Dealing with dust

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The importance of dust control

Dust emissions can have a range of environmental implications for the operators of a port. The main issues dust can cause in ports include:

- A dirty and potentially hazardous working environment for port operators and ship crews. Conditions such as these can affect staff morale
- A loss of productivity. Dust emitted affects operations, there are also costs involved in cleaning and controlling dust
- Employee health problems
- Abrasive public relations: dust emissions can drift beyond the port arena and generate unpleasant or even hazardous living /working conditions for neighbours
- Explosions: dust emissions generated at ports are potentially combustible

Dust control measures

When a port operator is faced with a dusty material that must be unloaded and handled, there are five potential approaches that one can utilise. These approaches are:

Prevention at source

This method focuses on reducing the levels of dust present in materials shipped into a port. To effect changes here, this requires the control of, or an ability to influence:

- Material purchasing decisions. One must investigate the possibilities of changing supplier with a view to find the same material with less dust, or with a coarser particle size
- Material manufacturing. Options for changing the particle manufacturing process to reduce dust by granulation, removal of fines, or the addition of liquid should be explored
- Material handling techniques. Correct practice can reduce particle attrition and dust generation

Prevention during handling

This approach concerns the reduction of the level of dust generated during handling operations at ports when loading / unloading ships or silos. A further key area is at the transfer points between conveyors.

Regarding ship unloading there are a range of different approaches which provide different material transfer rates, levels of particle breakage and dust generation. A grab crane generates a low level of attrition as the number of particles in contact with a moving grab jaw surface is relatively low when corresponded with the total volume of material transported. However, the containment is poor. Bucket wheel and screw elevator continuous ship unloaders provide better containment once in the conveyor tube, however, they subject a large number of particles to contact with the moving buckets or screw flights relative to volume of material moved. In this instance, breakage is moderate. For blanket elevators, the conveying action of compressing material between two belts is very gentle, but the containment is poor.

Finally, for pneumatic conveyors the containment is excellent both at the pickup point and during transport, but the conveying velocity at the end of the line can be very high, which results in the material being subjected to large impacts at the bends causing severe particle attrition and dust generation.

At conveyor transfer points the traditional approach is to allow material to drop from one conveyor to another with a wet spray applied to damp down dust. A better approach is to use hood and spoon techniques, whereby the profile of the hood is matched to the trajectory of the material coming off the belt conveyor, and the spoon directs it onto the next conveyor at the right velocity to keep the material and any dust together in a packed stream. This minimises the number of impacts and the severity, and the severity, thus reducing particle attrition.

For bunker loading or ship loading, it is best to use cascades and slow down chutes to minimise the drop heights to keep the material in a dense stream. Again, this minimises dust emissions, reduces impact velocity and limits particle attrition.

Containment

This method revolves around the concept that any dust generated must be contained within storage vessels and conveyors in order to minimise emissions. Good port practice would also see the fitting of transfer towers or bunkers with high speed roller doors for vehicle access. If a grab crane is used for bunker loading, cover the top with high speed doors and lower the grab into the bunker to unload in an effort to optimise the containment of dust emissions. Vitally, port officials must ensure that any hot surfaces are covered and lagged to minimise convection currents. A common containment issue is caused by access panels being left off after equipment maintenance, thus allowing dust emissions to escape, and also unleash the potential of air currents.

Suppression

Wet sprays are commonly used to damp down material and reduce dust emissions, yet traditional sprays could result in significant increases in the moisture content of the material. Too much moisture can make a material cohesive and lead to bunker flow problems. A current trend is to use fogging systems to set up a curtain of fog around the trajectory of moving material in order to contain it. Fogging utilises a high-pressure ultrasonic nozzle to generate very fine water particles (wet fogging 50microns, and dry fogging 2microns) to minimise air and water consumption, as well as add moisture addition to the material (typically 0.1-0.5%). The key operating principal for a fogging system is to match the size of the water droplets to the size of the dust particles to be contained. If the water droplet and dust particles are of similar sizes there is a greater chance of their flow streams colliding, resulting in the form of agglomerates that then drop out of suspension.

Extraction and collection

The use of air extraction ducts around transfer points to collect dust emissions is the last resort in the effort to master dust control. However, dust extraction is not