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 working to learn more about this chemical. As part of this work, EPA is investigating how much "background" ethylene oxide is in the outdoor air. Read on to learn more about the Agency's work on this issue.

What does the term "background ethylene oxide" mean? Where does it come from?

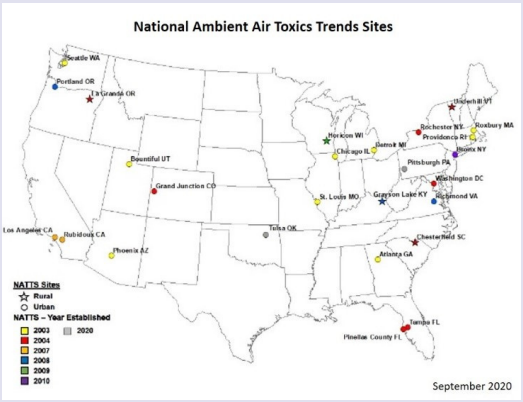
The term "background ethylene oxide" refers to ethylene oxide in the outdoor air that is not clearly linked to a particular industrial facility, such as a chemical plant or commercial sterilizer. EPA does not yet know the sources of this background ethylene oxide.

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 facility. 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 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 background ethylene oxide at sites that are not part of the NATTS or UATMP networks.



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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 adequate information about the amount of background ethylene oxide in the air for us to estimate risk with any accuracy. EPA is working on improvements to the monitoring method that will help us better measure ethylene oxide at low levels. Learning more about background ethylene oxide will help us develop a more complete picture of risks.

Is EPA confident in its ethylene oxide monitoring results?

Monitoring near facilities that emit ethylene oxide

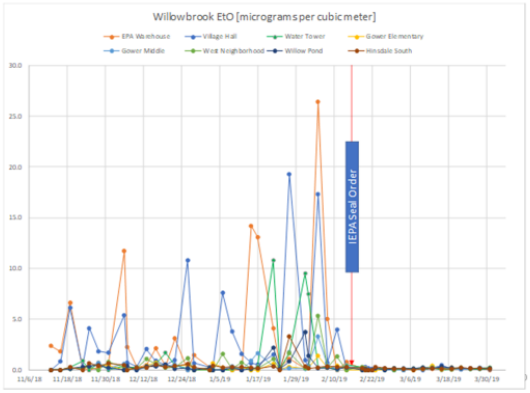
EPA has high confidence in the results of ethylene oxide monitoring results immediately downwind of facilities, where results have generally been well above the level of ethylene oxide that the current monitoring method can detect. The potential measurement differences related to the method are small, so they would not have much impact on facility-focused monitoring results which have largely been significantly above the detection limit. For example, during a monitoring study near an industrial facility in Illinois, ethylene oxide levels in the outdoor air plummeted immediately after the facility ceased using ethylene oxide (see graphic), adding to our confidence in results that are well above the method detection limit.

Background ethylene oxide monitoring

Based on the results of background ethylene oxide monitoring to date, we are confident that there is background ethylene oxide in the air. We are less confident in the exact amounts. 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 as low as 0.06 to 0.08 micrograms per cubic meter of air – which is the approximate detection limit at EPA's national contract lab. When ethylene oxide levels in the air are near these limits, EPA is less confident in the accuracy of these values.

Ethylene oxide levels near a facility in Willowbrook, Illinois dropped dramatically when the facility stopped using ethylene oxide



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What is a detection limit?

A *method detection limit* refers to the lowest level of a chemical that we are 99 percent confident is actually present in the air (known as "positive identification").

Is EPA confident in its ethylene oxide monitoring results? (continued)

- As EPA and our state and local partners become more experienced in monitoring ethylene oxide at low levels, we have learned more about things that might affect monitoring results. 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. The issues include the materials used to line the inside of the canisters and how the canisters are cleaned before they are put into service. 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.

Canisters sampling air for ethylene

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

EPA scientists are working to improve the current test method, which is known as "TO-15A." A test method is a set of approved scientific techniques for measuring the presence of a single pollutant or a suite of pollutants. 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 test 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 and to determine how ethylene oxide moves 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 background 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 website 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