PUBLIC SUBMISSION

As of: 8/17/16 11:29 AM
Received: August 09, 2016
Status: Posted
Posted: August 17, 2016
Tracking No. 1k0-8r8g-zyzy
Comments Due: September 01, 2016
Submission Type: Web

Docket: MSHA-2014-0031
Exposure of Underground Miners to Diesel Exhaust

Comment On: MSHA-2014-0031-0001
Exposure of Underground Miners to Diesel Exhaust

Document: MSHA-2014-0031-0041
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General Comment

See attached file(s)

Attachments

Eure Comment

AB86-COMM-3 8/17/2016

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Comments regarding: Exposure of Underground Miners to Diesel Exhaust

ID: MSHA-2014-0031-0001

8/9/2016

Many of the rules in 30 CFR Part 75 regarding mine fan ventilation could be written more definitively and with an explicitly higher level of control if the programmable logic controller (PLC) is written as an understood part of processes. By using PLCs, human action and therefore human error could be removed from many processes. The PLC is an industrial grade computer that is capable of being programmed to perform control functions. The PLC is used to perform tasks related to relay switching, timing, counting, calculating, comparing and the processing of analog signals. (Petruzella, 2)

In the hierarchy of controls the 30 CFR Part 75 rises to the level of administrative. Policy is, by definition, an administrative control. The administrative level of control ranks fifth in the hierarchy of controls and is considered a lower level of control (Manuele, 275). Many of the rules of 30 CFR Part 75 regarding ventilation fans are written as if they are allowed to be enforced by administrative controls and they are allowed to be controlled by engineering controls. Ideally elimination, substitution or engineering controls should be used. For mine ventilation fans, engineering controls enforced using PLCs appear to be the most reasonably practicable to remove human error. This comment is written to articulate where PLCs can be used to aid in the implementation of MSHA rules regarding mine ventilation.

30 CFR Part 75 Sec.311(a):

Mine fans shall be continuously operated with approved exceptions.

The rule does not explain how "*Mine fans shall be continuously operated with approved exceptions*". With the use of PLCs rules can be written that specifically require the mine fan to run until operations that have the potential to result in a catastrophe or single point failure are secured. The way the rule is currently written, the mine owner is allowed to interpret the rule as being locally (at the mine) enforced by administrative controls.

Whether the engineering controls come with the mine fan from the manufacturer or the mine fan is modified by an instrument technician who is working for the mine owner, the rule should exist as if engineering controls are required. The 66 FR 5526 rule limiting diesel particulate matter (DPM) emissions from diesel engines requires diesel engines used in mines that meet a permissible emissions level. The 66 FR 5526 rule is simply keeping up with technology which is what is being proposed by this comment regarding ventilation to reduce exposure of underground miners to diesel exhaust.

30 CFR Part 75 Sec. 75.311(b)(2) and (3):

Except as provided in paragraph (c) of this section, when a main mine fan is intentionally stopped and the ventilating quantity provided by the fan is not maintained by a back-up fan system mechanical equipment shall be shut off before stopping the fan and electrical power circuits entering underground areas of the mine shall be deenergized.

This rule is written in a manner that could be interpreted as an administrative control by the mine owner while the technology exists to make it an engineering control. It is entirely possible to set up the logic in a PLC to shut off portions of operation until ventilation is restore. It is also possible to maintain mechanized equipment and power circuits unusable until ventilation is restored.

30 CFR Part 75 Sec. 75.312(c):

At least every 31 days, the automatic fan signal device for each main mine fan shall be tested by stopping the fan.

A PLC allows for the operation of equipment to occur only when permissives are met. Timers could be implemented that prohibit the start of a ventilation fan if the automatic fan signal device has not been tested within a 31-day period. Once the signal device is tested, the circuit is reset for another 31 days. The use of the word "shall" is absolutely necessary coming from MSHA but how is it being interpreted locally at the mine. For example, if a steam turbine *shall not* be operated without 100 PSIG lube oil pressure then a steam turbine should trip or stop automatically if the lube oil pressure drops below 100 PSIG. The option exists to design logic that automatically trips the steam turbine below 100 PSIG lubricating oil or to have the operator trip the steam turbine below 100 PSIG lubricating oil. Both operator and automatic options should exist.

30 CFR Part 75 Sec. 75.313 Main Mine Fan Stoppage with Persons Underground:

(a) If a main mine fan stops while anyone is underground and the ventilation quantity provided by the fan is not maintained by the back-up fan system

(1) Electrically powered equipment in each working section shall be deenergized

(2) Other mechanized equipment in each working section shall be shut off

Through the use of programmable logic controllers (PLCs)the system could deenergize and secure equipment automatically without operator action. Safely engineering out operator action is preferable.

(b) If ventilation is restored within 15 minutes after a main mine fan stops, certified persons shall examine for methane in the working places and in other areas where methane is likely to accumulate before work is resumed and before equipment is deenergized or restarted in these areas.

Methane should be continuously monitored and readings should be continuously available. Furthermore equipment should not be capable to be energized or restarted in these areas unless methane permissives are achieved.

(c)(2) If Ventilation is not restored within 15 minutes after a main mine fan stops underground electric power circuits shall be deenergized. However, circuits necessary to withdraw persons from the mine need not be deenergized if located in areas or haulageways where methane is not likely to migrate to or accumulate. These circuits shall be deenergized as persons are withdrawn;

A programmable logic controller is capable of counting 15 minutes and ensuring that electrical power circuits are incapable of being energized. The responsibility of deenergizing power circuits does not have to be left solely to the mine operator. The automatic shutdown is an engineering control. The actual rule, as it is currently allowed to be interpreted by the mine owner, could be an administrative control. The administrative control should complement the engineering control by stating something to the effect of:

If ventilation is not restored within 15 minutes after a main mine fan stops underground electric power circuits shall be deenergized manually if the automatic shutdown of such circuits fails to initiate.

(d)(1)(ii) Underground power circuits shall not be energized and nonpermissible mechanized equipment shall not be started or operated in an area until an examination is conducted as described in Sec. 75.360(b) through (e) and the area has been determined to be safe,

This rule requires power circuits and some mechanized equipment could be operable only after the ventilation fan has been running for a determined period of time. That time should be at least 15 minutes plus a reasonable amount of time to accommodate for a mine examination. Through the use of programmable logic controllers this timing feature could be accomplished relatively easily.

30 CFR Part 75 Sec. 75.321 Air Quality:

(a)(1) The air in areas where persons work or travel, except as specified in paragraph (a)(2) of this section, shall contain at least 19.5 percent oxygen and not more than 0.5 percent carbon dioxide, and the volume and velocity of the air current in these areas shall be sufficient to dilute, render harmless, and carry away flammable, explosive, noxious and harmful gasses, dusts, smoke and fumes.

The air concentrations stated in Sec. 75.321 (b)(1), (2), (3), (4), (5), and (6) should stop work if any of those metrics are exceeded. If any of those metrics are within parameters but change significantly or act unexpectedly, alarms should sound letting operators know that such changes have occurred. Ideally work would be impossible if any concentration exceeded the permitted concentration. Using PLCs, this could be accomplished by initiating a desirable or intended "single point failure" that would shut down a critical aspect of the mining process.

30 CFR Part 75 Sec. 75.323 Actions for excessive methane:

(b)(1) When 1.0 percent or more methane is present in a working place or an intake course, including an air course in which a belt conveyor is located, or in an area where mechanized mining equipment is being installed or removed (i) Except intrinsically safe atmospheric monitoring systems (AMS), electrically powered equipment in the affected area shall be deenergized, and other mechanized equipment shall be shut off.

This rule should provide automatic trips at critical locations to stop work. If automatic trips do not work for some reason, stopping the equipment or securing equipment electricity can still be the responsibility of the operators. The ideal way to respond to high concentrations of methane should be engineering controls that cease work in portions of the mine that are directly affected by excessive methane if reasonably practicable.

30 CFR Part 75 Sec. 75.324 Intentional changes in the ventilation system:

(b)(1) Electric power shall be removed from areas affected by the ventilation change and mechanized equipment in those areas shall be shut off before the ventilation change begins.

If a ventilation change requires removing electric power and securing mechanized equipment in affected areas then, if possible, electric power and mechanized equipment should be automatically shut down for the duration of the ventilation change. Logic within a PLC should exist that disallows that same mechanized equipment to be restarted unless ventilation is established for at least 15 minutes. The enforcement of this rule could be performed by a PLC and be monitored by the mine operator.

Conclusion

Multiple locations in the 30 CFR Part 75 where the term "shall" is used could be followed by rules that explain how "shall" can or shall be enforced. Enforcement using administrative controls may work but enforcement using engineering controls should be preferred. In reference to Rasmussen's drift to danger model, resilience is the ability to steer the activities of the organization so that it may sail close to the area where accidents will happen, but always stays out of the dangerous area (Hollnagel, 36). PLCs are an excellent tool to cease any drift to danger. Where it is reasonably practicable, MSHA regulations should acknowledge PLC technology and write rules in a manner that involves their use.

There are many variables that may encourage an error provocative condition that results in workers bypassing rules. Furthermore, there is a possibility that workers either do not know or forget rules. Why not build the rules into the logic of a programmable logic controller? In the same way 66 FR 5526 requires that diesel engines be used that meet a desired DPM emissions standard, the same type of regulation could phase in the use of PLCs.

A human being is subject to such a magnitude of variables of varying degrees in different situation in which different possible responses can produce different effects that all possible combinations cannot be foreseen. The problem is compounded by the fact that each of these combinations is different for almost every individual. (Hammer, 121) Performance shaping factors regarding situational characteristics, psychological stresses and organismic factors influence how or whether a worker will follow policy. By using programmable logic controllers, many factors that dissuade workers from following MSHA rules and regulations can be made irrelevant and ultimately reduce exposure of underground miners to diesel exhaust.

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