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Risk Assessment And Air Pollution In The Cement Industry And Consequences

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Abstract: ***Even in the twenty-first century, millions of people are working daily in a dusty environment. They are exposed to different types of health hazards i.e., fume, gases and dust, which are risk factors in developing occupational disease. Cement industry is involved in the development of structure of this advanced and modern world but generates dust during its production. Cement dust causes lung function impairment, chronic obstructive lung disease, restrictive lung disease, pneumoconiosis and carcinoma of the lungs, stomach and colon. Other studies have shown that cement dust may enter into the systemic circulation and thereby reach the essentially all the organs of body and affects the different tissues including heart, liver, spleen, bone, muscles and hairs and ultimately affecting their micro-structure and physiological performance. Most of the studies have been previously attempted to evaluate the effects of cement dust exposure on the basis of spirometry and or radiology. However, collective effort describing the general effects of cement dust on different organ and systems in humans and / or animals has not been published. Therefore, the aim of this review is to gather the potential toxic effects of cement dust and to minimize the health risks in cement mill workers by providing them with information about the hazards of cement dust.***

I. INTRODUCTION

This training Module aims to present the main hazards that are embedded in the Cement production processes as well as the risk assessment including the management of the corresponding risk. The basic principles and the risk assessment methodology are described in training module M0-EN, within which the risk assessment form used in this module is provided. For every production process a representative Risk Assessment Table has been prepared, while for all the supporting processes there is a description of the hazards as well as an indicative Check List for managing the identified hazards.The goal of the module is for the participants to have by the end of the course to have:Basic realization of all the main hazards in the cement industry.
Basic knowledge and experience of the ways in which accidents can be prevented
Basic knowledge for managing risk

A. Classification Of Hazards In Cement Industry

In all the cement production processes there are hazards that can be classed in:
1) Routine and general hazards such as:
a) Safe behavior
b) Environment, work and passage areas
c) Work equipment
d) Safety labeling
e) Personal Protective Equipment(PPE)
f) Manual load handling

2) Special hazards during the cement production phases such as:
a) Quarrying
b) Crushing
c) Clinker production
d) Milling processes at raw mill, cement milling and coal milling
e) Material transport
f) Filtering
g) Storage
h) Loading and delivery of final products

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i) Fuel storage activities
j) Use of hazardous material
k) Generating units

II. OBJECTIVE

The goal of the module is for the participants to have by the end of the course to have:
Basic realization of all the main hazards in the cement industry.
Basic knowledge and experience of the ways in which accidents can be prevented
Basic knowledge for managing risk

A. Hazards And Their Sources In The Cement Industry Quarrying

The quarrying activity includes the drilling of bore holes, the filling up of explosives and the triggering of the explosives. Once this happens then the material is loaded and transported either to open storage piles or to the crushing area.m During the process of charging and ignition, the explosives are transported to the explosion area from the explosive storage facilities.

B. Hazards As A Result Of The Storage Transport And Use Of Explosives

The explosives are stored only in approved sites that have to comply with the requirements of relevant legislation. During explosives storage the main hazards are the following:

1) Storing explosives and capsules in the same area
2) Entry of unauthorized persons in the area
3) Smoking or use of naked flame in the storage area
4) Storage of other goods and equipment
5) Bad housekeeping in and out of the ware house.
6) Inadequate distance (<10cm) between the containers and the ware house wall
7) Absence of boundaries and labeling
8) Insufficient building maintenance(lighting, ventilation) with the possibility of concentration of humidity in the ware house
9) Execution of non-approved maintenance work on the warehouse electrical wiring.
10) Insufficient ware house security
11) Not following the FIFO (First In First Out) in the management of explosive stocks Using work or personal equipment that can create sparks (e.g. wireless mobile phones) Hazards during the transport of the explosives are:
  a) The use of unauthorized vehicles
  b) The transport of explosives together with capsules as well as not keeping the necessary labeling during transport
  c) The carrying of passengers
12) The unplanned stoppage The Transport of explosives during unstable weather Hazards during the use of explosives are:
  a) The Failure to implement the company rules and regulations
  b) The use of unauthorized explosives
  c) The Failure to use the approved explosion plan
  d) The existence of unexploded boreholes
  e) The Failure to prevent unauthorized person to approach the explosives area
  f) The transport of more than required explosives quantity
  g) The temporary storage of explosives at excessive temperatures (greater than 65degrees C) Or near naked flame
  h) The use of mobile telephony or wireless near explosives
  i) The use of unauthorized equipment when opening a hole in the Explosives. During the filling up and triggering the explosives The approach of other persons other than the person in charge near the explosion area following the triggering
  j) The failure to comply with the company procedures in case of untriggered explosives
k) The failure to comply with the connecting procedures in case of electrical

C. Hazards During The Bore Holing Process

During the bore holing process the basic hazards are

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1) The moving parts of the bore holing machinery
2) Falls from height
3) Material falling from height
4) Crushing of quarry table
5) Hurling of material
6) Presence of dust and noise
7) Movement of earth moving equipment

D. Crushing

The hazards in the Crushing department focus on

1) The rotational movement and the movement of the parts of the crusher
2) The exposure to noise and dust of the personnel responsible for the continuous control of the crusher
3) The maintenance activities inside the crushing chamber
4) The electrical problems
5) The activities inside the hopper due to:
6) The operation of the feeder
7) The possible crushing of material
8) The approach of heavy goods vehicles for unloading material
9) The movement of heavy goods vehicles:
10) Reversing of the vehicle into the hopper
11) Accident on personnel

E. Storage and Material Transportation System

The main hazards during the transportation and storing of material are:

The airborne dust created during the storage of material The conveyor belts during their normal operation as well as during their maintenance In order to reduce the risk from air borne dust:

Material should not be stored at unacceptable heights

To use dust suction systems

To implement the necessary procedures for the routine cleaning of the settled dust

In material transport systems there are moving parts that are a constant source of hazard for any person working near these conveyors during normal operation or during the maintenance activities. For the safe operation of material transportation systems all the necessary guards are applied to isolate the moving parts. Additionally where personnel is working at a short distance from the guards, emergency stops are provided within short distance of these operators.

During the normal operation of the transportation systems

1) The removal of guards by unauthorized personnel must be prevented.
2) Any maintenance work during the operation of the transportation systems must be avoided
3) Removing material during the operation of the conveyors must be avoided
4) The cleaning of overflows during operation must be avoided unless the cleaning is done by the conveyor operative.
5) The use of unauthorized passageways either over or under the transportation systems must be avoided because there is the risk of personnel getting trapped by the conveyor or overflowing material can fall from height
6) The overhead bridges must be clean in order to minimize the possibility of the tripping and falling of the personnel performing the checks on the conveyor belts
7) Any intervention on the conveyor belt overload systems must be done by authorized personnel
8) For the transportation systems to be secured so that accidental startups are eliminated.

F. Hazards And Protective Measures During Maintenance

The maintenance activities in the inside of the mills include:

1) The maintenance of millings

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2) The replacement of the milling balls As a result of the above activities a number of serious hazards are created for the workers at least as follows:
   a) Falls from height (from the mill platforms)
   b) Hurling of metallic fragments from the mill's shell
   c) Work in confined spaces with insufficient ventilation
   d) Exposure to dust
3) Exposure to High temperatures Due to the nature of the hazards involved such high risk operations must necessarily be planned so that all the following preventive measures are adhered to:
   a) Securing of the plant in a place where there is easy access of the maintenance technician into the mill
   b) The maintenance activity must be conducted by authorized personnel
   c) The work must be carried out under continuous supervision
   d) Adherence to documented operating preventive procedures
   e) Assure the necessary ventilation of the workspace
   f) Assure the reduction of temperature prior to access to the space
4) The use of the appropriate PPEs that must include:

a) Special helmet equipped with eye protector
b) Safety belt connected to a tying rope
c) Special work ware and foot ware able to withstand thermal load

G. Silo Cleaning Process

The internal cleaning of silos is high risk and relatively frequent operation in the cement industry and for this reason all necessary preventive measures must be taken. The cleaning of the silo takes place whenever there is a problem in the extraction of material due to the blocking of the outlets from solidified material. In addition this happens when there is a problem with the ventilators and a result there is insufficient ventilation or homogenization of the material in the Blending Sib.

The main hazards are focused in the following:

1) Work in confined spaces
2) Falling of personnel from the working platform
3) Falling of material
4) Exposure to dust
5) Use of lifting equipment
6) Preventive safety measures

For such a high risk operation there must be a responsible supervisor for the silo cleaning. He is responsible to ensure that the following steps are followed:

Firstly he must notify the silo operatives about the impending cleaning and to make sure that the feeding of material to the silo is stopped. This is done by decommissioning the relevant electrical motors, closing the silo inlet valves and by placing blind flanges for additional safety.

Before the start of any cleaning activity the silo must be inspected from above using light (RCD 15A) which is lowered gradually downwards in order to observe:

a) If there are conglomerated masses of material on the silo walls and at what height
b) The quantity and distribution of material
c) To identify whether the level of material is over or under the silo side door
d) Afterwards the cleaning of the walls from above is carried out, using the Give net system which is done with the use of connecting the necessary piping without having to enter thesilo
e) The next step is to open carefully the side door. The door and the area around the door is cleaned using a dust suction system (DISAB) and with the use of aluminum piping with the operatives staying outside the silo.
f) Once the supervisor has inspected and made sure that he has seen the bottom of the silo near the door and that no material masses are hang from the silo walls, then he gives the necessary instructions to start the Filters funs.
g) All personnel entering the silo must be equipped with the following:
h) Dust mask type P2 or P3 due to the small size of dust particles inside the silo

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i) Safety shoes
j) Safety glasses
k) Helmet
l) Safety belt and harness connected to an appropriate rope leading outside of the silo. There must be at least two operatives outside the silo who in case of emergency will pool out the operative inside the silo. The supervisor is always nearby throughout the cleaning activity
m) The cleaning of the silo is done either manually or using the suction system (DISAB). In both cases the cleaning is done peripherally in a downward spiral direction using the work platform
n) The operator inside the silo must pay constant attention to the fact that he must step only on the clean bottom surface

H. Clinker Production Process

The main hazards are focused on the following

1) Use of fuels
2) Contact with superheated material
3) Exposure to heat
4) Exposure to noise
5) Fall from height
6) Mechanical hazards
7) The hazards due to the maintenance activities inside the clinker furnace may involve:
  a) Taking down and repairing of the composite inner lining
  b) Taking down material that adhered to the inner walls In such activities other additional hazards must be included such as:
  i) Falling of material
  ii) Insufficient ventilation
  iii) Working in a confined space
  iv) Thermal load
  v) Saturation of space with dust
  vi) Moving part of transport machinery

I. Metal Welding And Cutting Operations

The welding and cutting operations entail hazards such as:

1) Hurling of hot particles
2) Burns and fires
3) Explosion
4) Electrocution
5) Exposure to hot and radiatingsources
6) Smoke and dangerousgases In such activities the main protection and prevention measures are:
7) The personnel undertaking these activities must have the necessary competence and authorization
8) The welding work areas must be isolated with the use of appropriate barriers so that glaring and hurling of hot particles to other areas is eliminated
9) When welding is carried out at higher levels all the necessary measures must be undertaken so that other operatives working below are protected from hot particles. It is the responsibility of the welder to implement such protection.
10) Remove all flammable material and waste material. If this is not possible then protective barriers must be used.
11) During the welding or cutting operation there must be a fire extinguisher at hand and the operative must be competent in their use.
12) Make sure that in case where welding is carried out indoors then a smoke suction system must be used appropriately placed.
13) Prior to leaving the welding area the operative must check if as a result of the operation a hot spot has been

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created.

14) Superheated welded areas must be protected so that they do not accidentally come in contact with skin.

15) Welding cannot take place in areas where there is storage of flammable liquids such as petrol and paint.

III. CONCLUSION

Even in the twenty-first century, millions of people are working daily in a dusty environment. They are exposed to different types of health hazards i.e., fume, gases and dust, which are risk factors in developing occupational disease. Cement industry is involved in the development of structure of this advanced and modern world but generates dust during its production. Cement dust causes lung function impairment, chronic obstructive lung disease, restrictive lung disease, pneumoconiosis and carcinoma of the lungs, stomach and colon. Other studies have shown that cement dust may enter into the systemic circulation and thereby reach the essentially all the organs of body and affects the different tissues including heart, liver, spleen, bone, muscles and hairs and ultimately affecting their micro-structure and physiological performance. Most of the studies have been previously attempted to evaluate the effects of cement dust exposure on the basis of spirometry and or radiology. However, collective effort describing the general effects of cement dust on different organ and systems in humans and / or animals has not been published. Therefore, the aim of this review is to gather the potential toxic effects of cement dust and to minimize the health risks in cement mill workers by providing them with information about the hazards of cement dust.

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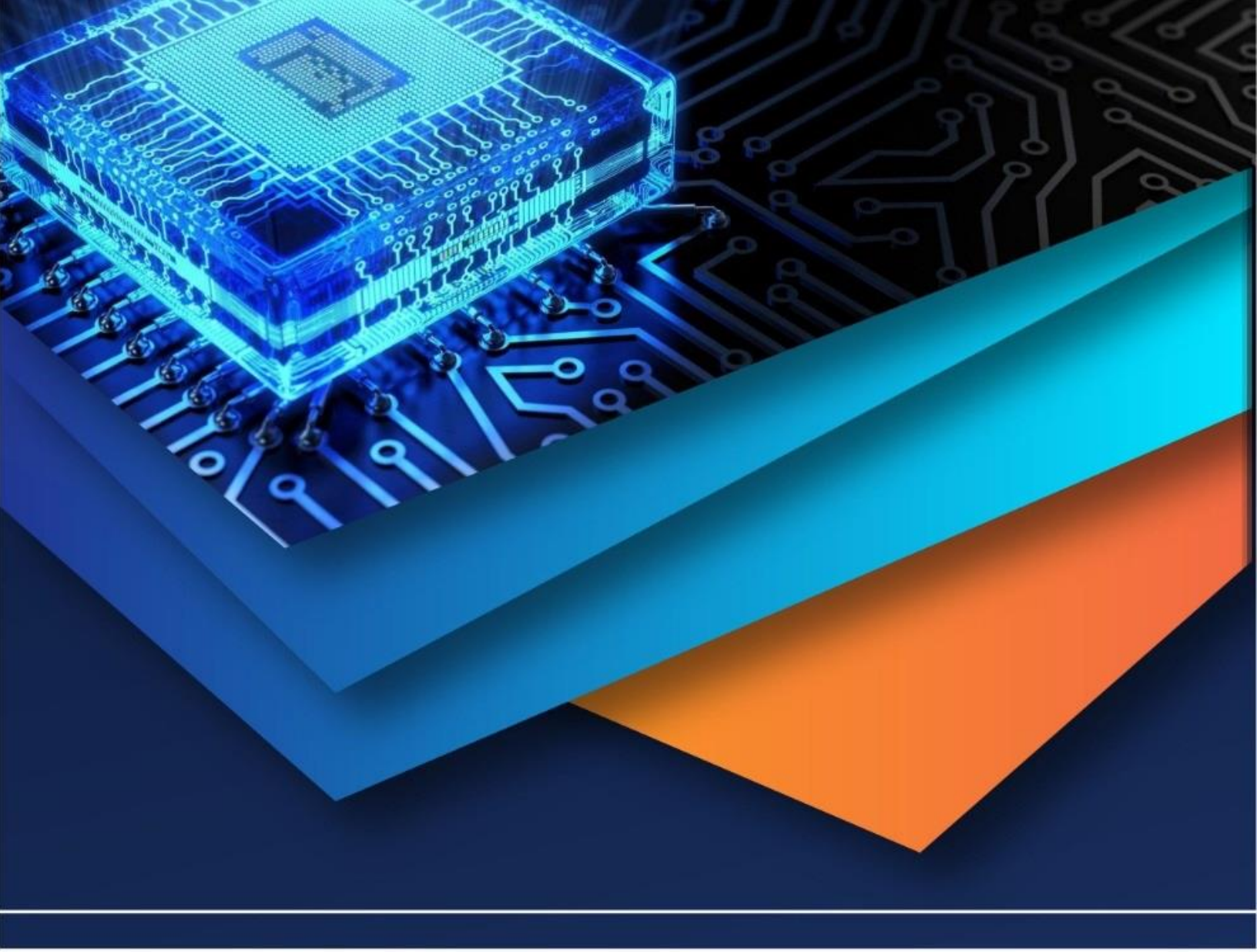

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