

Search and Rescue in Mine Disasters: Dos and Don'ts

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Abstract

Mining is a very hard and risky sector that includes domino effect risks in any adverse event and requires knowledge, experience, proficiency and continuous auditing, and it is very hard and risky. Turkey has not signed International Labour Organization (ILO) contract number 176 yet*. This contract is named the 1995 Safety and Health in Mines Convention, and the safe and healthy working conditions are set, and obligations are listed. The most important mistakes are made because these national and international rules and regulations are not carried out. In this chapter, these mistakes are elaborated, and suggestions are made.

KEYWORDS: Mining, regulation, methane poisoning

**The contract had not been signed yet when this paper was written.*

Mining is the most difficult and risky profession in the world; in particular, it involves interconnected risks, which can trigger themselves in a chain reaction in case something goes wrong. It requires knowledge, experience, expertise and constant supervision in order to minimize the risks [1]. In of all the types of mining, coal mining has the highest reported number of accidents and deaths per worker [1]. Research and rescue in a mine is a very important field and individuals with special education, equipment, and experience should perform them.

Every mine should have an effective emergency management system. Everyone, from the workers to the manager, should know what to do in any given situation.

Turkey is yet to sign the International Labour Organization's (ILO) convention number 176. In this convention, called Safety and Health in Mines Convention, 1995, safe and healthy working conditions in mines have been determined and obligations have been detailed [2].

Determinations/Errors Made in Some Mining Accidents [1]

- Equipment, cables, and wall boxes used for lighting inside the pit are not anti-firedamp.
- Smoking in the pit. Gas measurements are performed once every 10 days and regular records are not maintained.
- CO masks are present in the pit but workers do not carry these on their persons.
- Auxiliary ventilation has been implemented. Curtain walls have been built for preventing fire, and methane rate has increased because of inefficiently provided air, causing an explosion.
- High methane measurements are not recorded.
- Air gates in the system are not safe.
- The power of the propellers being used is unsuitable for the amount of air flowing from the main ventilation vent.
- Electrical equipment is not suitable for gas environment by making attachment to their cables.



- Breakers do not cut energy, although methane gas exceeds 1.5% inside the pit.
- Although methane gas reaches dangerous levels, necessary and authorized individuals are not alerted, a serial setup is not established between the monitoring station and the pit, and the pit is not evacuated on time.
- The sensors placed on the working area are replaced such that their settings are changed and their equipment is misused.
- Authorized personnel in the workplaces are not given sufficient gas measurement devices and the automatic gas measurement device GP 322 is not placed on necessary places.
- A risk analysis is not performed by the primary employer and health safety certificate and emergency plan does not exist.
- Some workers do not have an occupational training certificate.
- Because formalities caused by statesmen in the Soma accident slowed down the rescue operation, this issue must be paid attention to.
- In production workplaces, no second pathway connecting to above ground, which can be used as vent and a pathway for escape, is present. This prevents immediate and safe evacuation of the workers from the pit.
- It should be considered that flameproof (AISz) system, which is required to be used in pits with firedamp, loses this property over time.
- First aid and evacuation stations must be established.
- The pit must have an appropriately qualified gas measurement device, and gas measurements must be performed in every shift at regular intervals.
- Serious accidents may result when explosives may not be qualified to be used in pits, when the explosives are fired by unlicensed and unauthorized individuals, when rules are not precisely followed, and/or when necessary safety measures are not taken during firings.
- Because of an insufficient amount of education and drills, fire and explosion survivors do not use their personal oxygen masks, and because of panic, they are unable find a safe exit, thus increasing the death toll.

Common Points in Accidents [1]

- All methane-based mining accidents have occurred in very risky areas where accidents with multiple deaths and injuries can occur simultaneously.
- Dynamite blasting was performed prior to or during accidents.
- Electrical equipment, cables, and motors were not flameproof (ALSz) quality, and when the motors having

this quality break down, they were used underground again after repairing them above ground, without checking if they retained this quality.

- Ventilation plans either did not exist or were insufficient. Sufficient and effective ventilation did not occur inside the pit, particularly at dead ends.
- Healthy air and gas measurements were not performed and recorded. The number of sensors in the remotely monitored pit was insufficient and, because of their placement, they register a diluted gas measurement.
- Smoking was determined in the pit, and according to the existing regulations, obligations to employ occupational safety engineers and occupational physicians proportionate to the number of employees and to form an occupational safety committee do not exist.
- Internal auditing was not performed.
- Employees did not possess personal protection.
- Employees did not have appropriate expertise, certificates, or vocational training.

As Stated in the By-Law Number 1475 Regarding the Workers' Health and Safety Precautions That will be Taken in Mining and Quarry Businesses and in Tunnel Construction [3]

Anyone who sees a situation that is dangerous for workers' lives, health, or for the pit, immediately takes, if possible, necessary precautions to resolve this. If that person fails to do so, he/she will notify the workers working there regarding the situation and the need to retreat from the area, and the person will immediately inform the nearest supervisor.

Workers will be immediately evacuated from the area displaying the danger signs, except those that work under the orders of a specially appointed supervisor to resolve the danger.

The supervisor of the outgoing shift must inform the supervisor of the incoming shift regarding the possibilities of danger of the work that will be done under their supervision and regarding the precautions that need to be taken, and report the situation in writing.

Deaths and severe injuries, events that can jeopardize workers' health, safety and work order in the pit will be immediately reported to the technical supervisor.

Points that should not be crossed by workers during danger will be determined by the technical supervisor or his/her assistants and will be clearly marked. After it is reported that the danger is resolved, work cannot be resumed until the technical supervisor has conducted necessary controls in the danger zone, depending on the nature of the danger and determined that safety is restored.

Dangers that jeopardize workers' health and occupational safety and accidents that cause loss of lives, severe injuries,

or poisoning will be immediately declared to the Ministry of Labor and Social Security and the Ministry of Energy by the employer.

This declaration does not eliminate the obligation of the need to inform, per general provisions, local authorities.

Occupational accidents resulting in a worker being unable to work for more than 7 days will be notified, including their causes, in writing to the aforementioned authorities.

Due to underground mining accidents (explosion, fire, and collapse) being perceived as an above-ground incident, initially the civil defense and fire crews are dispatched to the scene of the accident. During the time it takes for the evacuation teams to reach the scene of the accident and respond, these teams try to respond to the situation owing to the psychological imposition of the accident atmosphere. Naturally, rather than rescuing, these teams, lacking the training, education, and equipment required to respond to mining accidents and the abilities to use them, risk their own lives, and this may cause further accidents underground. Furthermore, coordination chaos may occur above ground.

The scene of the accident is crowded by the victims' relatives and nearby habitants; this jeopardizes the healthy work environment. Furthermore the scene of the accident may be filled with local or national visual or print media, depending on the magnitude of the incident. This results in news that are misleading to the public and incendiary to the relatives of the victims if proper elucidation is not provided. If necessary precautions are not taken, it results in taking of victim photographs that may lead to even more suffering of their relatives.

In mining accidents, there are victims with burns of varying degrees that require immediate treatment. The search for a hospital with a burn treatment unit and the transfer of the victim risks the life of the victim.

In conclusion, all accidents occurred due to failure to meet the requirements of the "By-Law Regarding the Workers' Health and Safety Precautions That will be Taken in Mining and Quarry Businesses and in Tunnel Construction" [4], and particularly, "The Regulations Regarding the Precautions That Need to be Taken in Pits That Have Firedamp and That Are Prone to Fires" [5] and "Regulations For Health and Safety Conditions in Underground and Above Ground Mining Businesses" [6] provisions that have been enacted on the basis of this by-law.

The most powerful accidents among the occupational accidents of underground coal mines are collapses, particularly firedamp explosions. Accident frequency rate of collapse is

higher than that of firedamp explosion. Methane drainage is the definitive solution to prevent methane-based accidents. This prevents methane from accumulating to the point where it can pose dangers during labor, by absorbing and removing 50%–90% of methane that can be produced prior to production. Furthermore, as incoming methane levels decrease, ventilation cost will decrease, the production cost will decrease, dust production will decrease, and work environment will be more comfortable. By draining methane that is certain to arise during production, fines-according to the Kyoto Protocol, of which we are a signatory-will be avoided and an economically valuable product will be procured. Due to lack of experience that may ensue because coal seam is thick, and hitherto, work has been conducted in a methane-free environment, producing without methane drainage can lead to a new disaster [1].

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