How is Airblast Controlled?

Airblast is controlled mainly by the proper use of stemming material (the drill cuttings or crushed stones that are shoveled back into the blasthole after the explosive material has been loaded to a predetermined depth from the surface), and by not loading explosives into portions of holes with cracks, voids or mud seams. These techniques minimize the escape of gases and confine the explosive energy where it is needed to efficiently break rock.

What are the Ground Vibration and Airblast Limits?

The United States Bureau of Mines (USBM) conducted extensive research over a 35-year period on the effects of blast-induced ground vibration and airblast on residential structures. This research produced recommended limits that, if adhered to, will effectively protect residential structures from damage, even if the blasting is repeated on a daily basis over a period of many years.

How do we know if these Vibration and Airblast Levels are Safe?

Seismographs are used to measure vibration and air blasts effects. These scientific instruments take the human opinion out of the measurement and give exact measurements on each blast. With science and technology today, blasters are able to predict the vibration and air blast limits before putting off a blast. The State of Illinois limits levels for vibration and air blasts. These measurements are taken by an independent third party to verify compliance with these regulations. These seismic consultants will measure each blast detonated at this location to insure that the vibration levels are safe.

If Vibrations or Airblasts are Felt at my house does this mean I have damage?

Ninety-nine percent of the time damage to a structure does not occur just because the vibrations or air blasts are felt. Humans are much more susceptible to vibrations and air blasts than structures. The surprise of a blast being detonated creates a much more adverse effect than the actual blasting. A person in a home with a lot of noise within the house (kids, TV, stereo) may not even notice that a blast has been detonated where as an extremely quite home may feel the effects. A person outside of the house may not even know that the blast has been detonated while someone inside the house will be able to tell that a blast has been detonated. The air blast from blasting operations often causes doors or windows to rattle slightly thus making the homeowner aware that a blast has been detonated. The air blast is the most noticeable effect of blasting and is the least likely to cause any damage. Many activities within homes produce more vibrations than blasting operations. Normal door slamming and children running through the house produce more vibrations than blasting operations. The movement produced in structures on a daily basis by expansion and contraction properties often results in movement to the structure which is many times greater that blasting operations. The only accurate way to measure vibration intensity is with a seismograph

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Blasting—Dangerous or Not?

Each day in Illinois, nearly half a million pounds of explosives are safely detonated in quarries and surface coal mines. With all the news of late, most people inexperienced in the use of explosives have the opinion that explosives are used to destroy structures. From all of the news that we see
these days, this is the only use that the general public sees of explosives. To the contrary, commercial explosives are used to do work everyday. On a daily basis thousands of pounds of explosives are detonated safely in the construction, mining, and quarrying industries. Commercial explosives are used on a daily bases to fragment rock and keep the environmental effects of vibration and noise at safe levels in surrounding areas.

Blasting operations are planned such that most of the energy in the explosives is used to break rock. The energy that is not used to break the rock goes into environmental effects
such as vibration and air blast. As the vibration waves travel away from the blast site, the energy of these vibration waves decreases with distance. These vibration waves can not be seen but can be felt at surrounding structures. The blast are calculated such that the energy of the vibration waves do not cause damage to surrounding structures. These vibration waves travel on the surface of the ground and as a result the structures located underground (wells, pools, pipelines, septic tanks) are not likely to be effected by vibrations. In most cases the actual movement of the ground is less than .05 inches (which is about the width of a human hair). Realistically speaking, if there is a potential of any blast causing damage to surrounding structures, that blast will be changed

Why is Blasting Necessary?

Blasting is the most cost effective way to fracture rock so that it can be excavated by earth-moving equipment. This, in turn, reduces the costs of building materials, such as gravel and concrete, energy produced from coal, and many other products derived from limestone, coal and other minerals.

Who May Conduct Blasting?

Only a certified blaster may conduct blasting in Illinois' quarries and surface coal mines. To become certified, a blaster must obtain 2 years of blasting crew experience including on-the-job training, attend 30 hours of classroom training, and pass an exam covering blast design, safety, vibration control and monitoring, and state and federal blasting regulations. Once certified, a blaster must attend 24 hours of continuing education during every 3-year renewal period.

What Causes Ground Vibration and How is it Measured?

When a blast detonates, some of the explosive energy not utilized in breaking rock travels through the ground in all directions as wave motion, similar to the ripple created in a pond when a stone hits the water. This wave motion, or ground vibration, travels mainly along the surface at speeds of 5,000 to 10,000 feet per second, depending upon the density and thickness of the rock and soil. Its energy level decreases rapidly with distance from the blast and normally decays to levels undetectable by humans beyond several thousand feet. Because explosives are expensive and vibration represents wasted energy, it is to the blaster's advantage to utilize as much of the energy as possible in fragmentation, thereby minimizing vibration. Blasting seismographs are used to measure ground vibration in terms of particle velocity, which is the speed at which each particle in the ground oscillates as the wave motion passes. This would be similar to measuring the speed of a fishing bobber in a pond as it moves up and down when a ripple passes under it. Particle velocity is measured in inches per second, but beyond several hundred feet from a blast the actual movement of the ground, or displacement, is generally only a tiny fraction of an inch, about the thickness of a piece of paper, or less. So it is important to understand that a particle velocity reading expressed in inches per second refers to the speed at which the ground moved, and not the amount of movement.

How is Ground Vibration Controlled?

Blasters control ground vibration mainly by limiting the weight of explosives detonated within any 8-millisecond period of time. They do this by using millisecond delay detonators (blasting caps) to separate the firing time of each hole from adjacent holes. In a typical 50-hole blast, the result would be 50 smaller and separate explosions instead of one large blast. A common misconception is that the number of blastholes determines the resulting intensity of vibration. However, given the same charge weight per delay (pounds of explosives detonated within any 8-ms period) and the same distance, a 100 hole blast can be designed to produce no more vibration than a 10-hole blast.

What is Airblast and How is it Measured?

When a blast detonates, some energy is lost to the atmosphere in the form of noise and/or concussion. This phenomenon is caused by the venting of gases through cracks and fissures and the upward and outward movement of the rock on top and in front of the blastholes. The resulting increase in the air pressure is commonly called airblast. Like ground vibration, airblast levels decrease rapidly with distance from the blast. However, airblast travels only at the speed of sound, around 1,100 feet per second, depending upon air temperature, and can be greatly influenced by wind direction and speed, and by atmospheric temperature inversions which can bend it back toward the earth and focus its energy several miles away. Airblast is usually measured with a special microphone connected to the same type of seismograph that measures ground vibration. The most common units of airblast measurement are pounds per square inch (psi) and the decibel (dB), which is based on a logarithmic sound-pressure scale related to human hearing. .