

## **Excavation Blasting and the Risk of Noxious Fumes**

Blasters and blasting permittees have a legal obligation to protect the public from the adverse effects of blasting. One serious potential adverse effect of blasting for excavation is the inadvertent exposure of people to noxious fumes commonly produced by blasting. Blasting regulations require that the health and safety of the public not be affected by blasting, so the Department takes several steps to ensure that blasting permittees take appropriate safety precautions to protect the public. This fact sheet answers commonly asked questions about the risk of exposure to noxious fumes inside of homes, businesses, and other structures, and explains the responsibilities of the blasting contractor.

### **How is blasting regulated in Pennsylvania?**

The Pennsylvania Department of Environmental Protection (DEP) regulates all commercial explosives use in the state. The most current and comprehensive explosives regulations are found under Title 25, Chapter 211 in the Pa Code (accessible at [www.pacode.com](http://www.pacode.com) or inquire at a local DEP District Mining Office). In addition to Chapter 211, some additional activity-specific explosives regulations are also found in chapters 77, 87, 88, and 89, which are Pennsylvania's mining regulations. Chapter 210 contains the regulations relating to blaster's licensing. Most of Pennsylvania's explosives regulations have been derived from the federal Surface Mining Conservation and Reclamation Act of 1972 (SMCRA) and the Noncoal Surface Mining Conservation and Reclamation Act (Pennsylvania Environmental Statutes, Title 52, Sections 3301-3326). Commonwealth regulations and statutes authorize DEP to take necessary actions to protect public health and safety and the environment.

### **How is blasting for excavation generally conducted?**

A blast usually consists of a series of holes drilled through the soil and into the rock below. The holes typically range in diameter from 1-1/2 inches to 4-1/2 inches for construction blasting, and typically up to 7-3/4 inches or more for mining. The holes are often drilled in a grid or staggered grid pattern. Each hole drilled into rock is loaded with a certain quantity of explosive material, leaving a space at the top of the hole for backfilling with gravel, which locks in and contains the explosive energy when the blast is fired. The detonators in each hole are timed sequentially so that each one fires one after another in rapid succession. This allows the blaster to limit the individual charge sizes so that vibration is kept to a minimum. For any one blast event, natural conditions may vary within and between holes, including mud seams, cracks, voids, and water collecting in the hole after drilling. A blaster must work to ensure that each hole is loaded appropriately, and the explosive material is not compromised or allowed to detonate without sufficient confinement. Finally, after a blast has been detonated, the blaster-in-charge inspects the site to ensure that all explosives have detonated, and the site is safe for workers to return.

### **What fumes are produced by blasting?**

Explosives are carefully balanced chemical combinations that rapidly decompose in the form of an explosion, or a rapid release of gas, heat, and pressure. Every detonation of explosives produces water vapor, carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), and nitrogen oxides. When the explosives are well-confined and not affected by water, fewer noxious fumes are produced, and the greatest amount of energy is released to do the work of breaking the rock, but if the explosive is less confined (perhaps because of a crack or mud seam underground) or has been affected by water entering a hole, the explosive reaction is not as complete and more noxious waste gases may be released in place of some of the energy that would have otherwise been produced. Radon is not produced by blasting and its presence is not affected by blasting activities. Radon is a naturally occurring elemental gas that results from the decay of naturally occurring radioactive elements within the earth.

## **How are people usually exposed to these fumes?**

Exposure to dangerous levels of noxious fumes produced by blasting is relatively rare, but it has occurred under certain conditions. The greatest potential for exposure to the fumes produced by blasting is if a person is indoors near a blast that has not been ventilated where there is a conduit through which the fumes may travel. One conduit that fumes may readily follow is a manmade pathway, such as along the buried utility lines connected to homes or businesses, but they can also pass through the rocks and soils if the material is sufficiently permeable.

## **What steps does the Department take to protect the public from these fumes?**

DEP works proactively with the blasting and explosives industry to ensure that any blasting permit issued has had the appropriate risk factors taken into consideration. Most blasting conducted in the vicinity of occupied buildings requires that carbon monoxide detectors be placed in structures up to a certain distance away, unless they are already so equipped. All blasting permits are evaluated by inspectors who are also experienced blasters and each site is individually evaluated by an inspector according to the conditions that exist there. For example, if blasting will be done in rock that has many pathways for gas to migrate such as in fractured rock, or if blasting will be done very close to occupied structures or existing utilities connected to occupied structures, a permittee may be required to take steps to reduce the potential for people's exposure to fumes. Examples of these precautionary measures might include limiting the size of blasts, excavating each blast immediately to help ventilate the fumes, or digging a trench to interrupt the path fumes could follow toward a structure. A site in which the rock is less permeable would not be as inherently risky, so additional precautions might be different for that location.

## **What are the indications that fumes may have entered my home or business?**

Carbon monoxide, regardless of the source, is particularly dangerous because it has no smell or color and is about the same density as normal air. The best way to tell if carbon monoxide is present is by using a carbon monoxide detector. If a detector sounds an alarm, do not wait... get out and call 911 right away! Some of the symptoms of carbon monoxide poisoning are headache, confusion, weakness, nausea, drowsiness, and even hallucinations. Carbon dioxide exposure results in many of the same symptoms as carbon monoxide exposure. One obvious sign of carbon dioxide's presence is a water heater or furnace pilot light suddenly going out without explanation. This can happen because carbon dioxide is heavier than air and it tends to lay low displacing the oxygen needed to maintain a flame. It is less likely for nitrogen oxides from blasting to enter structures, but some risk still exists. Evidence suggests the greatest risk with these heavier-than-air gases is that they can collect in trenches, manholes, and other below-grade areas where workers are exposed. The most common of these fumes produced by blasting is nitrogen dioxide (NO<sub>2</sub>), which is toxic, reddish-brown in color, and has a pungent, acrid odor.

## **What do I do if I suspect fumes from blasting have entered my home?**

If you suspect that noxious fumes from any source have entered your home, get out immediately and call 911. The source of the fumes may be identifiable by fire personnel because most fire departments have meters that sniff out the source of such gases. Gases such as carbon monoxide can come from numerous sources not related to blasting. If the gases are thought to be associated with blasting, contact the Department of Environmental Protection with the details and the case will be investigated by an inspector. Report urgent environmental emergencies to 800-541-2050. For non-emergency complaints, you can call 866-255-5158 or use the Department's online environmental complaint form by going to: <https://www.dep.pa.gov/About/ReportanIncident/Pages/EnvironmentalComplaints.aspx>

For more information, visit [www.dep.pa.gov](http://www.dep.pa.gov).