

# Carbon Dioxide The Other Silent Killer

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# Carbon Dioxide

- On February 26, 2016 at 9:45 AM a gas company in Warwick County Indiana received a call from a customer regarding an issue with all of the gas fired appliances in their home.
- There was no heat, no hot water, and the range would not light.

# Carbon Dioxide

- What the gas company personnel and local responders were soon to find out is that the occupants of the home were very lucky to be alive.

# Historical Information

- Warrick County Indiana is one of the largest strip mining areas in the State of Indiana.
- Thousands of acres were disturbed over the last 80 years in the process of removing the coal.
- The State of Indiana put in place a program to reclaim and repurpose much of this land.

# Map Showing Surface Coal Mines in Warrick County, Indiana

## Explanation

-  Surface Mine
-  Mine Identification Number

## Map Description

This map shows the location and extent of surface coal mines in Warrick County, Indiana, which includes updated mine maps as published annually from the Indiana Department of Natural Resources, Division of Reclamation and the Indiana Bureau of Mines.

Other areas shown on this map were adapted from information collected by the Indiana Geological Survey (IGS) in the mid-1980s and published as the first Coal Map series. Original information collected for the Coal Maps was obtained from a variety of sources including IGMR Division of Reclamation maps, Annual IGMR Geologic Reports, mining company reports, and/or geologic reports, geologic field notes, and several series of published maps.

## Additional Information

All mine data shown on this map are registered in a Geographic Information System (GIS) using ArcView software of the Environmental Research Institute (ERI) on the Windows platform. The data were compiled using a 1:50,000 scale map projection and the 1:50,000 scale coordinate system derived from U.S. Geological Survey 7.5-minute quadrangle maps.

Some of the mine areas shown on this map were obtained from information collected by the Indiana Geological Survey (IGS) in the mid-1980s and published as the first Coal Map series. Original information collected for the Coal Maps was obtained from a variety of sources including Indiana Department of Reclamation maps, Annual IGMR Geologic Reports, mining company reports, and/or geologic reports, geologic field notes, and several series of published maps.

## Data Availability

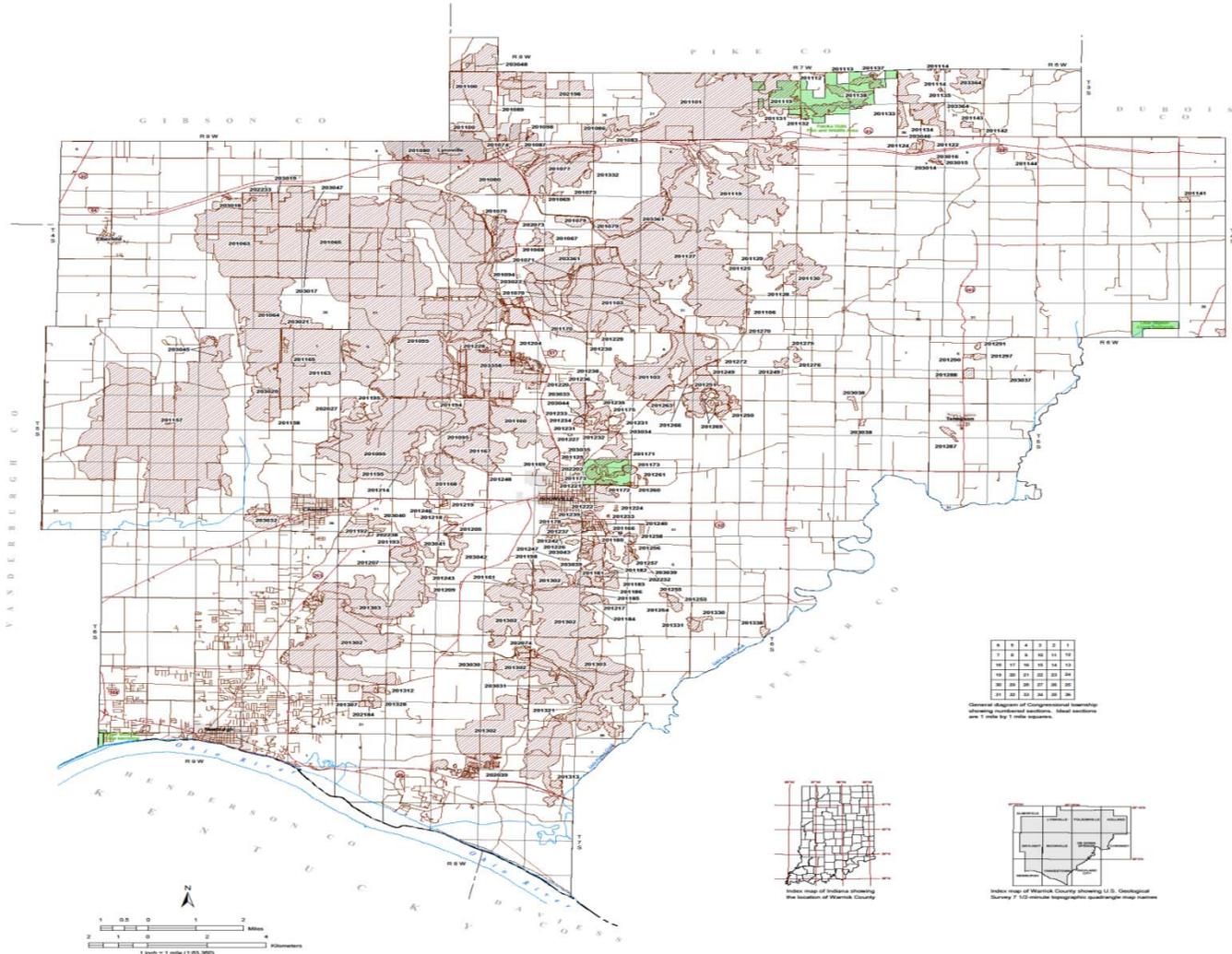
Paper and digital copies of this map are available for purchase through the Publications Sales Office of the Indiana Department of Natural Resources. Requests for specific mine information should be directed to the Coal and Industrial Minerals Section, Indiana Geological Survey.

811 North Walnut Street  
 Indianapolis, IN 46202  
 Phone (317) 855-1700  
 Fax (317) 855-0202  
 e-mail: IGMR@Indiana.edu  
 URL: <http://www.in.gov>

Some mine locations are approximate and incomplete. Please provide additional information to the Coal and Industrial Minerals Section, Indiana Geological Survey.

## Disclaimer

This Map Information Map was compiled by Indiana University, Indiana Geological Survey using data believed to be accurate. The Indiana Geological Survey is not responsible for any errors, omissions, or misstatements of fact, whether expressed or implied, in this map or in any other products or services of the Indiana Geological Survey. There is no attempt to either design or protect users of this map by either the terms or conditions of any purchase or use of this map. This map is provided as a service to the public and is not intended to be used for any other purpose. The map is provided as a service to the public and is not intended to be used for any other purpose. The map is provided as a service to the public and is not intended to be used for any other purpose.



4	3	2	1
11	10	9	8
18	17	16	15
25	24	23	22
32	31	30	29
39	38	37	36
46	45	44	43
53	52	51	50

General Diagram of Congressional Districts showing approximate locations. Mine locations are 1 mile by 1 mile systems.



Inset map of Indiana showing the location of Warrick County.



Inset map of Warrick County showing U.S. Geological Survey 7.5-minute topographic quadrangle map areas.



Landmark county boundaries, water, and towns digitized from 1:50,000 scale USGS topographic maps. Mine areas digitized from 1:50,000 scale USGS topographic maps. Data compiled by ERI, IGMR, and IGMR staff. Copyright 1998, Indiana Geological Survey.

Coal Mine data compilation system developed by ERI, IGMR, and IGMR staff. Compiled by ERI, IGMR, and IGMR staff. Last revised December, 2011.

# Historical Information

- This particular home was built recently on a ten acre plot in one of the reclaimed mining areas.
- The home was situated on the highest point on the property.
- The occupants of the home are in their mid 50s and recently downsized after their children had moved on.







# Physical Properties of CO<sub>2</sub>

- Carbon Dioxide is an odorless, colorless gas that is common in our environment.
- It has many uses from the propellant in a fire extinguisher to the carbonation in soda and beer.
- The density of CO<sub>2</sub> is twice that of air, 1.977.
- Unlike Carbon Monoxide that is toxic in small quantities, Carbon Dioxide is not toxic but is, however, a simple asphyxiant.

# Carbon Dioxide Production

- Carbon Dioxide is a by-product of combustion and decomposition.
- It can be found in any area where decomposition of biodegradable matter is taking place, landfills, swamps, coastal areas, sewers, etc.

# Carbon dioxide Production

- Decomposition gas from a landfill is approximately:
  - 60% CO<sub>2</sub>
  - 40% Methane
  - Varying amounts of H<sub>2</sub>S

# The Incident

- Prior to the customer calling about the inoperable appliances, there had been significant rainfall, including .99 inches that fell the night before.
- When the first responder from the gas company arrived, he immediately noticed that his gas detector was not working properly and that he felt light headed with a slight headache.

# The Incident

- Quick thinking on his part, he told the occupant to evacuate while he vented the residence.
- Local first responders were called at this time to assist over concerns for the occupant.
- Subsequent remote testing after ventilation of the home, found only 12.7% oxygen in the basement.

# Prior to the Incident

- Home owner mentioned that they often had to relight the pilot light on the water heater in the garage, five or six times a week.
- On the day of the incident, the husband went to the garage to start his vehicle, a brand new Toyota pickup truck, and it wouldn't start.
- Not until after he opened the garage door, did the vehicle start.

# Prior to the Incident

- After testing determined that the cause of the incident was CO<sub>2</sub> generated by decomposition of biodegradable fill material, members of the local fire company told the gas company personnel that they had four previous calls involving reduced oxygen levels in other homes in the same area.

# Prior to the Incident

- In one of the incidents, it was related to them that a 64 year old woman had passed away in her sleep. Two weeks after her passing, her husband call 911 to complain about nausea, dizziness, and shortness of breath. Reduced oxygen levels in the home were again the cause.

# Prior to the Incident

- The County Coroner had determined she had died of natural causes. Now they aren't too sure of that finding.

# Remediation

- The house was built with a radon gas removal system that was not active, no blower. A blower was installed and activated.
- However, concerns that this would put a negative pressure on the house, an HVAC contractor also installed an ERV (energy recovery ventilator) to supply make up air.

# Remediation

- The gas company personal also recommended, and the home owner agreed, that they install a CO<sub>2</sub>/O<sub>2</sub> monitor in the basement.



639 ppm

CO<sub>2</sub> GOOD

Year: 00-01-01  
Month: 01  
Day: 01  
AM 01:23

Air Temp. 15.4°C

Humidity 25.6%

CO2METER.COM

SET

ESC

RESET

MIN/MAX

# Post Incident Considerations

- Should we be concerned that this may happen in this area? Definitely.
- This is the third incident involving CO<sub>2</sub> that I am aware of, an operator in New Jersey had two similar incidents involving their workers, both after a heavy rain fall and flooding, both while entering a basement to check the status of appliances.

# Summary

- Carbon Dioxide is naturally occurring in the subsurface environment from decomposition.
- This can be from a landfill, swamp/coastal area, or, as in this incident, reclaimed real estate where a significant amount of fill material has been imported.
- In each incident it appears that significant rain fall precipitated the displacement of the Oxygen by the Carbon Dioxide in the ground.

# Conclusions

- Carbon Dioxide is twice the weight of air.
- A Combustible Gas Detector may not read accurately, if at all, in a reduced oxygen environment.
- If Carbon Dioxide is suspected, the simplest test is to check the Oxygen levels.
- If CO<sub>2</sub> is suspected, consider the location, environment and weather conditions.

Thank You

Questions?