

## EPA's Work to Understand Background Levels of Ethylene Oxide

As the U.S. Environmental Protection Agency (EPA) pursues its mission to protect human health and the environment, addressing the chemical [ethylene oxide](#) is a major priority for the Agency. While EPA is making progress in reducing emissions of ethylene oxide from industrial facilities, we also are continuing to learn more about this chemical. Part of this learning is investigating and understanding how much “background” ethylene oxide is in the outdoor air and its origin. Read on to learn more about the Agency’s work on this issue.

### What does the term “background ethylene oxide” mean?

The term “background ethylene oxide” refers to ethylene oxide in the outdoor air that is not clearly linked to a particular industrial facility, such as a chemical plant or commercial sterilizer.

### Why is EPA interested in background ethylene oxide?

In recent years, EPA has learned more about the health risks from breathing air that contains ethylene oxide over a lifetime, but there is a lot about ethylene oxide that we still do not know. One of the questions we are examining is whether ethylene oxide is in the air broadly across the U.S. – and if it is, at what levels. We began examining this question after monitoring studies of ethylene oxide in the air near industrial facilities in 2018 and 2019 found it at monitors *downwind* of the facilities. This was expected because wind carries ethylene oxide from facilities toward the monitors. But the studies also detected ethylene oxide, although at lower levels, at monitors *upwind* of the facility, indicating the possibility that background ethylene oxide exists.

### What is EPA doing to find out how much background ethylene oxide is in the air?

Beginning in late 2018, a number of state and local air agencies have been monitoring for ethylene oxide at a number of locations in two longstanding monitoring networks: the National Air Toxics Trends Stations (NATTS) and Urban Air Toxics Monitoring Program (UATMP) sites. These networks, which are not focused on specific industrial sources, are designed to help track progress and trends in reducing air toxics across the country. They include monitoring locations in both urban and rural areas. In addition, several states, including Florida, New York, Maryland, and Rhode Island recently have begun monitoring for ethylene oxide at sites that are not part of the NATTS or UATMP networks.



## **What is my risk from background ethylene oxide exposure? Does it cause cancer?**

Studies show that long-term exposure to ethylene oxide increases the risk of developing certain types of cancer, including breast cancer in females, and cancers of the white blood cells. In order to estimate cancer risk related to ethylene oxide, we need to know people's exposure to the chemical. Because the cancer risk from ethylene oxide is associated with long-term exposure, EPA focuses on people's exposure over 70 years. Exposure refers to how much ethylene oxide people breathe in, how often they breathe it in, and for how long. Right now, we do not have enough confidence in monitoring measurements of background ethylene oxide to use them to estimate risk.

## **Is EPA confident in its ethylene oxide monitoring results?**

### ***Monitoring near facilities that emit ethylene oxide***

EPA has high confidence in the results of ethylene oxide monitoring results immediately *downwind* of facilities, where results have generally been well above the level of ethylene oxide that the current monitoring method can detect. For example, during a monitoring study near an industrial facility in Illinois, ethylene oxide levels measured in the outdoor air plummeted immediately after the facility ceased using ethylene oxide, adding to our confidence in measurements near facilities that are well above the method detection limit.

### ***Background ethylene oxide monitoring***

Despite recent monitoring efforts, we don't know what background levels are for ethylene oxide – we can't put an exact number on it. There are several reasons for this. For example:

- EPA's current method for measuring ethylene oxide cannot detect it at all levels. Some results of the background monitoring have shown ethylene oxide at levels close to the detection limit of EPA's national contract lab. When ethylene oxide levels in the air are near these limits, there is greater uncertainty in the measurement and EPA is less confident in the accuracy of these values.

#### **What is a detection limit?**

*A method detection limit* refers to the lowest level of a chemical that we are 99 percent confident is present in the air.

- Recently, EPA has been examining whether aspects of the canisters used to collect air samples may cause some results to be biased – meaning that the results are either higher or lower than the true amount of ethylene oxide in the air. We are finding that canister age, materials used to line the inside of the canisters, and how the canisters are cleaned before they are put into service, can cause results to be biased high. Even though the impact of these issues on measurements is expected to be relatively small, it is especially important for understanding potential background levels. When measured levels are as low as the background levels reported to date, even a small change in

results can be significant. EPA is working to better understand and address these issues. A recent EPA technical note on the ethylene oxide canister effect and memo on the effect of canister type on ethylene oxide concentrations can be found here:

- <https://www.epa.gov/sites/default/files/2021-05/documents/technical-note-on-eto-canister-effect-052521.pdf>
- <https://www.epa.gov/sites/default/files/2021-05/documents/ord-eto-canister-background-memo-05072021.pdf>

### **What is EPA doing to improve its ability to measure ethylene oxide?**

EPA scientists are working to improve the current measurement method, which is known as “TO-15A.” TO-15A is commonly used to measure air toxics, including ethylene oxide. Air samples are collected in a canister over a 12- or 24-hour period, then sent to a laboratory for analysis. EPA is working to improve this method and to develop new technologies and methods that would allow us to measure ethylene oxide at lower levels than is currently possible, and in near-real time. EPA also is working to improve our understanding of how ethylene oxide interacts with other pollutants in the atmosphere



Canisters sampling air for ethylene oxide

and to determine how ethylene oxide travels in the environment. This work will take time, but ultimately, it will help EPA determine the sources of background ethylene oxide.

### **Where can I see the ethylene oxide monitoring data?**

Annual summaries of air toxics data, including ethylene oxide, are available at <https://www.epa.gov/outdoor-air-quality-data/monitor-values-report-hazardous-air-pollutants>. The site allows you to select the year and geographic area of interest. Detailed monitoring data are available in EPA’s [Air Quality System](#) (AQS), a technical database that houses outdoor air quality data collected by EPA, state, local, and tribal air pollution control agencies across the country. You will need to register for a free account to get access to AQS. Anyone planning to use the data should consult with the air agency that provided it and consider data quality “flags” attached to individual measurements.

### **Where can I learn more about EPA’s work to address ethylene oxide?**

Please visit EPA’s ethylene oxide website at <https://www.epa.gov/hazardous-air-pollutants-ethylene-oxide>