

Dust – The Great Escape

Dust is inevitable. Whether from grinding up ores to extract the sweet, sweet minerals inside, or from crushing, what are essentially boulders, into tiny, little rocks that are a much more manageable size for handling and transport, or even just when handling the super fine aggregates so often used in construction, the emission of at least some amount of dust is *nigh unavoidable*. And dust just gets everywhere. The formation of this dust is not entirely unwelcome, however, and in some cases, the dust is the intended product; so, efforts to negate it are rarely required, nor are they entirely plausible. Therefore, the more auspicious approach is to control the spread of this biproduct by removing any possible avenues of emission into the environment. It doesn't matter how much dust you produce if it never gets a chance to see the light of day.

The great escape of dust tends to be most prevalent in some rather specific locations: transfer points, where the product is in its most turbulent state. At the end of the belt where the material is discharged, especially when into open air, such as onto stockpiles, rather than into sealed chutes or hoppers. In areas where product is exposed to environmental factors, primarily wind, which can whip the top layers up into a violent frenzy. In any areas where vibration is common, where this jolting movement can bounce the material around, causing unsettled particles to wander off the conveyor looking to wreak havoc. In places where carry-back or spillage are present, since these are unintentional there are usually few safeguards present to prevent these issues causing excessive dust to spread. And if the particulates are fine enough, the movement of the belt starting, stopping or even just when travelling at high speeds can be all that's needed to disturb the top layers of material and throw dust. The fineness of dust is categorised as particulate matter (PM), then subcategorised based on size. Fine particles (PM2.5) are smaller than 2.5 μm (1 μm = 0.001mm), coarse particles (PM10) are sized between 2.5 μm and 10 μm and "larger than PM10" is for all particles with a diameter of 10 μm or greater. Coarse and larger than PM10 particles make up the largest proportion of what is typically produced in quarrying and mining activities ^[3].

With all these different factors why even bother putting in the effort to stop the spread in the first place? Well, just listing the rampant health issues associated with fine airborne particulates from mining and industrial sites, we have the numerous respiratory diseases, such as silicosis, coal workers pneumoconiosis, chronic obstructive pulmonary disease, and the savagely increased risk of lung cancer, which are just the result of working around coal and silicas dusts- with the occupational exposure *limits* of respirable dust and respirable crystalline silica being 1.5mg/m³ and 0.05mg/m³ respectively ^[2]- without even mentioning the plethora of health risks from working with the metalliferous dusts inherent to ore mining ^[6], or the outright toxic particulates from industries such as fertiliser manufacturing, as well as the numerous cardiovascular issues, kidney disease and autoimmune diseases such as scleroderma ^[1]. On top of the copious amounts of health issues we also have numerous other hazards: including the very real risk of dust explosions, impaired visibility, damage, and accelerated wear of exposed electrical and mechanical devices, including motors- which are large fire hazards-, plus a significant loss of product. There are a considerable number of plaguing issues that stem from dust exposure, so it's best to implement a few measures to keep the dust down.

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PPE is imperative for dust protection

Thankfully when it comes to subduing the beast that is dust, modern conveyor solutions provide quite the arsenal. Take the transfer for example, likely the dustiest place on any conveyor. Skirting is one of the most effective methods of keeping material from just spilling out of your transfer the moment it touches the belt. Ideally you would want skirts that provide some sort of contact seal, but when the diameter of dust is measured in microns, even a 1mm gap is enough for millions of particles to escape. So, a proper seal needs this belt contact to be effective, and contact means wear, so a skirt needs a way to combat wear or it risks quickly becoming worthless. A self-adjusting skirt, that maintains full effectiveness for its entire lifecycle without the need for direct maintenance, is incredibly cost effective. These self-adjusting skirts are typically quite soft to allow for them to conform to the belt unhindered. This softness leaves them vulnerable to the harshness of the material stream, which can cause some serious damage as it flows by, so typically a hard internal skirt, that stops just short of the belt, is used to keep the material at bay, while the soft skirt picks up the slack and completes the contact seal in relative safety. But if the wear and tear of contact systems rubs you the wrong way, then the innovative, contactless external skirts may be your best bet. While they do tend to hit a higher price point in the short term, these marvellous devices tend to make up for it with their almost non-existent maintenance costs. Using their unique geometry to manipulate the power of airflow; a continuous suction effect is created to keep dust in. These contactless skirts still require the support of an internal hard skirt to make sure they don't clog up with the larger product, but their overall effectiveness is impressive. Whatever your preference, having at least some basic skirting is always better than having none.



Contactless external skirt and static rail system

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Of course, with all this skirting it's imperative that your belt profile is well supported to maintain consistency and prevent gaps, even more so with contactless skirting which requires a very particular spacing for the proper suction flow to be possible. Any sag in the belt and you can suddenly find yourself wondering where you left your shovel. How you go about supporting your belt is usually determined by the conditions of your transfer point. Systems that experience low impact from a small fall height or light products can get away with static belt support systems, which provide little in the way of impact support, but help maintain that perfect, flat surface across the transfer. Environments that require at least some impact support should invest in an impact bed, a large structure with flexible rubber rails that alleviate some of the impact force from the belt. For situations where severe impacts are common, a dynamic bed may be required. These utilise a trough panel suspended by spring elements to support the belt, while the static outer rails maintain the edge profile. These systems all tend to utilise low frictions rails (typically < 0.3 static coefficient of friction) on the wings to create a consistent surface for the belt to move across, however, this is still an increase in friction over most rollers. While these rails typically quite resistant to abrasion, they will eventually require replacement as well.

The problem of dust cannot be solved solely at the transfer, however, as even if the dust is controlled there and the product is settled, the dust can still present new problems across the rest of the conveyor. Compared to the transfer point, the run of the belt typically has far less structure to encase the product and protect it from the open elements, sometimes as little as just a set of stringers are present. Therefore, special equipment adapted to these constraints must be used; belt covers are physical barriers that attach to the stringers and almost completely enclose the belt, preventing the influence of wind, and trapping dust that is disturbed by vibration and belt movement. Belt covers typically are made from rigid materials such as steel or reinforced plastics, which are effective barriers, simple to install, and can be modified with features like inspection and maintenance windows, alternatively more flexible materials like mesh cloth can be used, which maintain airflow and a degree of visibility while preventing dust migration. Water sprays can also be used and are very effective for dust suppression, however, the resultant water saturation is undesirable for a lot of products and the wastewater must be dealt with limiting their desirability for numerous applications. Similarly, extraction fans can be very effective when run across the belt length, but maintenance for these is high as filters must be replaced to maintain effectiveness. Unlike the belt run, discharge points can usually be encased in structure with dust curtains to prevent any wayward dust spreading, but when material is being discharged into open space say for stockpiles, an extendable loading chute is more appropriate as it can be used to guide the material down to the stockpile without excessive dust being thrown during the fall. Belt cleaners are also essential in preventing carry back, which causes a slow loss of material on the underside of the belt which creates opportunities for dust in unprotected areas. Effective belt cleaning in an enclosed area can alleviate this risk of carry back and thus prevent the dust that results from it.

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Steel belt covers on an overland conveyor

Dust is an innate byproduct of the conveying process. Preventing it outright is essentially unfeasible due to costs and difficulty, however, controlling and containing dust is both simple and affordable with an abundance of modern products for the many aspects of dust control. Maintaining a low level of dust is important for a plethora of reasons, including the health risks associated with airborne dust, even in small quantities, wear of mechanical and electrical systems, poor visibility, and the overall loss of product. Operators should evaluate their conveyor and determine if there are any locations that are a source of dust, so that a solution can be applied. Operators who would prefer evaluations confirmed or would prefer professional input on the severity of issues can seek conveyor inspections from the numerous available conveyor solutions providers.

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