WORKSAFE SERVICES DIVISION OCCUPATIONAL HEALTH AND SAFETY LEGISLATIVE INTERPRETATIONS		
Topic	Drilling restrictions – Distance from misfired hole	Issued by: V.P., WorkSafe Services
Statute	*Regulation 96-105*	Date Issued: October 13, 2004
Section	137(3) & (4)	Date Revised:

137(3) An employer shall ensure that no drilling is done within 1.5 m of a hole containing explosives unless the drilling is remotely controlled.

137(4) An employer shall ensure that, except where the drilling is done by remote control and employees are sufficiently protected, no sectional steel drilling takes place

a) within 7.5 m of any hole containing explosives, or

b) closer than a distance equal to one and one-half times the depth of the drill hole to any hole containing explosives, if there is the possibility of the drill deviating off course and intersecting with a loaded hole.

Question

What is the lawful distance between performing sectional steel drilling and a misfired hole that was loaded and blasted but possibly contains explosives when there is no possibility of intersection? Can the provisions of Section 137(3) apply when it can be demonstrated that sectional steel drilling will not lead to an intersection of a misfire or mishole? We have provided a summary of our current mining practice to assist in your response.

Current Mining Practice

The typical mining block size is approximately 30 m high and 17 m square. Production blast holes are 127 mm in diameter and drilled from a drill drift located in an overcut, using “in-the-hole” or ITH drills. The explosives used are emulsion-type and initiated with pentolite boosters

After the ore is pulled from the stope, it is normal practice to survey the open stope with a Cavity Monitoring System, commonly called CMS, in order to measure the actual shape, determine the pulled tonnage, the dilution, the ore left in place due to hole deviation and misfired holes, as well as estimate the paste backfill tonnage. This information is used to design the drilling pattern of each adjacent stope and pinpoint any area that requires special drilling procedures. In some cases, a borehole camera is used to verify the presence of explosives in some problematic holes. Historically, each blast hole deviated by less than 1.5 meters from its original target.

The types of drills used at our mine have thick sectional tubing and an ITH hammer having a proven reputation for being accurate. These drills are also equipped with an automated system that allows drilling an entire drill hole, without any miner supervision. The maximum 1.5 metre deviation, which corresponds to 5% for a 30 metre hole, is normal for that type of drill and rarely larger.

Four (4) separate situations have been specified where it can be demonstrate that interception with a mishole will not occur during sectional steel drilling when drilling blast holes that are 127mm (4.5 inches) in diameter and using **in-the-hole** (ITH) drills which uses a technology where the hammer is located behind the drill bit which increases penetration rates and reduces deviation.

Response
Regulation 96-105 defines misfire as a *"a remnant of a blast-hole that still contains explosive after a charge has been fired."*

Sectional steel drilling" (while not defined by 96-105) refers to drilling long holes, which require a number of drill steel, or rods, coupled together to produce the required hole length. Typical rod lengths are 1.3 m to 1.8 m (4 to 6 feet). Sectional steel drilling is used mainly in drilling holes for production blasting. In an underground operation hole diameter sizes range from 50 mm to 127 mm (2 - 5 inches) and are 6 m to 40 m (20 to 125 feet) long.

Sectional steel drilling is also commonly referred to as:

a) ring drilling;
b) In-the-hole (ITH);
c) down-the-hole (DHD) drilling; or,
d) electric hydraulic top hammer drilling.

ITH and DHD refer to the same type of drill and are used interchangeably.

While the stope survey with a CMS is a common practice in mines and a very useful tool in locating problems as a result of hole deviations and misfired blast holes, in the case of a misfired blast hole, this system only detects a region where the rock was not broken as planned. The reason for this abnormal configuration can normally be attributed to large deviations and/or holes not correctly loaded and/or detonators not working properly.

The only way to know where the hole is, with accuracy, is to have each hole surveyed prior to loading explosives. Consequently, the CMS method cannot locate drilled holes, but can only identify a problem. Hole surveying can be done with specialized tools available on the market or with a probe inserted in the hole, which can be visible at its breakthrough point and positioned with reflective laser survey equipment, and plotted on drilling plans. These methods will allow to locate any potential misfired hole, prior to blasting, and to safely apply the proposed drilling procedure.

The use of a borehole camera is very effective in determining if there are explosives left in the blast hole. Unfortunately, that tool cannot be used in all cases and would not make it possible to drill closer than 1.5 meters from problematic holes. Remnant explosives could still be present in the hole and special safety procedures would therefore have to be followed.

Conclusion
After reviewing the four possible scenarios, where only the CMS method is used to determine misfired hole locations, without surveying breakthroughs and toes of holes, drilling must be done by remote control within 3 meters of any mishole to take into account the worst case scenario where each hole has a maximum deviation of 1.5 meters.

For any hole with a breakthrough or for toes of holes that have been surveyed and plotted on drilling plans, drilling must be done by remote control within 1.5 meters of any mishole.