

## **SAFETY AND PROTECTION OF HEALTH IN TRANSPORT OF MATERIAL BY BELT CONVEYOR**

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**Abstract:** At operating processes there is a release of harmful pollutants. Pollution is a factor causing failure of machines, their components, but mainly harms health of population. Identification of risks, definition of weak elements of manipulation with material is possible to define safety requirements and take safety-measures.

**Keywords:** safety, manipulation of material, band conveyor, dustiness

### **1. Introduction**

Chemical pollutants in form of dust, fume, vapours, gases and smog are releasing into environment in many technological processes. Increase of their concentration is significantly supported also by activity of people, concretely by operating power stations, industrial activity, using transport, or combustion of communal and industrial waste.

One of working activity, which results in creation of dustiness, is also technology of band transport, based on transport of loose material and thus dusty materials.

Elimination of dustiness is in given case unavoidable mainly for assuring appropriate working conditions of employees and also for increasing lifetime of individual mechanical parts of technical equipments of given device and all operation.

These contrary secondary impacts can be significantly decreased by analysis of risks of selected type of transport device, by properly chosen technology, by knowledge of transported material properties and by total logistic discipline.

### **2. Influence of dustiness on people health in material transport**

Dust arises in industry during crushing, grinding, sieving, mixing, sorting, dividing and of course during transport of material.

Size of dusty elements is in interval 1-100  $\mu\text{m}$ , elements larger than 30  $\mu\text{m}$  are marked as gross dust and are fast settling, sedimenting in common environment.

Volume of elements, which is also by consequence of given production operation got into environment depends also on speed of their movement and on use and construction of transport systems. It occurs also to secondary dustiness in result of air movement, when settled elements are repeatedly turbid and thus significantly affect to total dustiness in given working environment.

Effect on human can be biologically non offensive, but also very harmful. Almost all substances flame in form of dust, with exception of pure inorganic, which create assumptions for initiation of explosive environment.

From the view of assuring failure free operation of production devices, negative impact of dust on individual parts of equipments is not negligible. Many risks result also from alone dust accumulation on workplace.

According to size of dust elements and their ability to endanger breathing tract, we distinguish three components of dustiness:

- ❖ **Inhalable**  
part of external flitting dust, which gets through mouth and nose into breathing tract.
- ❖ **Thorasic**  
fraction of Inhalable, which gets back to larynx into breathing tract, but which can be transported back from the breathing tract by ciliary epithelium. These are elements under  $30\ \mu\text{m}$ .
- ❖ **Alveolic**  
fraction of Thorasic, which represent smallest particles, which permanently stay in alveolar system and cause chronic diseases of lungs. These are particles under  $10\ \mu\text{m}$ .

American EPA (Environmental Protection Agency) established other criteria for dustiness evaluation namely values PM 10, PM 2,5 (in  $\mu\text{g}/\text{m}^3$ ).

### 3. Belt transport

Technology of band transport is chiefly determined for transport of loose and thus dusty materials, Critical places are hoppers, input of material on band and spoil banks, so places where material leaves conveyor, including places of shifting from one conveyor to other.



Fig. 1 Belt conveyor

Dust particles, which leave transport path contrary affect on employees health, they can create explosive environment, significantly decrease lifetime of bearings carrying cylinder, parts of conveyor drive, rollers of conveyor and surrounding technical devices.

Sediments of dust created in proximate surroundings, limit, endanger or disable approach to some parts of operation and surroundings of conveyor.

Construction of classic band conveyor consists of steel construction, driving, reversing and stretching cylinders, supporting benches, on which rollers are installed, and of course transport band.

Transported material gets on band by dumping or shifting. By shifting is understood overflow of material from other band conveyor, dumping is fall of material from other type of conveyor, eventually from dust trunk. From view of dustiness, loose height is very important.

This affects speed of material by continual proportion, which has decisive impact on material turbid during fall on transport band. In heights above 2 meters, it is advantageous to create directed hopper. Principle is shown in Figure 2.

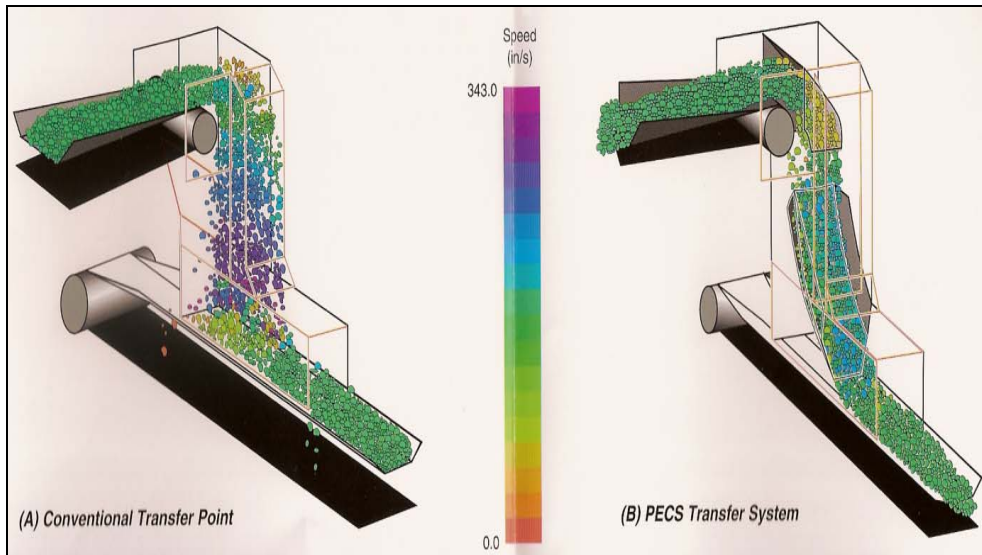


Fig. 2. Behaviour of material in hopper

#### 4. Alternatives of dustiness decrease

Material after fall on band is unsettled, turbid and it is necessary to steady it down. Turbid of dust is also many times conditioned also only by influence of air. Elimination of dustiness is solved by:

- ❖ optimizing of air flow in hopper. Falling material rends surrounding air with itself. This consecutively, during fall, distributes dust particles carried by inertia outward by all possible ways, respectively creates overpressure in hermetic hopper. Control (elimination) of air approach is performed before input of material into hopper and partially also in alone hopper,
- ❖ supporting band in place of fall,
- ❖ necessary casing by special plates during transport of abrasive material,
- ❖ sealing conveyance, eventually by use of multi sealing,
- ❖ use of air filtration system,
- ❖ use of water fog and other.

No less important as sealing of material input places on transporting band, is also fairly realization of places, where material leaves band. Loading devices are autonomous part. Transported material is being dashed on mounds at the end of transport route – open stocks,

or loaded directly to transport devices of other kind – wagons, lorries, vessels, containers, and following influenced alternatives of open storage areas and storage tanks, In these cases, exploitation of loading devices, so called trunks, is very efficient.

## 5. Conclusion

Dustiness originates by manipulation with loose materials, so turbid of dust elements in air, by their abundance in space and continuous settling. Thus, it creates environment contrary for health of employees, environment in which performing the work activities is obstructed, conditions negatively affecting mechanical parts of conveyor and other touched devices are resulting in loss of material and the influence in living environment as such, is also not negligible. Continuous innovation of many technological projects contributes to decrease contrary aspects and also contributes to safety of work.

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