

Mine Foreman Training

Mine Fires and Explosions

Unit 5

Power Point Program and Training
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Explosions



What are the principal causes of explosions?



**Ignition of gas, coal dust,
or both by an electrical
arc, open lights, smoking
and misuse of explosives.**



**What combination of
circumstances is
necessary to cause an
explosion?**



(1) Fuel (gas, dust or both)

(2) A source of ignition (open flame or arc)

(3) Oxygen



**What are the most
common causes of mine
explosions?**



**Accumulations of
explosive mixtures of
methane and air.**



What is the principal cause of accumulations of explosive mixtures of methane and air?



**Interrupted or
insufficient ventilation.**



**What are causes of
interrupted ventilation?**



Roof falls, accumulations of water, or failure to properly maintain ventilation controls.



**What negligent act
constitutes the most
dangerous gas-explosion
hazard in coal mines?**



**Disrupting ventilation
devices or systems.**



What are the principal causes of the ignition of explosive mixtures?



**Electric arcs, smoking,
and failure to maintain
equipment in
permissible condition.**



What are explosive mixtures?



**Methane and air, coal
dust and air, or methane
and coal dust in
suspension and air.**



**How can mine explosions
be prevented?**



**By good supervision,
adequate ventilation, using
permissible equipment and
explosives, adequate rock
dust, and prohibiting
smoking in the mines.**



What should be done to prevent a possible explosion from being intensified by coal dust?



Removal of fine dry coal dust and adequate rock dusting.



**Why is smoking prohibited
in all underground coal
mines?**



Because of the danger of ignition of explosive mixtures and the possibility of starting mine fires.



What is the best way to guard against the possibility of miners taking matches and smokers' articles underground?



By proper training, posting a warning at the entrance of the underground mine, and implementing an effective search program.



What action should a miner take if he/she knows that a fellow worker or official is smoking underground?



**Notify the foreman
immediately.**



**What should be done
when methane is
detected at potentially
dangerous levels?**



Miners should be withdrawn from the affected area, the power cut off from the section, and the methane removed.



**Who should supervise
the removal of unusual
or dangerous quantities
of methane?**



**A certified mine official
or the state mine
inspector.**



To whom should unusual accumulations of methane be reported?



**To the appropriate mine
inspectors and mine
management.**



**What should be done
before employees are
permitted to enter idle
or abandoned sections?**



**The sections should be
examined by a certified
official.**



From what dangers is protection required in unused or abandoned parts of a mine?



**Dangers of
accumulations or
outflows of dangerous
gases.**



How should all unused and abandoned parts of the mine be protected against the accumulations or outflows of gases?



**By ventilation or proper
sealing.**



What should be done with electric power when unusual, dangerous accumulations of methane are found in any portion of a mine?



Electric power should be disconnected from the affected portion of the mine.



**What should be done
with electric power in a
section when ventilation
fails?**



**The power should be
disconnected.**



What should be done before power is restored to a section where ventilation has failed or accumulations of methane have been detected and removed.



A thorough pre-shift examination should be conducted and the area determined to be safe.



Under what conditions should an employee be prohibited from entering a mine to perform work on idle days?



**When a pre-shift exam
has not been conducted
and supervision has not
been provided.**



**What should be done
with accumulations of
gas in worked-out or
abandoned portions of a
mine?**



The gas should be removed immediately, or the area should be effectively sealed.



**How should dangerous
gases be removed?**



**They should be diluted
with air, rendered
harmless, and carried
away by the ventilating
current.**



**What evidence is
required that working
places have been
examined?**



The date and time of examination, as well as the initials of the examiner, should be marked as close as possible to the face.



What is the first thing a miner should do upon entering a working place at the beginning of a shift in a fire-bossed mine?



See if the fire boss has placed a danger sign and his initials in any area.



**What should miners do
if they cannot find the
fire-boss' mark?**



**Notify the section
foreman.**



**Who should be superior
to the fire-boss relative
to the performance of
their duties?**



**A fire-boss should have
no superior officer.**



**What should a foreman
do if a drill hole has
penetrated old workings
that are inaccessible?**



Test for gas and low oxygen.



FIRES AND FIRE PREVENTION



What are the principal causes of fires in a coal mine?



**Electric arcs, smoking,
ignition of gas and dust,
improper blasting, and
spontaneous combustion.**



In what way may the possibility of mine fires be lessened?



By the use of permissible explosives, careful electrical installations, sealing of abandoned areas, prohibiting smoking, and careful supervision.



**Why should oil, grease,
and rubbish not be
permitted to accumulate
in or about mines?**



They are fire hazards.



Where should oil and grease be stored on the mine surface property?



**In closed metal
containers that are in
properly ventilated, fire-
proof buildings.**



**What kind of receptacles
should be provided for
oily waste?**



Tight metal receptacles.



**Should open lights,
smoking, and open
wiring be prohibited
from places where oil
and grease are kept?**



Yes



What protection against fire should be provided where oil and grease are kept or used in quantities?



Fire extinguishers of the proper type, as well as rock dust or sand.



How should oil and grease be carried and kept in a mine?



**They should be carried
in substantial closed
containers and only one
day's supply should be
kept underground.**



**How should lubricating
oil and grease be kept in
face regions or other
working locations?**



They should be kept in portable, closed metal containers.



Why should welding apparatus and cutting torches not be used where oil, grease, or coal dust is present?



**The fire hazard is too
great.**



**What precaution should
be taken when welding
underground?**



Cutting and welding should not be done in or inby the last open crosscut or in return air except in cases of emergency and only after proper checks for explosive gases have been made. Adequate fire extinguishing agents must be available in case of fire.



What hazard may be created by wooden structures inside a mine?



The hazard of fires. Inside structures (substations, pump rooms, etc.) should be of fireproof construction, including their doors. Where the fireproofing material is in contact with timber or coal, it should not be of metal, because metal will transfer heat from the inside to the outside of the structure, thereby defeating the main purpose for which the incombustible structure was intended.



FIRE-FIGHTING EQUIPMENT



**What are the classes of
fire?**



**Class A, Class B, Class
C, and Class D.**



**What materials are
involved in Class A
fires?**



**Materials such as wood,
coal, and paper.**



**What materials are
involved in Class B
fires?**



Flammable liquids.



What materials are involved in Class C fires?



Combustible materials in electrical equipment.



**What materials are
involved in Class D
fires?**



Combustible metals.



**What three ingredients
must be present at the
same time for a fire to
occur?**



**Fuel, oxygen, and heat
(ignition source)**



**If one of these three
ingredients is removed,
will the fire go out?**



Yes



**How can heat be
removed from a fire?**



By cooling the fire with water or the appropriate fire extinguisher.



How can oxygen be removed from a fire?



**By smothering the fire
or otherwise excluding
air from it.**



True or False: Fires in enclosed areas consume the oxygen in the surrounding air.



True



True or False: Most fire deaths are caused by fire gases and not directly by the flames or heat.



True



**Burning trash, paper,
and wood is an example
of what type of fire?**



Class A fire.



**In addition to Class A
fire extinguishers, what
can be used to extinguish
Class A fires?**



Water



True or False: When neoprene and other synthetic rubber compounds burn, they give off extremely toxic gases in addition to carbon monoxide.



True



What kind of fire extinguisher should be used to extinguish burning diesel fuel, kerosene, gasoline, or grease?



Class B fire extinguisher.



If a battery charging station, transformer, circuit breaker, electric motor, or other electrical equipment were on fire, what type of fire extinguisher should be used?



Class C fire extinguisher



What type of extinguisher should be used on combustible metals such as magnesium, titanium, zirconium, and potassium?



Class D fire extinguisher



What types of fire extinguishers or fire-fighting agents are suitable for fighting mine fires other than electric fires?



Soda-acid, foam, carbon dioxide, nitrogen, and dry chemicals.



What types of fire extinguishers are suitable for fighting electrical fires?



Carbon dioxide and dry-dust type (Class C).



What kind of fire-fighting equipment shall be provided or available at each mine?



**Appropriate types of
fire-fighting equipment
of adequate size.**



**How shall fire-fighting
equipment be located
and maintained?**



Fire-fighting equipment shall be:

- (1) Strategically located;**
- (2) Readily accessible;**
- (3) Plainly marked;**
- (4) Properly maintained; and**
- (5) Inspected periodically, with records kept of inspections**



**How many fire
extinguishers of what
size must be kept at a
mine?**



There shall be an adequate number of fire extinguishers of appropriate size.



**When a fire extinguisher
has been discharged,
what must be done?**



It must be replaced or recharged with the same capabilities before being discharged.



**How often are fire
extinguishers to be
inspected?**



**At least every six
months.**



**How often shall fire
extinguishers be tested?**



At least once each year.



**How shall fire
extinguishers be
maintained?**



**They shall be maintained
according to the
manufacturer's
recommendation.**



What procedures must be followed to show proof of inspection and testing of extinguishers?



Each extinguisher shall bear a tag showing the date of inspection and testing and the initials or name of the person making the examination.



**Do fire extinguishers
require approval?**



Yes



Who must approve the design and construction of fire extinguishers?



**Underwriters
Laboratories, Inc. or
Factory Mutual
Research Corporation**



True or False: All fire extinguishers have labels that indicate the type of fires they can be used to extinguish.



True



**What other information
is on the fire
extinguisher's label?**



Information regarding the distance from the fire at which the fire extinguisher is effective.



**Are fire extinguishers
required on self-
propelled mobile
equipment?**



Yes. The appropriate type and size must be provided.



**Are extinguishers
required on portable
cutting and welding
equipment?**



Yes. Fire extinguishers of the appropriate type and size shall be an integral part of portable cutting and welding equipment.



**What precautions must
be taken when welding
or cutting near
combustible materials?**



Precautions which will ensure that smoldering metal or sparks do not cause a fire. Adequate fire-fighting materials must be immediately available.



What devices must be installed on belt conveyors to prevent hazards that might cause fires?



**Safety (slippage)
switches that
automatically stop the
drive pulley if the belt
stalls or slips excessively.**



Fighting and Sealing Mine Fires



**What are the usual
methods of controlling
or extinguishing
underground mine fires?**



- (1) Direct attack with water, chemicals, rock dust or sand.**
- (2) Enclosing affected areas with tight seals.**
- (3) Flooding affected areas.**
- (4) Use of foam.**



How may rock dust be used effectively to control an underground mine fire?



**By coating the fire area
with a thick layer of rock
dust.**



**Under what conditions
may rock dust be used to
control a mine fire?**



When the fire can be approached near enough so that rock dust can be directed upon the burning material.



What advantage does rock dust have over the use of water in controlling an underground mine fire?



Rock dust helps to exclude oxygen and eliminates the formation of steam and water gas. The use of rock dust also protects the roof from disintegration usually caused by steam and water.



What is the most effective means of applying rock dust to an underground mine fire?



**A high-pressure rock-
dusting machine.**



What is the safest and most effective way of fighting a serious underground mine fire?



By sealing the affected area, if possible.



**When should a mine fire
be sealed?**



**Whenever it is not
reasonably safe to
employ direct methods
of fighting it.**



When is it advisable to fight an underground mine fire by flooding?



Whenever it cannot be sealed or fought directly.



Why is it not advisable to fight an underground mine fire by flooding?



- (1) Heavy damages.**
- (2) Expenses of removing the water.**
- (3) Impossibility of ascertaining that the fire is extinguished.**
- (4) The mine may be idle for some time.**
- (5) Possibility of generating explosive and dangerous gases by an insufficient amount of water on the fire area.**



What is the object of sealing a mine fire?



To cut off the supply of oxygen.



What are the principal hazards in sealing mine fires?



**The dangers of
explosions and of miners
breathing poisonous
gases.**



**What changes occur to
the atmosphere in a
sealed fire area?**



The oxygen decreases, carbon dioxide increases, and the carbon monoxide increases at first but gradually decreases as the fire is extinguished. Also, explosive gases may accumulate.



What is the first thing to do upon discovery of a mine fire?



**Withdraw the miners
from the mine, except
those engaged in fighting
the fire.**



How may the danger of an explosion be minimized while sealing a fire area?



By sealing sufficiently far away to prevent explosive mixtures from accumulating to dangerous levels before the fire seals can be completed.



**What kind of fire seals
should be erected first?**



Temporary seals



Why should temporary seals be erected first to seal a mine fire?



Speedy erection of temporary seals lessens the exposure of the workers to the danger of an explosion.



What material should be used for temporary fire seals?



Triple brattice cloth that is installed tight against the ribs, roof, and floor.



During what period after a fire seal has been erected is there danger of an explosion?



**While the oxygen
content remains above
12%.**



What are the essential requirements of permanent fire seals?



They should be as air tight as possible. Provisions should also be made for obtaining air samples and providing relief from water pressure.



Before erecting a permanent seal, what should be done as a safety precaution?



All track, wires, and other material that will cause ignition should be removed from the location of seals, and the area in front and behind should be well timbered and rock dusted.



**How may permanent fire
seals be made relatively
airtight?**



By attaching them to the floor, roof, and ribs.



Of what material should permanent fire seals be constructed?



**They should be
substantially constructed
of incombustible
material.**



What facilities should be provided in permanent fire seals where air samples are to be collected?



**Pipes and valves should
be provided through
which air samples may
be collected.**



By what means can the condition of the fire in a sealed area be determined?



**By analysis of air
samples collected from
behind the seals.**



What would a continued high oxygen content in a sealed fire area indicate?



**That there is a leakage of
air into the sealed area.**



**What would a
fluctuating high carbon
monoxide concentration
in a sealed fire area
indicate?**



That there is enough leakage of air into the sealed area to keep the fire active.



What does the presence of carbon monoxide in a sealed fire area indicate?



It indicates an active or recently active fire.



What are the two most dangerous gases encountered in mine fires?



Carbon monoxide and methane.



How does the action of a mine fire cause explosive gases to be formed?



**By distillation of
combustible gases from
the coal and the
surrounding
carbonaceous shales.**



How may the danger of an explosion following a mine fire be minimized?



**By sealing a large
enough area.**



What is the primary consideration in fighting mine fires?



**The safety of the miners
engaged in the work.**



What is the danger of reversing the air current in the event of a mine fire?



Gases formed by the fire may form an explosive mixture when fresh air is provided and this mixture may explode when drawn across the fire.



In the event that a mine fire is in a return-air entry from an extremely gassy section, what precaution should be taken?



The air should be short-circuited to prevent the gas from being carried across the fire area.



In the event that a mine fire is discovered in an intake-air entry, what should be done to protect the workers in the mine from smoke and dangerous gases?



The air should be short-circuited to prevent the smoke and products of combustion from reaching the workers.



In case of a serious mine fire in an intake-air entry, where should the air be short-circuited?



Outby the fire area, if possible.



In case of a serious mine fire in a return-air entry where should the air be short-circuited?



Inby the fire.



In the event of a mine fire in a gassy mine, how should the fire be approached?



**Cautiously, by
competent persons using
all necessary safety
equipment and approved
gas detection devices.**



What precautions should be taken to protect those engaged in attempting to extinguish a mine fire?



The fire-fighting crew should be provided with fresh air or equipped with approved oxygen breathing apparatus.



**In the event of a mine
fire in a gassy mine,
should the fan be
stopped?**



**Only at the direction of
the rescue personnel in
charge.**



How long a period is usually set, after temporary seals are erected, before personnel are permitted to return to the seals for investigation?



Twenty-four hours or longer.



After a fire has been sealed with temporary seals and twenty-four hours have elapsed, what precautions should be taken to ensure that permanent seals may be erected in relative safety?



Air samples should be taken and a minimum number of miners exposed.



Unsealing Mine Fires



**Who should supervise
the reopening of sealed
areas?**



**Proper mine inspection
agencies.**



What should be done to determine when a fire area should be opened?



Samples of air from the sealed area should be taken and analyzed.



How would an air analysis indicate that the fire was extinguished?



**By low oxygen content
and the absence of
carbon monoxide.**



**What should be absent
from the air samples
before an attempt is
made to unseal a mine
fire?**



Carbon Monoxide



**What level of oxygen in
the methane-air mixture
renders an explosion
impossible?**



**An oxygen level of 12%
or lower.**



Why is it not advisable to unseal a fire shortly after the carbon monoxide has disappeared and the oxygen content is reduced to about 3% or lower?



Sufficient time should be allowed for the area to cool to minimize the danger of rekindling the fire.



To what extent should oxygen be reduced before it is advisable to attempt to open a fire seal?



About 3% or lower.



Why is it necessary to have a low oxygen content before a fire seal is opened?



To ensure that the fire is out.



**How should ventilation
be restored to a fire
area?**



**Gradually and
systematically.**



**Why should ventilation
be restored to the fire
area gradually and
systemically after
unsealing?**



To ensure that all places are cleared of gas before personnel enter and to prevent explosive mixtures from forming by increasing the oxygen content.



What is the effect of extinguishing a sealed mine fire with carbon dioxide generated by the fire?



Practically none.



**What preparatory work
is necessary prior to
unsealing a mine fire?**



Preparation should be made for the fire gases to pass directly to the main return and all entries outby the seals should be well rock dusted.



**Why should careful
consideration be given to
unsealing a fire area?**



The dangerous character of the gases in the sealed area makes the operation extremely hazardous.



What is the major consideration in determining when a fire seal should be broken?



**The composition of the
gases in the sealed area
and their correct
interpretation.**



What is the comparative effect upon the air between a raging fire and a smoldering fire?



The oxygen will be consumed faster in a raging fire.



**How will oily shale roof
and high-volatile coal
affect conditions
otherwise favorable to
reopening a fire seal?**



Heat will be retained longer and the danger of rekindling will be increased.



How may a sealed fire area between intake and return airways be affected by the difference in ventilating pressure?



The difference in pressure may create an air leakage across the fire area.



**What effect does
barometric pressure
have on a sealed fire
area?**



Variations of barometric pressure will result in air leakage around the fire seals in the direction of the lower pressure.



**Under what conditions
may a sealed fire area be
quickly reventilated?**



When the affected area is small and there is every indication that the fire has been extinguished.



To what extent should oxygen be reduced in a sealed fire area before operations to recover bodies are started?



The oxygen should be reduced to a point where explosion within the area is impossible, preferably below 3%.



What is the procedure in using air locks to recover a sealed fire area?



Apparatus crews advance short distances inside of air locks and, after erecting new seals with provisions for air locking, establish ventilation to the new base. This procedure is repeated until the entire area is recovered.



**To what extent should
electricity be permitted
in a mine during the
unsealing of a fire area?**



Electricity to the entire mine should be disconnected.



What source of electrical arc or spark may be overlooked but should be considered before re-opening a sealed area?



Battery-powered equipment.



Recovery Operations Following Explosions and Fires



What is the first thing to be done on the surface of a mine after an explosion?



See that the ventilating fan is operating properly



With the ventilating apparatus working properly, what steps should be taken regarding possible survivors?



**Every endeavor should
be made to determine
the location of possible
survivors.**



What is the most important duty of the electrician after a mine explosion?



To open and lock-out all electrical switches in power circuits leading into the mine.



**What should be the duty
of the security personnel
after a mine disaster?**



They should rope-off the areas around the main mine entrance and the fan and admit only authorized persons.



**What should be the duty
of the mining engineer
after a mine explosion?**



To furnish an up-to-date map of the mine showing the regular coursing of the air and to keep it updated showing the progress of recovery.



What agencies should be notified immediately when a mine explosion occurs?



**The Department of
Mines and Minerals,
now known as the Office
of Mine Safety and
Licensing, and the Mine
Safety and Health
Administration.**



How should recovery work be scheduled after a mine explosion where such work may be extensive?



**In four 6-hour shifts or
three 8-hour shifts per
day.**



Who is eligible to supervise crews on each shift in recovery work after a mine explosion?



**Personnel with
experience and special
training in recovery
operations.**



What is the minimum number of apparatus crews that should be employed underground at a time in recovery work after an explosion?



At least two



**What type of workers
should be on each shift
during recovery work
following a mine
explosion?**



**Trained mine rescue
teams.**



What should be the qualifications of mine rescue team members?



**They should be well-
trained, physically fit,
and competent.**



**What equipment should
rescue parties wear?**



**Respiratory apparatus
crews should wear self-
contained oxygen
breathing apparatus.**



What means of gas detection should be provided for rescue parties?



**Permissible detection
equipment capable of
detecting methane,
oxygen, and carbon
monoxide.**



In recovery work, where is it advisable to have an underground first-aid station?



Near the fresh-air base.



**What examination
should be made
immediately upon
entering a mine
following an explosion?**



**Return airways should
be examined for smoke
or indications of fire.**



**What particular danger
is present if the
ventilation is restored
after an explosion,
before an exploration is
made?**



Smoldering fires may be revived and another explosion may follow.



What chief factors determine the location and establishment of a fresh-air base in mine recovery work?



The fresh-air base must be in fresh air, free from possible contamination by poisonous and explosive gases, secure against roof falls, and readily accessible for rescue and recovery operations.



What breathing apparatus must be used for exploration beyond fresh air?



Self-contained oxygen breathing apparatus.



What should the captain of a mine rescue team do before leaving the fresh-air base?



The captain should have all apparatus examined, communicate the extent and duration of the trip to the person in charge, and see that another crew is in reserve.



How should mine rescue teams keep in contact with each other and with the fresh-air base?

**With a life line and a
voice communication
system.**

What is the advisable distance a mine rescue team should explore when lives are not at stake?

About 300 feet.

What is the maximum distance a mine rescue team should explore under favorable conditions when lives are at stake?

**One thousand feet - one
way.**



What is the length of a standard mine rescue life line?



One thousand feet.



**What are the
recommended life-line
signals?**



**One Pull: “Stop” if traveling,
or “all right” if at rest.**

Two Pulls: “Advance”

Three Pulls: “Retreat”

Four Pulls: “Distress”



**How should the life line
be carried at all times?**



**Taut between all
members and the fresh-
air base.**



**Is it advisable to explore
ahead of fresh air in
dense smoke?**



**Only to save lives or in
an emergency.**



**Under what conditions
of travel is it particularly
dangerous to explore
ahead of fresh air?**



**When necessary to crawl
or wade in deep water.**



In the course of recovery work, if miners are discovered alive but not physically able to travel by themselves, how should they be treated?



They should be transported to the fresh-air base and given first-aid treatment.



When re-establishing ventilation for recovery operations after an explosion, what type of stoppings should be used?



**Wood and brattice cloth
or boards and plaster.**



**What should be done
when fires are found
during recovery
exploration?**



Every effort should be made to extinguish them. If a fire is inaccessible it should be sealed at once.



Why is it advisable to have telephones at the fresh-air base?



**To speed the
transmission of messages
and instructions.**



Why should a map of the mine be available for personnel in charge of recovery?



So that rescue and recovery may be planned and executed systematically.



**Where should the shifts
be changed when
recovery work is in
progress?**



At the fresh-air base.



What precautions should be taken when miners are coming off shift from recovery operations?



**They should be checked
out of the mine.**



What precautions should be observed by recovery teams as they advance in the process of restoring ventilation?



They should be careful not to permit dangerous gases to issue from adjoining open dead ends or unventilated areas. Such areas should be ventilated or sealed.



**What is the most
harmful gas found after
an explosion?**



Carbon monoxide.



Barricading



What is a barricade?



A stopping erected to prevent gases from an explosion or fire reaching an unaffected part of the mine where miners may remain until rescued.



**Have barricades been
successful in preserving
life after mine fires and
explosions?**



Yes, in many instances.



**How may barricades be
constructed?**



From any suitable material at hand, such as refuse from gob, stopping material, ties taken from tracks, brattice cloth, or lumber.



Should an explosion occur and the entries leading to the surface from a section in which miners are working be filled with gases, what is the safest thing to do?



**If the entries are travelable,
use self-contained self rescuers
(SCSRs) to travel to safety.
Otherwise, short-circuit the
ventilation from the section
and erect a barricade.**



What can be done to prevent the gases from an explosion from reaching the point where a barricade is to be erected?



**Short-circuit the air
outby the place and erect
a temporary curtain.**



**How large an area
should be enclosed
within a barricade?**



As large as possible.



**While within a barricade
how should miners
conduct themselves?**



They should remain at rest, but move about occasionally to mix the air.



**How can compressed air,
if available, be of
assistance within a
barricade?**



**It can be used to
replenish oxygen in the
air.**



How much air does the average person require within a barricaded area when at rest?



**About one cubic yard
per hour.**



When gases begin to enter a barricade, what can be done?



If the place is large enough, additional barricades can be built in by the first ones erected, or the crevices can be plugged with brattice cloth or clothing.



**What should all
workmen know about
the layout of their
section of the mine?**



They should be familiar with the normal routing of the air and the most suitable locations for barricades.



**Why should temporary
barricades be built first
when possible?**



A brattice cloth barricade can be erected quickly and it can protect the miners from noxious fumes while they erect a permanent barricade.



How might dangerous gases and smoke enter a barricaded area if proper precautions are not taken?



Dangerous gases and smoke might enter from openings to workings which were overlooked during barricading.



What signs and signals should trapped miners provide for rescue workers?



They should leave a sign outside the barricade and should frequently signal by pounding on water pipes, track, or the roof or rib to attract the attention of rescue parties.



**What should be done
with electric cap lamps?**



**Not more than one
should be permitted to
burn at a time.**



**What should be done
with the food and water
that is on hand?**



**It should be carefully
rationed.**



For approximately what length of time may ten miners be barricaded in an area 270 feet long, 5 feet high, and 20 feet wide before they begin to suffer from oxygen depletion?



Approximately 100 hours.

Solution: $\frac{270 \times 20 \times 5}{27} = 1,000$

cubic yards.

$\frac{1000}{10} = 100$ hours

(Note: 27 cubic feet = 1 cubic yard)



Coal Dust



Is it possible to have an explosion in a mine without explosive gas being present?



Yes. In addition to explosive gas, the fine coal dust in suspension is explosive.



What usually causes explosions to spread over a wide area and sometimes extend throughout the mine?



Coal dust



**How does coal dust
contribute to the severity
of an explosion?**



When coal dust is raised in suspension and ignited, the explosion spreads and becomes more severe.



**Is all coal dust
explosive?**



**Yes. All coal dust is
explosive.**



What effect does the presence of small amounts of methane have upon explosibility of coal dust?



**It increases the
explosibility of coal dust.**



**How is fine coal dust
distributed throughout
the mine?**



It is carried by the ventilating current and deposited on the ribs, roof, floor, and timbers.



**How are coal dust
explosions most
frequently started?**



**By explosions of
methane, explosives and
electric arcs.**



**How much coal dust is
enough to start a coal
dust explosion?**



**About one-twelfth of an
ounce per cubic foot of
air.**



What are the largest size particles of coal dust that will easily be ignited?



**Those that will pass
through a 20-mesh
screen.**



What effect does fineness of coal dust have upon its explosibility?



**Fineness will increase
the explosibility.**



**What should be done
with accumulations of
fine, dry coal dust in a
mine?**



They should be removed.



What may be done to protect miners from concentrations of coal dust?



Concentrations of coal dust can be reduced by spraying water as coal is being mined, using dust collection systems, and adequately ventilating the mine.



**Should return air
containing large
concentrations of coal
dust be permitted to pass
through active
workings?**



No



**What is the ignition
temperature of coal
dust?**



From 970° to 1130° F.



**How should dry and
dusty sections be
treated?**



The dust should be removed and the sections kept thoroughly rock dusted.



**What benefits are
derived from rock
dusting?**



The danger of a coal dust explosion is reduced by decreasing the explosibility of the coal dust, and illumination in the mine is improved.



**What parts of a mine
should be rock dusted?**



All sections of the mine.



**What kind of rock dust
should be used in coal
mines?**



Rock dust must meet the following criteria:

- (1) All rock dust must pass through a sieve having 20 meshes per linear inch and 70% or more must pass through a sieve having 200 meshes per linear inch;**
- (2) Particles of rock dust, when wetted and dried, will not cohere to form a cake which will not be dispersed by a light blast of air; and**
- (3) It must not contain more than 5% combustible matter nor more than a total of 5% free and combined silica (SiO_2).**



**Is it advisable to use
rock dust with a free and
combined silica content
lower than 5%?**



Yes, if it is obtainable.



**How close to the
working face should
rock dust be applied?**



**Within 40 feet of the
face, including the last
open crosscut.**



What is the minimum amount of incombustible material necessary to render coal dust non-explosive?



65%



**What is wet rock
dusting?**



It is a mixture of rock dust and water in the form of a slurry and applied by a spray.



**What areas of the mine
may be wet rock dusted?**



Wet rock dust may be used on roofs and ribs of mines in face areas only. Dry rock dust should be applied to the floor.



Within what distance of the face must rock dust be maintained on the floor, roof and ribs of a working section?



40 ft.



After rock dust has been applied in a coal mine, how may the incombustible content of the mine dust be determined?



By analysis of samples.



**What is the largest size
dust particle analyzed
with a volumeter?**



**One that will pass
through a 20-mesh
screen.**



**Where and when should
dust samples be
collected?**



**At representative
locations and at regular
intervals.**



**Should records be kept
of analyses of dust
samples?**



**Yes, for future reference
and comparisons.**



Mine Rescue Apparatus



**What is a self-contained
oxygen breathing
apparatus?**



A device to protect the wearer against any concentration of poisonous mine gases or oxygen deficiency.



What is the general principle of the self-contained oxygen breathing apparatus?



Oxygen is supplied to the wearer and exhaled carbon dioxide is absorbed.



**How does one breathe in
a self-contained oxygen
breathing apparatus?**



Inhalation and exhalation are through a mouthpiece or facepiece, depending on the type of apparatus.



**How many persons are
required for a mine
rescue team?**



Five or six.



How shall a mine rescue team be prepared for emergency service?



**By training at least once
a month.**



Why should all members of a mine rescue crew be physically fit?



**So they can safely
perform strenuous work
while wearing the
apparatus.**



When is it dangerous to breathe pure oxygen, as that used in a self-contained oxygen breathing apparatus?



**At pressures above
normal atmospheric
pressure.**



Each underground coal mine operator shall submit documentation to the commissioner that a *trained mine rescue team* is within sixty (60) minutes' driving time of each of his mines.



If the coal company cannot provide a trained mine Mine rescue team, the Office of Mine Safety and Licensing (OMSL) shall provide a trained mine rescue team which shall be available within 60 minutes' of driving time.



Environmental



**What is an
environmental
emergency?**



**Any situation in or
around a coal mine that
involves or can cause
damage to the
environment.**



**What are some examples
of environmental
emergencies?**



- (1) Leaking fuel or chemical tanks.**
- (2) Black water discharges into natural streams.**
- (3) Ponds that leak or show signs of failure.**
- (4) Improper disposal of batteries, waste oils, or cleaning solvents.**
- (5) Slide or slope failure**
- (6) Outcrop barrier failure (blowout)**



**What is a foreman
required to do if an
environmental
emergency is observed?**



(1) Immediately report the situation to a supervisor or a member of management.

(2) Make a record of the location, time and date, and person notified.

(3) Take any immediate remedial action that may be appropriate.



**Can a person be
imprisoned or fined if
they are responsible for
harm to the
environment?**



Yes. Even if you work for someone else, you may be held liable if your actions were responsible for harm to the environment.



End of Unit 5