



Q4 2021 City and County of Broomfield Health Report

October 1, 2021 - December 31, 2021

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Objectives

1. Summarize health data reported to the City and County of Broomfield
2. Evaluate reported health data in comparison with air quality monitoring (AQM) events
3. Share information with Broomfield residents

Key Takeaways

1. The number of health concerns filed in Q4 ($N=62$) was greater than any other quarter in 2021.
2. The top three symptoms reported in Q4 were difficulty sleeping, anxiety or stress, and headaches. These symptoms are consistent with those reported in previous quarters.
3. The number of reported symptoms in Q4 ($N=166$) was greater than any other quarter in 2021.
4. During Q4, approximately 60 wells in Broomfield were in the production phase. Approximately half of the producing wells are older, vertical wells and half are horizontal wells (Livingston and Interchange B pads). Additionally, there are approximately 110 wells throughout Broomfield that are plugged and abandoned. During Q4, NW Parkway B underwent drilling (one well) and hydraulic fracturing; NW Parkway A underwent drilling, hydraulic fracturing, and coiled tubing; and the United pad underwent drilling.

Overview of Symptom Data Reported by Residents¹ for Q4 2021 Period

10/1/21 - 12/31/21

- A total of 62 health concerns were submitted by 33 unique individuals in Q4.
- 166 health symptoms² were reported in Q4, compared to 34 in Q3, 32 in Q2, and 34 in Q1.
- 33% (n=11) of unique individuals have seen a physician about their symptoms.

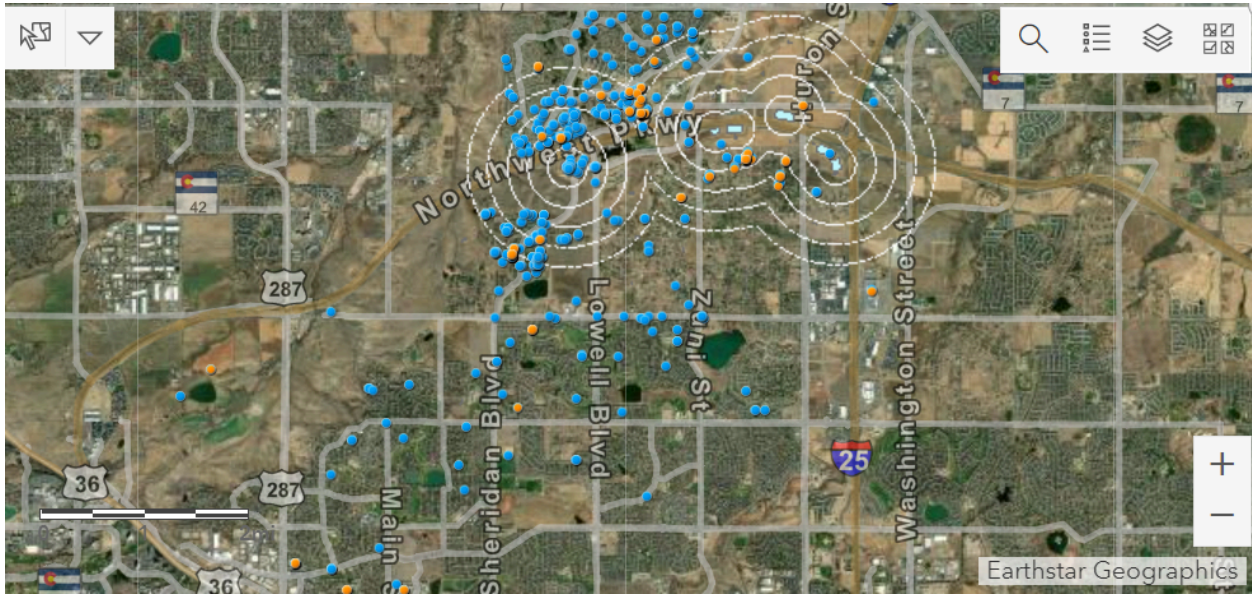


Figure 1. Locations of reported health concerns. Blue dots represent locations of reported health concerns since November 2019. Orange dots represent locations of reported health concerns in Q4 2021. Each ring around an oil and gas pad represents 1,000 ft.

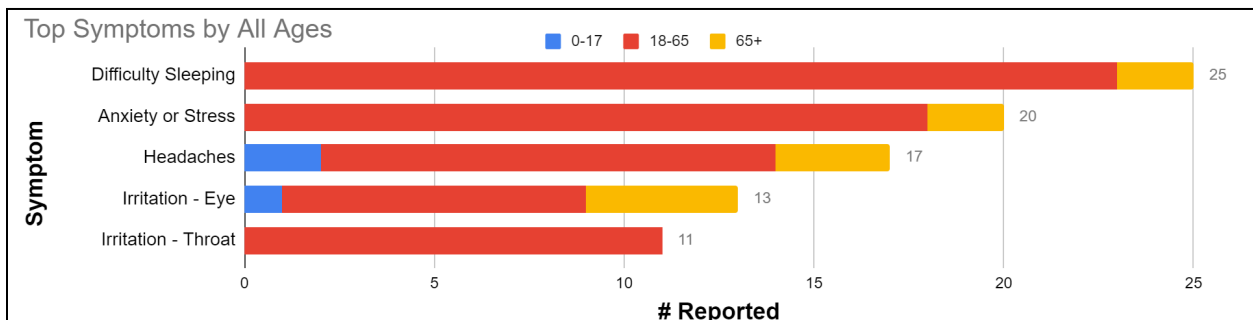


Figure 2. Top five symptoms reported for all ages²

¹ Quarterly reports include data reported to Broomfield Public Health as well as health concerns filed with the Colorado Department of Public Health and Environment (CDPHE). Not all health concerns are filed from Broomfield residents. ² Symptom data represents individuals that filed multiple times.

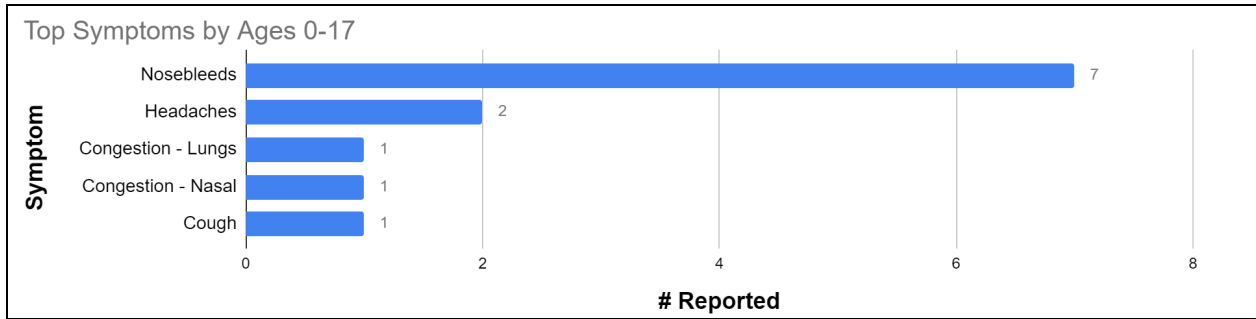


Figure 3. Top five symptoms reported for ages 0-17

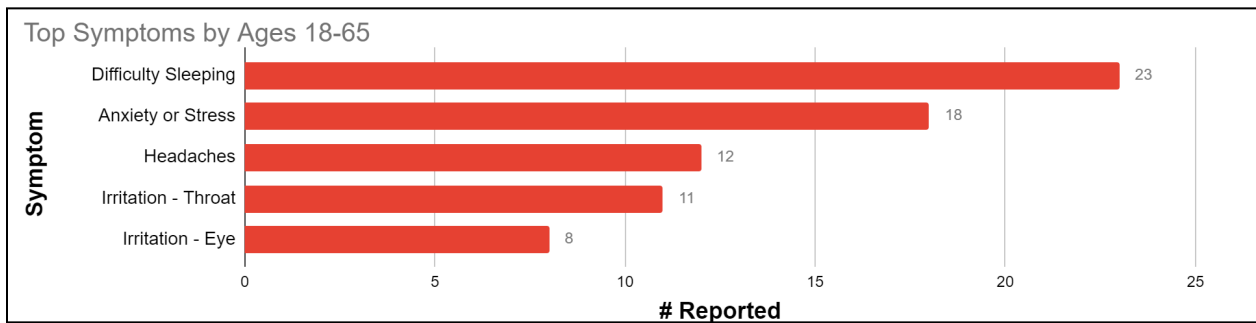


Figure 4. Top five symptoms reported for ages 18-65

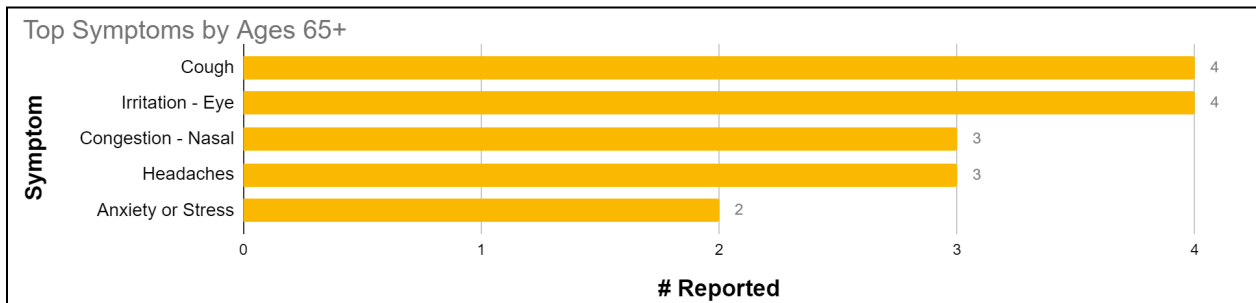


Figure 5. Top five symptoms reported for ages 65+

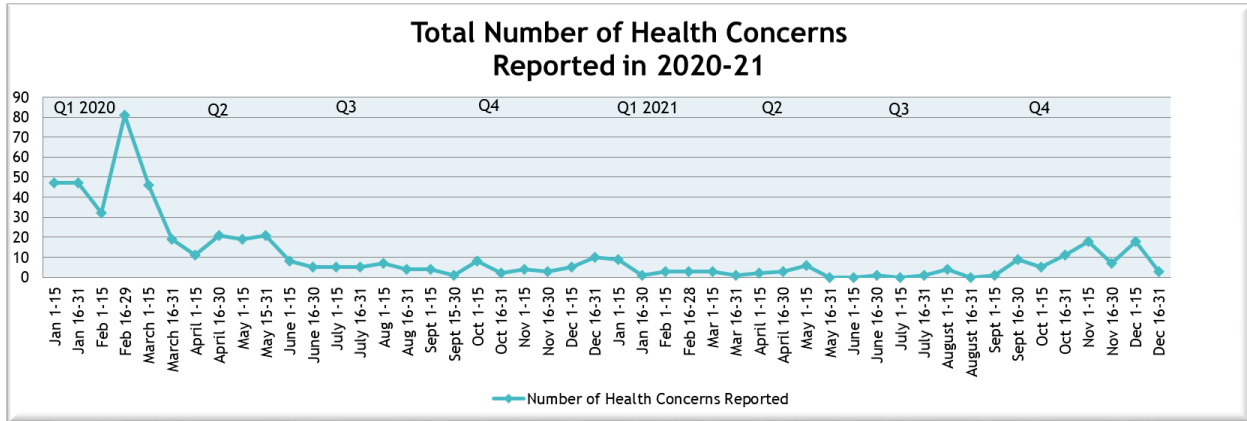


Figure 6. Total number of health concerns reported in bi-monthly intervals in 2020-21

- 62 health concerns were reported in Q4 2021; compared to 15 in Q3; 12 in Q2, and 20 in Q1.
- The number of health concerns reported in Q4 is four times greater than in Q3.
- Pre-production oil and gas operations resumed in mid-September 2021 at which time a noticeable increase in reporting of health concerns occurred.
- In 2020, 273 health concerns were reported in Q1; 85 in Q2; 26 in Q3; and 31 in Q4.

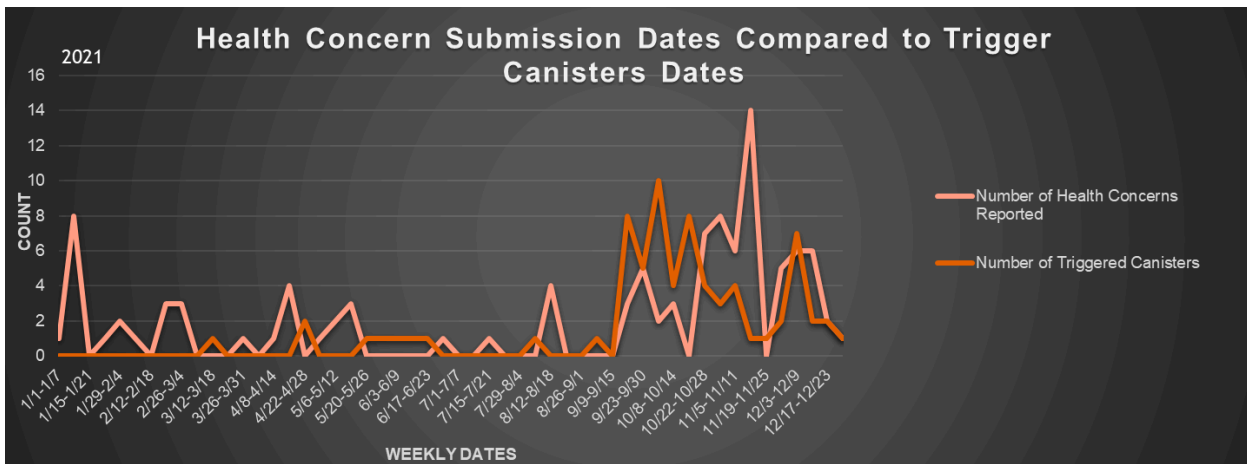


Figure 7. Number of health concerns submitted in 2021 per week compared to number of triggered canisters⁴ per week

- 49 whole air canisters were triggered in Q4 2021.
- A greater number of health concerns were filed in Q4 than any other quarter in 2021.
- Although we cannot demonstrate a correlation between symptoms types and trigger canisters concentrations, figure 7 highlights that health concerns and trigger canisters both increased throughout Q4.
- Increases in volatile organic compounds (VOCs) were attributed to drilling and hydraulic fracturing activities throughout the quarter.
- Oil and gas pre-production operations resumed in mid-September and throughout Q4 consisted of drilling, hydraulic fracturing, and coiled tubing at NW A pad; drilling and hydraulic fracturing at NW B pad; and drilling at the United pad.

⁴This graph does not include trigger canisters that were deployed due to sensor malfunction or citizen grab canisters. Health data in figures 6 and 7 represent individuals that submitted health concerns multiple times. Reported health concerns do not always represent the exact date that a health symptom occurred as many individuals report ranges for symptoms dates.

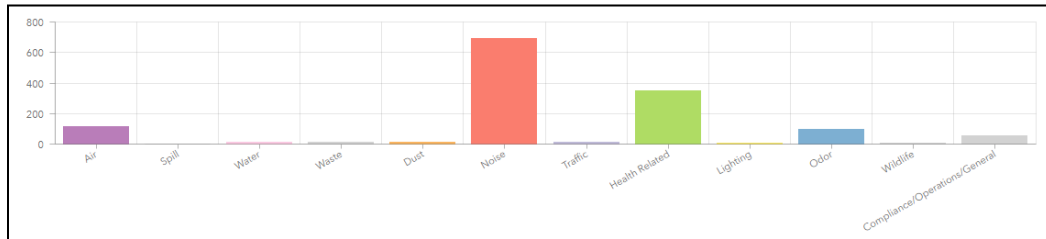


Figure 8. The top concerns reported over time (since 2019) include noise, health related, odor, air, and operations, respectively.

Oil and Gas Health Survey:

- The City and County of Broomfield Department of Public Health and Environment and Colorado School of Public Health at University of Colorado Denver Anschutz campus are working together to better understand the health implications of living near oil and gas development.
- During Q4, a health survey was sent to approximately 3,900 households throughout Broomfield. To read more about the study, visit <https://www.broomfieldvoice.com/oil-and-gas-health-survey>
- This research was designed to take a more detailed look at reported health symptoms during active drilling, hydraulic fracturing, and coiled tubing in Broomfield.
- The data collection period concluded December 31, 2021 and analysis is underway. Results are expected to be shared with the public late spring 2022.

Conclusions

1. A greater number of health concerns were filed in Q4 ($N=62$) than any other quarter in 2021.
2. The top three symptoms reported in Q4 were difficulty sleeping, anxiety or stress, and headaches.
3. The number of reported symptoms in Q4 ($N=166$) was greater than any other quarter in 2021.
4. During Q4, approximately 60 wells in Broomfield were in the production phase. Approximately half of the producing wells are older, vertical wells and half are horizontal wells (Livingston and Interchange B pads). Additionally, there are approximately 110 wells throughout Broomfield that are plugged and abandoned. During Q4, NW Parkway B underwent drilling on two wells and hydraulic fracturing on

four wells; NW Parkway A underwent hydraulic fracturing and coiled tubing on six wells; and the United pad underwent drilling on 11 wells.

Limitations

- Trigger canister events do not imply that high levels of compounds were found in the canisters, but rather, the sensor's mV threshold was exceeded causing the canister to deploy.
- Breaking down the data by symptom type and onset date presents challenges, as this makes the already limited dataset even smaller.