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Debra Smit, Breathe Project
412-760-7677, dsmit@breatheproject.org

Peer-Reviewed Study Documents Dramatic Health Impacts from Clairton Coke Works Explosion/Fire from Winter/Spring 2018/2019

A peer-reviewed study,¹ conducted by Community Partners in Asthma Care Dr. Deborah A. Gentile, medical director, shows a near doubling of the number of acute outpatient and emergency department visits for asthma during the 2018/2019 Clairton Coke Works fire as compared to the same time frame the year before.

The results point to a need to establish a rapid alert system to promptly notify impacted residents and to activate protective health strategies and emergent medical care during such pollution events.

The study, published in the journal *Toxics*, used actual asthma diagnoses as an objective measure of asthma morbidity. The results provide more objective evidence of the impact of the fire at U.S. Steel's plant beyond the recently-released University of Pittsburgh study,² which relied on self-reported symptoms and rescue medication in a subjective survey.

The study's goal was to evaluate the impact of the Clairton Coke Works fire industrial incident and the resulting air pollution exceedances on asthma morbidity. The authors assessed pre-fire and post-fire rate ratios (RR) of outpatient and emergency department (ED) visits for asthma exacerbations among adult residents living in proximity to the damaged Clairton Coke Works that continued to operate from Dec.24, 2018 through Feb. 28, 2019 as compared with a pre-fire period of Dec. 24, 2017 through Feb. 28, 2018.

¹ Morphew, T.L.; Venkat, A.; Graham, J.; Mehalik, M.; Anderson, N.; Gentile, D. Impact of a Large Fire and Subsequent Pollution Control Failure at a Coke Works on Acute Asthma Exacerbations in Nearby Adult Residents. *Toxics* 2021, 9, 147. <https://doi.org/10.3390/toxics9070147>.

² Brandy M. Byrwa-Hill, Albert A. Presto, Sally Wenzel, and James P. Fabisiak, "Impact of a pollution breach at a coke oven factory on asthma control in nearby vulnerable adults." *The Journal of Allergy and Clinical Immunology*. Published April 20, 2021. DOI: <https://doi.org/10.1016/j.jaci.2021.04.011>.

The results of the study show a near doubling of the number of acute outpatient and ED visits for asthma exacerbations in the period after, as compared to the period before, the Clairton Coke Works fire. Specifically:

- In the timeframe before the fire, there were 54 acute outpatient visits; and after the fire, there were 98 acute outpatient visits. This translates to a pre-fire versus post-fire increase in the outpatient rate from 5.6 to 10.2 per 1000 residents, respectively (RR=1.82; 95% CI: 1.30, 2.53; p<0.001).
- In the timeframe before the fire, there were 19 ED visits; and after the fire, there were 35 ED visits. This translates to a pre-fire versus post-fire increase in the ED visit rate from 2.0 to 3.6 per 1000 residents, respectively (RR=1.84; 95% CI: 1.05, 3.22; p=0.032).
- Overall, there were 73 and 133 total visits for asthma exacerbations before and after the fire, respectively. The 82% increase from 7.6 to 13.8 total acute asthma visits per 1000 residents pre-fire and post-fire, respectively, was significant (RR=1.82; 95% CI: 1.37, 2.42; p<0.001).

The study showed that these increases in asthma exacerbations corresponded with a large increase in the amount of sulfur dioxide (SO₂), a pollutant regulated under the Clean Air Act and recorded at air monitors located in the communities near the Clairton Coke Works plant. Post-fire, the distribution of the median SO₂ level more than doubled that observed in the pre-fire period. Pre-fire and post-fire median SO₂ (ug/m³) distributions were 8.00 [2.00, 27.00] and 18.50 [6.75, 37.25], respectively (p=0.014).

The study also tracked the effects of elevated PM 2.5 particles, SO₂, and hydrogen sulfide (H₂S) emission levels by looking at the effects of asthma exacerbation on days when these pollutants exceeded concentration limits set by the Environmental Protection Agency (EPA), the PA Department of Environmental Protection (DEP), and the Allegheny County Health Department.

In terms of PM 2.5 particle pollution exceedances during the study periods, total asthma visits more than doubled. The rate of total asthma visits was 0.15 on PM_{2.5} non-exceedance days (<35 ug/m³) and more than doubled to 0.37 on PM_{2.5} exceedance days (>35 ug/m³). On days with PM_{2.5} >35 versus <35 ug/m³, the rate ratio was 2.47 (95% CI: 1.52, 4.01; p<0.001).

For SO₂ exceedances, the rate of total asthma visits increased 60%. The rate of total asthma visits was 0.15 on SO₂ non-exceedance days (<75 ug/m³) and increased to 0.24 on exceedance days (>75 ug/m³). On days with SO₂ >75 versus <75 ug/m³, the rate ratio was 1.58 (95% CI: 1.00, 2.48; p=0.048).

For H₂S exceedances, the rate of total asthma visits increased by 86%. The rate of total asthma visits was 0.14 on H₂S non-exceedance days (<5 ppb) and increased to 0.26 on H₂S exceedance days (>5 ppb). On days with H₂S >5 versus <5 ppb, the rate ratio was 1.79 (95% CI: 1.27, 2.54; p=0.001).

The study found that the results were not due to weather factors or flu-season factors. There was no evidence of increased weather inversion events before as compared to after the fire. The average daily strength, depth and duration of inversions did not significantly differ between the contrast time periods. The average daily temperature and wind direction and speed did not differ significantly during the contrast time periods. There was no evidence that severity or peak of influenza season contributed to the post-fire findings of increased asthma visits. The influenza season was milder post-fire as compared to pre-fire and it peaked outside of the post-fire study period.

The study contributes to the identification and understanding of the effect of this incident on health outcomes, and will be disseminated to community residents, leaders, and officials to motivate the development of relevant public health policies to protect impacted residents during such events. Such policies should include regulations that industries curtail emissions during exceedances of outdoor air pollution levels.

The results point to a need for a rapid alert system to be established to promptly notify impacted residents so they can respond with protective health strategies during such events. For example, residents with asthma should receive targeted messages to limit outdoor air pollution exposure, implement self-management plans and start or increase controller medications. Additionally, more vulnerable residents, such as those with asthma or other pre-existing respiratory conditions, should be advised and/or assisted to relocate immediately.

The results point to a need for a rapid response system to be developed to quickly assess immediate health impacts and provide both preventative and emergent medical care, and a health registry should be developed in vulnerable communities to track short-term and long-term outcomes related to OAP exposure.

Morphew, T.L.; Venkat, A.; Graham, J.; Mehalik, M.; Anderson, N.; Gentile, D. Impact of a Large Fire and Subsequent Pollution Control Failure at a Coke Works on Acute Asthma Exacerbations in Nearby Adult Residents. *Toxics* 2021, 9, 147. <https://doi.org/10.3390/toxics9070147>.

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