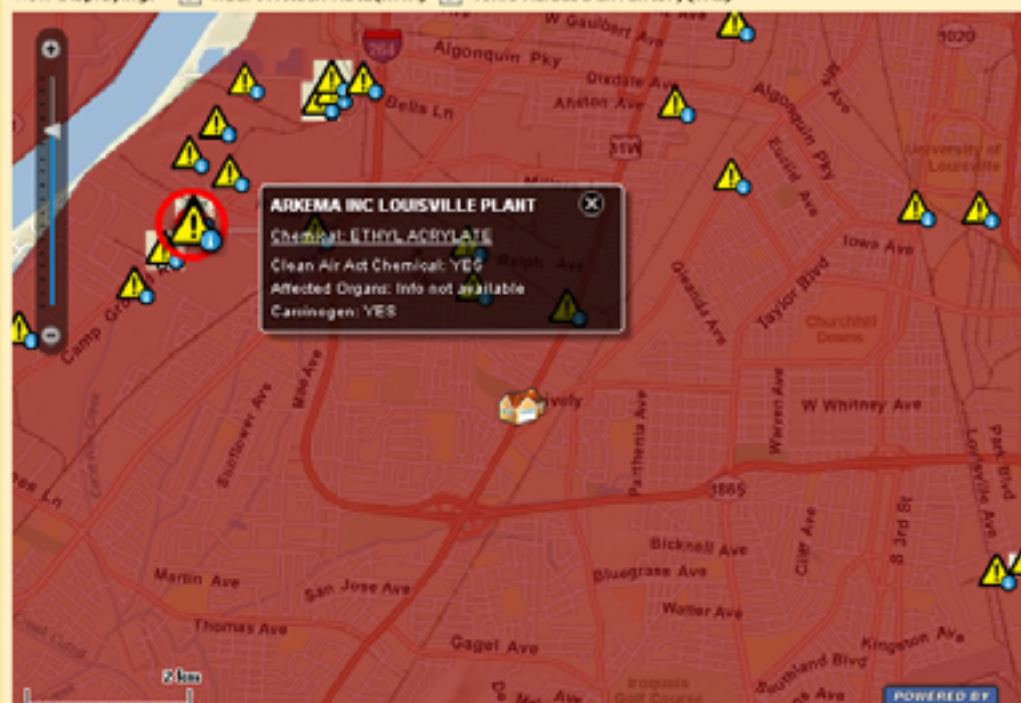


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### 1 Where have you lived?

redlands, ca **LOCATE**

Enter an address, city or ZIP CODE where you have lived for two or more years

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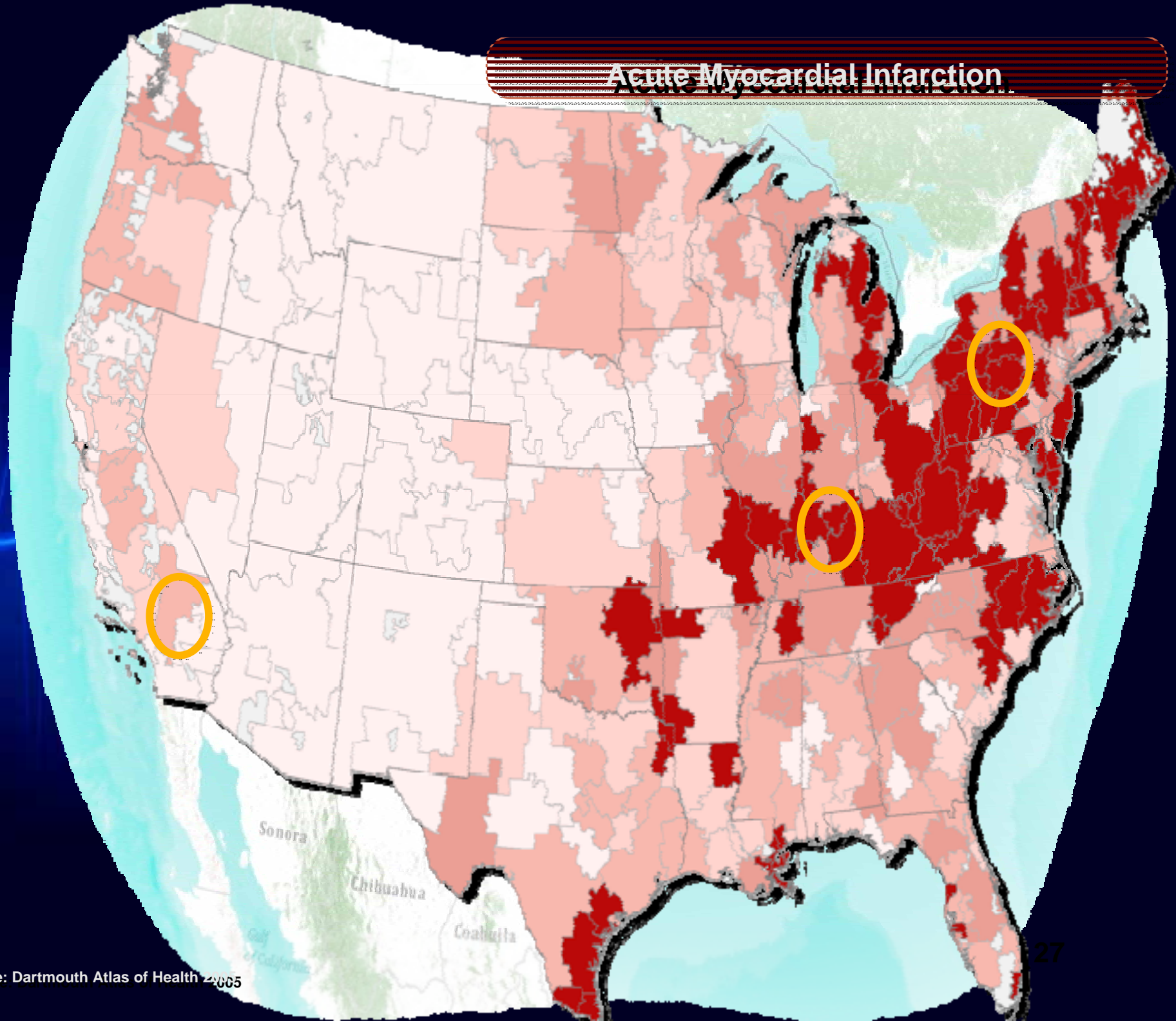
Owensboro, KY	10 chemicals/3 miles; HAR 0	<b>-</b>
Lexington, KY	23 chemicals/3 miles; HAR 8	<b>-</b>
Atlanta, GA	8 chemicals/3 miles; HAR 10.84	<b>-</b>
Shively, KY	99 chemicals/3 miles; HAR 9.21	<b>-</b>
Redlands, CA	2 chemicals/3 miles; HAR 7.04	<b>-</b>

**CREATE REPORT** **SHARE YOUR MAP**

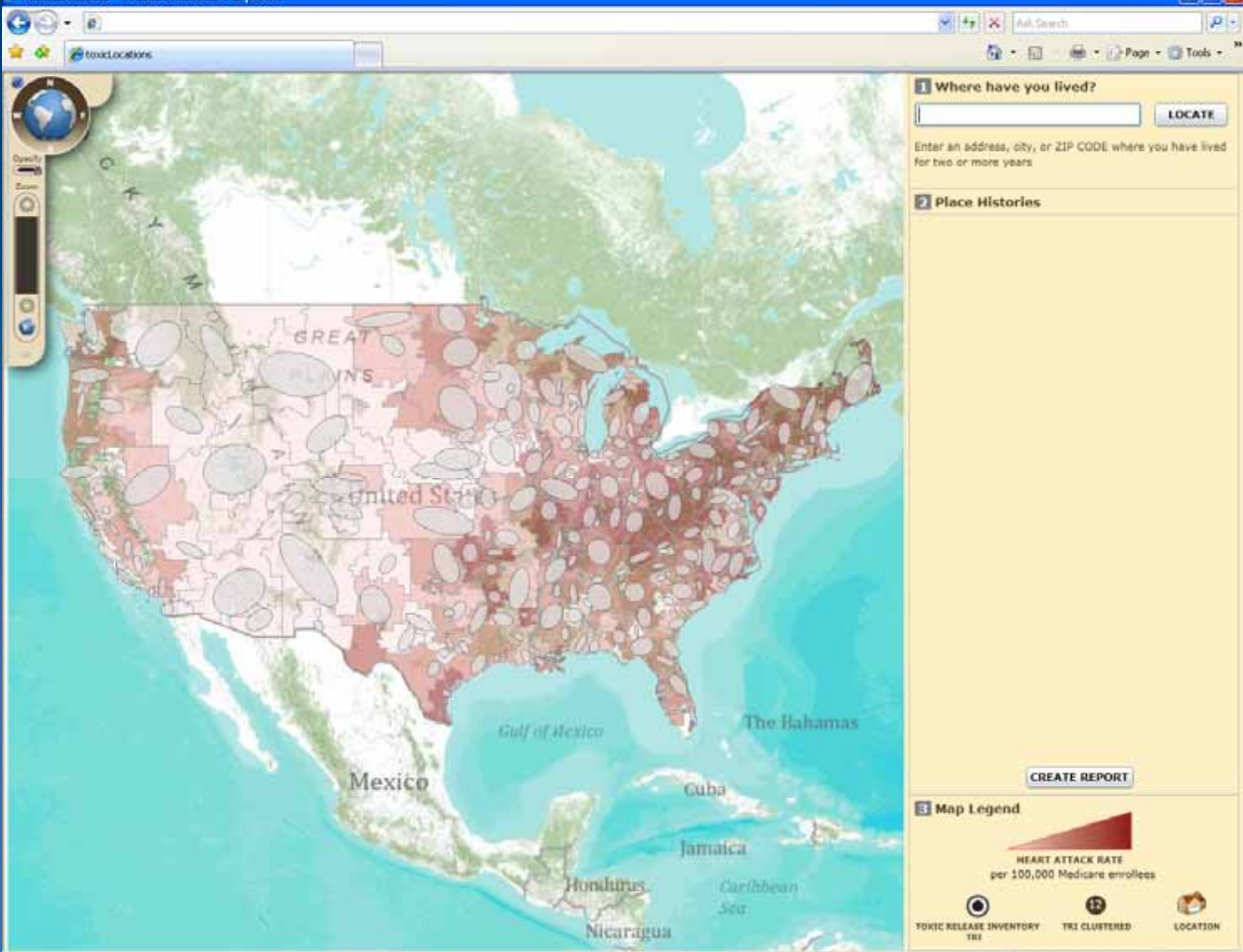
### Map Legend



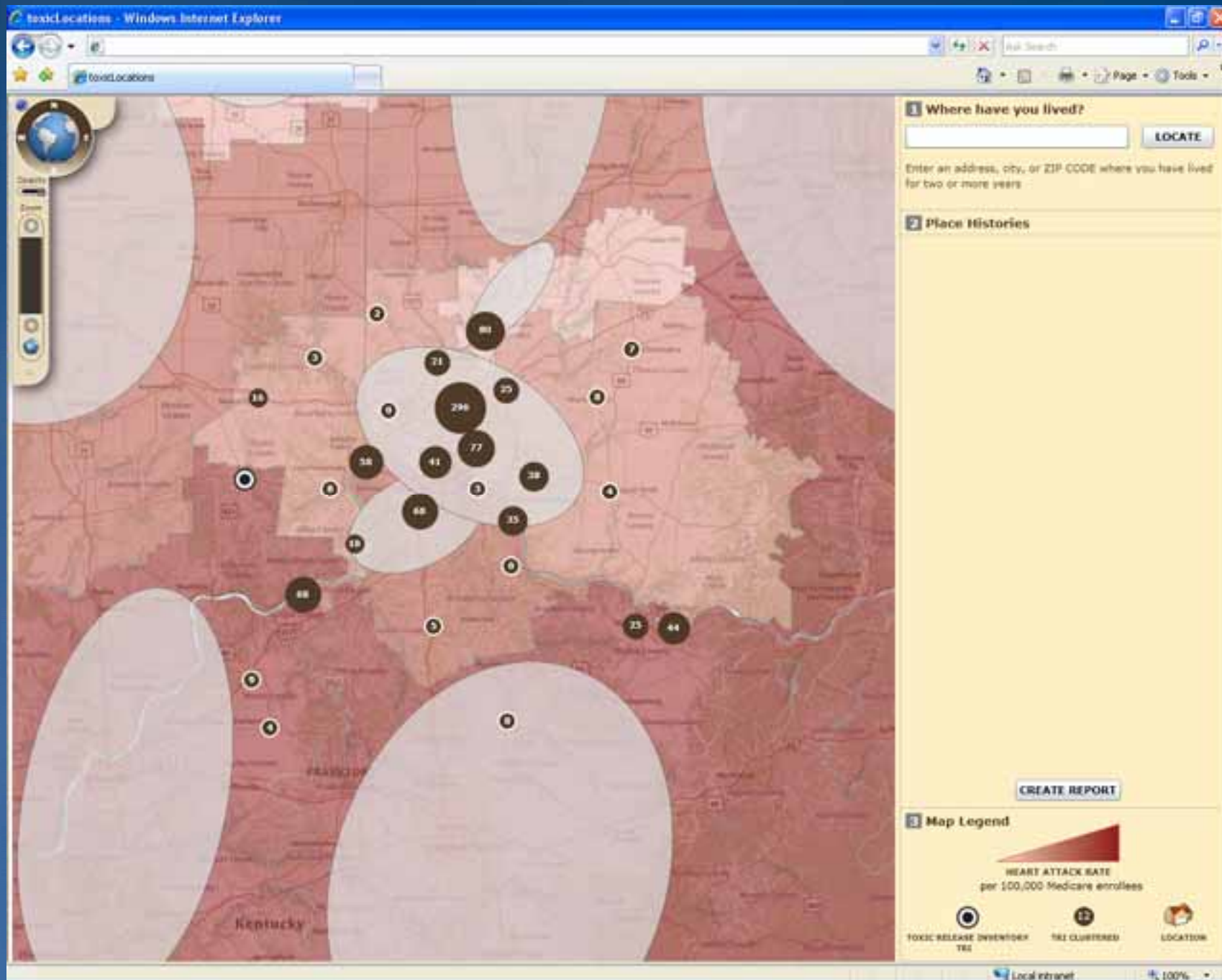
## Acute Myocardial Infarction

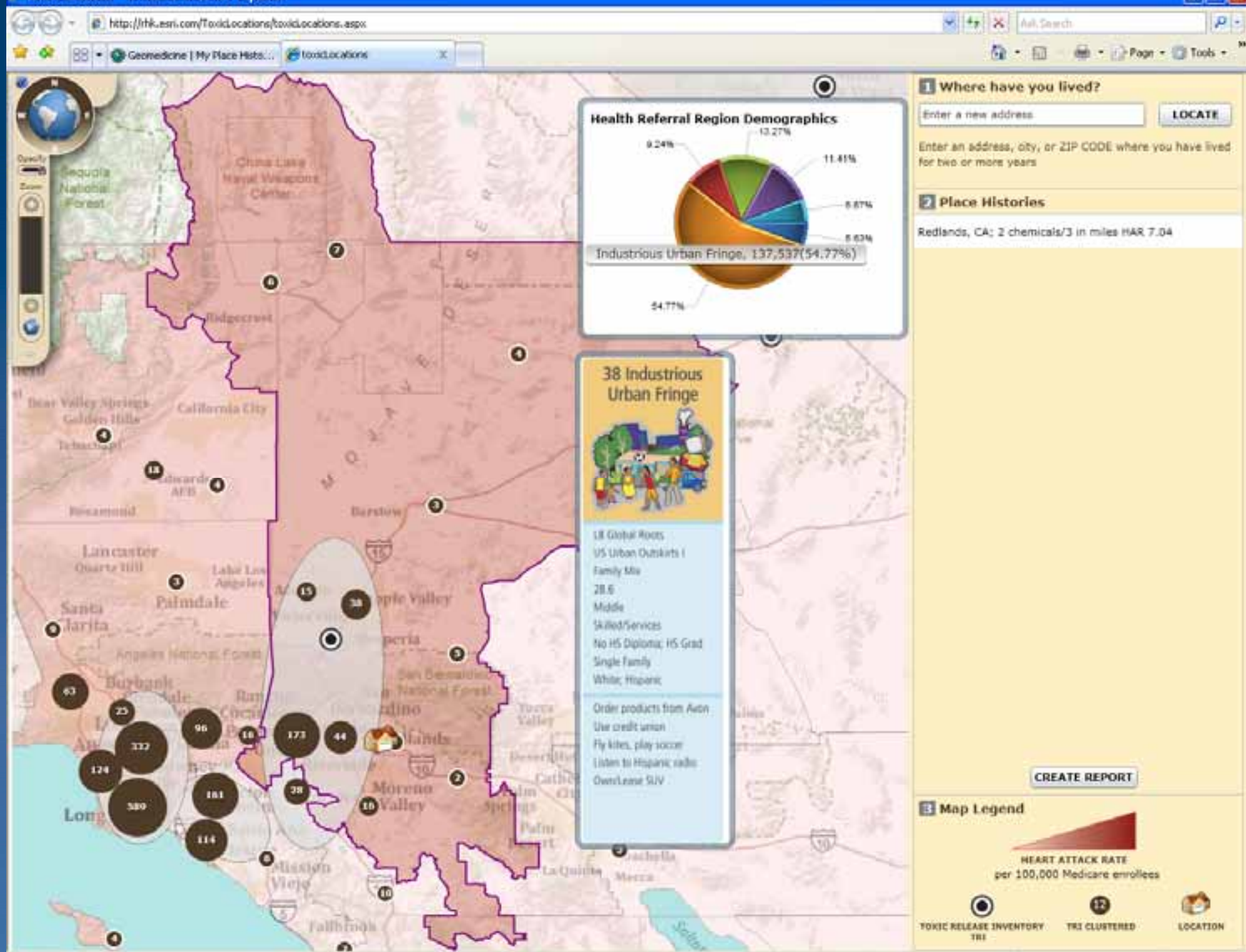
















Search  as Agent Disease Job

Haz-Map Search More Searches Haz-Map Help Glossary

### Browse Haz-Map

Agent Name	Ethyl acrylate
Alternative Name	Acrylic acid, ethyl ester
CAS Number	140-88-5
Formula	C5-H8-O2
Major Category	Plastics & Rubber
Synonyms	2-Propenoic acid, ethyl ester; Acrylate d'ethyl ester; Acrylic acid, ethyl ester (inhibited) [German]; Aethylacrylat [German]; Akrylanes 511; Ethoxycarbonylethylene; Ethyl 2-propenoate (natural); Ethyl acrylate, inhibited; Ethyl propenoate [Dutch]; Ethylakrylat [Czech]; Ethylester kyseliny akrylove [Czech]; Etil acrilato [Italian]; Etilacrilatului [Romanian]
Category	(Meth)acrylates
Description	Colorless liquid with an acid odor. [NIOSH]
Sources/Uses	Used to make acrylic resins for fibers, adhesives, coatings, textiles, paper, and leather. [ACGIH]
Comments	Liquid causes first degree burns on short exposure. [NIOSH] Pulmonary edema may result from inhalation of high concentrations. [NIH-HSFS] Merck Index # 3759; A lachrymator; Causes

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Comments	Liquid causes first degree burns on short exposure. [NIOSH] Pulmonary edema may result from inhalation of high concentrations. [NIH-HSFS] Merck Index # 3759; A lachrymator; Causes damage to the liver, kidneys, and lungs in high-dose animal experiments. [HSOB]
Reference Link	<a href="#">Sensitization to patch test acrylates</a>
<b>Exposure Assessment</b>	
Skin Designation (ACGIH)	Insufficient data
TLV (ACGIH)	5 ppm
STEL (ACGIH)	15 ppm
PEL (OSHA)	25 ppm
MAK	5 ppm
IDLH (NIOSH)	300 ppm
Excerpts from Documentation for IDLHs	Human data: Prolonged inhalation exposures at 50 to 75 ppm produced drowsiness, headache, and nausea [Hemec and Bauer 1978]
Vapor Pressure	29 mm Hg
Odor Threshold Low	0.0002 ppm
Odor Threshold High	0.0013 ppm
BD50	315 ppm
Lethal Concentration	LC50 (rats) = 1.414 ppm/4h
Explanatory Notes	Detection odor threshold from AHA (mean = 0.00024 ppm);
Reference Link	<a href="#">International Chemical Safety Cards (WHO/IPCSSLO)</a>
Flammability (NFPA)	2, may ignite at ambient temperature
<b>Adverse Effects</b>	
Toxic Pneumonitis	Yes
Dermatotoxin	Skin Burns
Skin Sensitizer	Yes
Lachrymator	Yes
Hepatotoxin	Hepatotoxin, Secondary



# Data Sources

- **Toxic Release Inventory**
  - TRI - US EPA - (since 1987)
  - Private/Public entities (1987), Federal (1994)
  - 600 out of 80,000 chemicals monitored
  - Does not include auto/truck emissions /fertilizers/pesticides
  - Linked to NIH, NLM chemical profiles
  - 94,000 annual reports/25,000 establishments
- **Dartmouth Atlas of Health Care – (since 1996)**
  - US DHHS/CMS (claims data)
  - Medicare patients only

***...using data that has stood the test of time***

# Future of geomedicine

- Place histories common
- Product use histories common
- Personal – epidemiology
- Rise of new sub-specialties
- Unprecedented patient data flows
- Increasing geographical transparency

*...managing our environmental inventories*

# Geomedicine

## integrating geographically relevant health information

Administrative – Financial – Operational

### Programs

Infants  
Children  
Adults  
Seniors  
Special

### Facilities

Providers  
Services  
Offices  
Schools  
Employers

### Roles

Planning  
Analyzing  
Monitoring  
Communicating  
Reporting

### Geographies

Counties  
Cities  
Regions  
Postal  
Village

location

the common denominator



**“Geography is Destiny in Medicine”**

## Jack Lord, MD



**Bill Davenhall**  
**Global Manager**  
**Health and Human Services**  
**ESRI**  
**[bdavenhall@esri.com](mailto:bdavenhall@esri.com)**