



A Nalco Company

Dust Control Engineers to the Minerals Extraction and Processing Industry

PRODUCTS & SERVICES

Dust Extraction

Dust Collection

West Dust Suppression

DustFoam Suppression

Stockpile Dust Suppression

Roadway Dust Suppression

Dust Control Chemicals

Freeze Conditioning Agents

Reverse Air Bag Filter

Pulse Jet Bag Filter

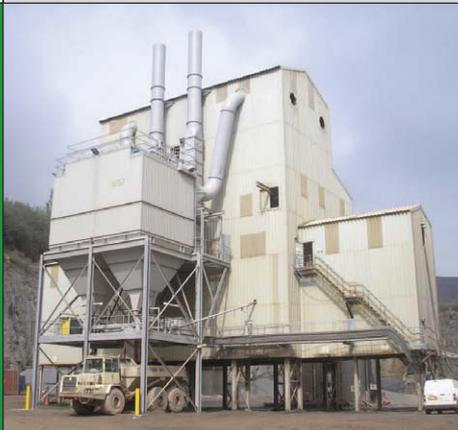
Venturi Scrubber

Cyclones

Skimmers

Dust Conditioners

Wheel Wash



Source of Dust

Source of Dust

When a mineral product is extracted, crushed, screened or handled small fragments generally below 100 microns particle size are released into the surrounding environment. The heavier particles generally above 30 microns settle out in the vicinity of the emission source. Wind and air disturbance can influence settlement. Particles below 30 microns move around with the air currents. Fine particles below 10 microns are normally not visible in their individual size and it is this fraction that is referred to as fugitive airborne dust (assuming still air conditions).

Legislation/Directives

Airborne dust is a nuisance and hazardous to health depending on its chemical composition. In the Minerals Extraction Industry respirable dust and in particular products containing silica or lead, normally represent the main health hazard. Particles below 5 microns are normally not collected in the nose or in the mucous of the mouth but pass directly to the lungs. This can build up in the lungs causing chronic diseases such as silicosis and pneumoconiosis.



Legislation in most parts of the World set limits for:

- (a) Control of dust to atmosphere from plant, exhaust stacks, roads and stockpiles.
- (b) Control of dust breathed in by the operators. For silica oxide (free silica) for example this can be as low as 0.1 mg/Nm^3 in the respirable range. Effects of respirable dust can be somewhat mitigated by wearing the correct PPE equipment appropriate to the health hazard.

The handling of materials containing harmful elements and dusts that give rise to high atmospheric emission levels therefore require special consideration in relation to plant design and the obvious need to remove the operators totally away from the working process – if possible. Experience shows that if allowed a number of process designers ignore dust control in their plant philosophy so as to keep the capital cost below a perceived budget. In such cases when the plant starts operating it is often the case that dust emission becomes unacceptable and expensive modifications such as sealing and/or retrofitting of dust control methods become necessary. This scenario can often be the most expensive solution and can result in confrontation with local government authorities and/or damaged relationships with neighbours. In the initial start up of the process this initial impression may be difficult to eradicate. There are two basic methods employed by **Enviroflo Engineering Ltd** to control dust within the bulk handling and minerals handling industries - a typical plant can sometimes have a combination of both:

- Dust Extraction and Collection
- 'Wet' type Dust Suppression

Dust Extraction and Collection

For this method of dust control we use mainly a choice of two types of dry dust collectors:

- Enviro Reverse Air Bag Filters
- Enviro Pulse Jet Bag Filters

Enviro Reverse Air Bag Filter

The “Enviro” Automatic Reverse Air Bag Filter range has been developed for the process industry where a high degree of reliability is demanded and maintenance is required to be minimal.

It is not a pulse/reverse jet filter requiring an air compressor. Instead its automatic cleaning relies on the periodic introduction of low pressure atmospheric air into the bags in the reverse direction to normal flow.

Periodically, a particular chamber of bags is isolated from the influence of the main fan (off load) and is subjected to a ‘reverse air’ pulse by virtue of a rotating plenum. The plenum is driven by an electric motor and gearbox and actuated by a control system.

The filter is intended for use in industry for the recovery of dry dust, powders, etc. and to return this back to the process. Alternatively, waste dusts can be deposited in a holding hopper for dumping. The filter is also used for air pollution control purposes to satisfy the emission requirements of the various air pollution authorities.



Enviro E100/3/10x10 Reverse Air Filter on Tertiary Impact Crusher. Filter is arranged to straddle product conveyor and to feed collected dust back on to process belt.



Enviro E216/3/16x12/1 Reverse Air Filter on Aggregate Crushing Plant.

Enviro Pulse Jet Bag Filter

An Enviro Pulse Jet Bag Filter is cleaned by a blast of compressed air. The filter bags are arranged in rows normally 12 or 14 per row and the number of rows depends on the filter size. A blowpipe is mounted above each row of bags and fed by a compressed air manifold (or tank) mounted on the outside of the filter. The blowpipe contains nozzles to coincide with the

centre line of each bag. The cage that supports each bag incorporates an internal venturi mounted from the top wires. When each pipe receives a signal to 'blow', the appropriate diaphragm valve is opened by means of a solenoid valve allowing compressed air into the blowpipe.



Above: Twin Bag Filter System at Hanson's Machen Quarry South Wales. Original Reverse Air Filters some 18 years old were replaced by Enviro 'Pulse Jet' Filters. The new filters were complete with pneumatic conveying and dust conditioning equipment. This upgrade resulted in a considerable increase in production of the associated Bitumen Coating Plants and almost zero dust deposition within the building and a dust loading to atmosphere of some 2 mg/m³. Filter volumetric capacities are 50,000 Am³/h each.

Enviro Pulse Jet Bag Filter

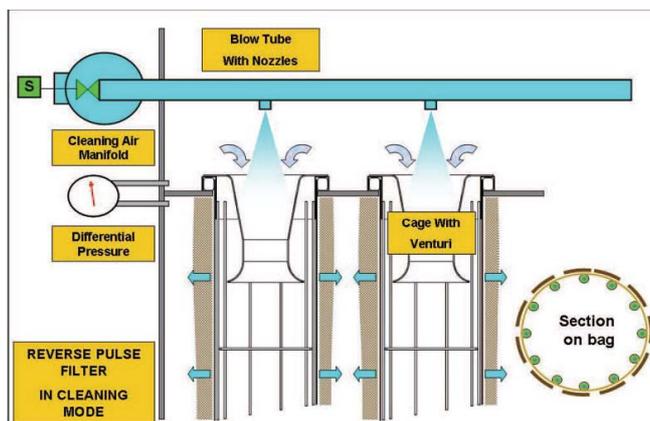
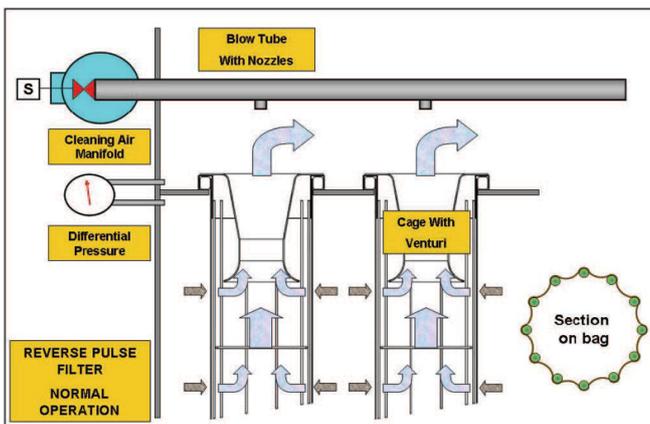
An equal amount of compressed air is blown vertically downwards into each bag via the venturis. The venturi is fitted to increase the air entrainment down the bags. The additional air supplements the compressed air and adds to the cleaning process. Each row of bags therefore receives a short pulse of compressed air of approximately 100 ms duration. The high pressure compressed air creates a shockwave down each bag causing it to release the majority of dust formed around the outside. This falls into the hopper below.

- Rows of bags are cleaned at random.
- Adjustable time and pulse duration for cleaning.
- Differential pressure controlled—Saves energy.
- A range of remote signals to confirm compressed air presence, burst bag row, stack monitoring.
- Continuous indication of pressure loss.
- All signals can be hard-wired to the main plant PLC.

The pulse jet filter operating principle is totally different therefore to the reverse air cleaning principle. Reverse air cleaning introduces an amount of cold air into the cleaning system in order to clean down the bags. This cold air can cause dew point conditions within the bag filter if the inlet temperature is low with a high humidity. The cleaning air also steals a corresponding amount of air from the process. If the cleaning mechanism is not set up correctly a considerable amount of air can leak through the cleaning system into the bag house again cooling down the incoming air and reducing the air drawn from the process.

An Enviro Pulse Jet Bag Filter is normally mounted on a pyramid or trough type hopper and supported by a common steelwork configuration. The filter would arrive on site with filter bags and cages already installed, together with the cleaning system.

The picture below shows an Enviro 'Pulse Jet' Cleaning System fitted to an original Reverse Air Filter installed on a Twin Bitumen Coating Plant. An instant increase in the filter cleaning performance was noticed resulting in better combustion, cleaner environment within the building and considerable increase in plant production.



- Differential Pressure Control.
- Explosion Venting.
- Fire Protection.
- Heavy Gauge or Stainless Steel Casing.
- Vertical or Horizontal Bags.
- Insulation/Cladding.
- Burst Bag Detection.
- Dust Monitoring.

Enviro Pulse Jet Bag Filter



Typical Enviro Pulse Jet Bag Filter on asphalt plant capacity 81,000 Am³/h.



Typical Enviro Pulse Jet Bag Filter on asphalt plant capacity 81,000 Am³/h.

Wet Suppression Systems

When minerals such as quarry aggregates, metallic ore, coal, iron ore, etc. are handled through conveyors, crushing, screening and various dry processes there is dust released - the amount generally depending on the moisture present in the product, the product grading and the degree of disturbance the material is subjected to. If the process is carried out within buildings then this dust is released within the buildings causing serious contamination and producing a hostile environment for other engineering equipment to operate such as electric motors, gear boxes, compressors etc. The buildings are required to be cleaned out on a frequent basis and in addition to the labour problems involved in cleaning out these buildings, some materials can be hazardous to health as defined by the COSHH regulations. This dust spillage has to be removed by operators wearing protective clothing, masks, breathing apparatus etc. (PPE). Enclosing the process reduces the release of dust to the atmosphere but does not eliminate it. (Personnel generally cannot work within buildings during processing).

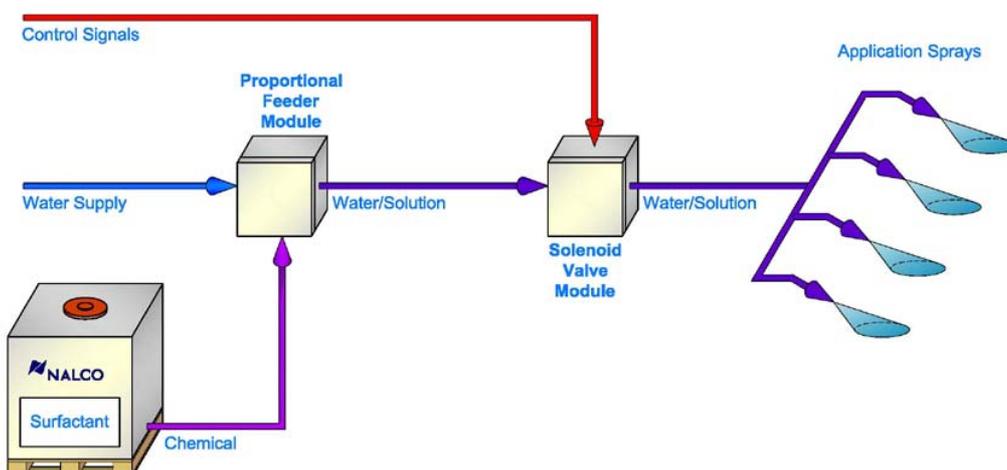
If the process is not 'contained' and the plant is on an open site then the dust will be released into the atmosphere. This will deposit locally around the process plant but will also blow in the wind and contaminate the surrounding areas. It can however infringe the environmental rules for fugitive dust within and outside the site boundaries.

The addition of moisture for dust control purposes into minerals being processed has been carried out for many years and it is a fact that the addition of water/absorbed moisture can considerably reduce dust nuisance during handling.

In the past water has been added to the process mainly by the use of atomised sprays. This water on some better engineered systems can be automatically shut off to parts of the plant that are not operating by using process signals and solenoid valves. Often, the minerals being handled repel water and it is sometimes difficult using water only systems to allow the water to become absorbed into the finer fraction of the product that is the main contributory mechanism to dust release. This is sometimes overcome by adding more water up to 3% - 5%. This amount of water often cannot be tolerated. To overcome part of this difficulty surfactants are used to reduce the surface tension of the water making it easier to coat the mineral being processed and reduce the water being used. Surfactants can reduce water consumption down to 0.5% - 2%.

'Wet' Dust Suppression Systems have their use in the market place if they are applied properly. They are economical to purchase and operate and chemical costs are relatively low. They however do not as a rule control dust as efficiently as DustFoam Systems and use more water in the process.

Enviro Wet Suppression System Schematic



DustFoam Suppression

In instances where there is a shortage of water or where there is a limit to the amount of moisture that can be added if the product is to be fine screened, for example, where the minimum mesh size is below 4mm, high moisture contents can cause 'blinding' of the screens that will seriously impair screening efficiency. There are other mineral products where it is important to keep the added moisture content down - i.e. coal being fed to boilers, aggregate fed to asphalt plants, where 'free flow' characteristics etc. are important as are thermal costs related to driving off moisture. This again limits the amount of water that can be added as a dust suppression agent.

To overcome most of the above problems and also to improve the degree of dust control achieved, special foaming agents have been developed. The DustFoam is produced at source by the introduction of water at a controlled rate together with compressed air into a foaming chamber. This foaming chamber creates micro bubbles that can be applied at strategic parts of the process that generate the majority of dust. The micro bubbles are required to have a high degree of stability—i.e. they should not break up when sprayed into the materials being handled. They should maintain their shape until they enter crushers, transfer points, etc. where they 'burst' causing the moisture they contain to be integrated into the product. Nalco produce patented foam products known as 'DustFoam' and DustFoam Plus which makes a foam renowned for its micro-bubble stability. Cheaper foams are available but these normally require a greater consumption to achieve similar effects which is more costly overall. Enviroflo Engineering and Nalco have the facilities to offer after sales support to customers which can include service and maintenance agreements if required. If DustFoam is applied to one application, it can have a considerable advantageous 'carryover' effect to other parts of the plant.



Containerised DustFoam Equipment

- Proportioning Module.
- Control Module.
- Water Tank/Pump.
- Electrical Control Panel.
- Insulation/Cladding.

DustFoam Suppression

As a general rule 0.6 litres of Nalco DustFoam mixed with ninety-nine litres of water will produce some 5,000 litres of foam that can be added directly to the process. Normally 0.15% moisture is added to the product. On small tonnage applications this can increase up to 0.16% moisture with foam solution ranging from 0.6 - 0.75% water to foam ratio being normal. It is the case that the system may also run below these values but this can only be decided on site during commissioning depending on the mineral being handled, the locations of application points, degree of sealing etc.



The use of DustFoam suppression systems therefore enables a considerably smaller volume of water to be used than the conventional water, or water and surfactant, systems. The NALCO DustFoam is totally inert, is an organic material and has no detrimental effects on watercourses, cement manufacturing processes, bitumen coating processes etc. A NALCO Material Safety Data Sheet is available for COSHH requirements.

Case Study—Glensanda Quarry

After careful evaluation of the original Dust Extraction System serving the crushers, screen and conveyor transfer areas it was decided for a number of reasons related to maintenance, abrasion, power consumption etc. to replace this system with an Enviroflo/Nalco Dry Foam System. A special foaming agent was used containing a 'tackifier'. This foam is termed Nalco DustFoam Plus which encapsulates the dust more efficiently than the standard DustFoam. The presence of the tackifier increases the retention time of the treatment for up to 28 days. This has considerable advantages in dust generation during out loading into boats and also when the aggregate is offloaded dust emissions are reduced. Note that minimal dust is being emitted during ship loading and the crushing and screening buildings show little evidence of dust leakage to atmosphere.



Dust-free ship loading at Glensanda Quarry (part of Aggregate Industries UK Ltd.). This is the largest quarry in the UK with a production rate up to 6.8 million tonnes/annum.

DustFoam Suppression

A typical DustFoam System comprises:

Proportional Feeder where water and DustFoam are mixed together in a particular ratio.

A Control Module where the water and foam solution pressure and flow is monitored. Also within control module a compressed air line complete with pressure and flow monitoring facilities is fitted. Additional engineering equipment is also included to each line such as isolating valves, non-return valves, automatic shut off valves, etc. There is also a purge line between the compressed air train and the water/DustFoam train to blow the foam line clear when the process has stopped.

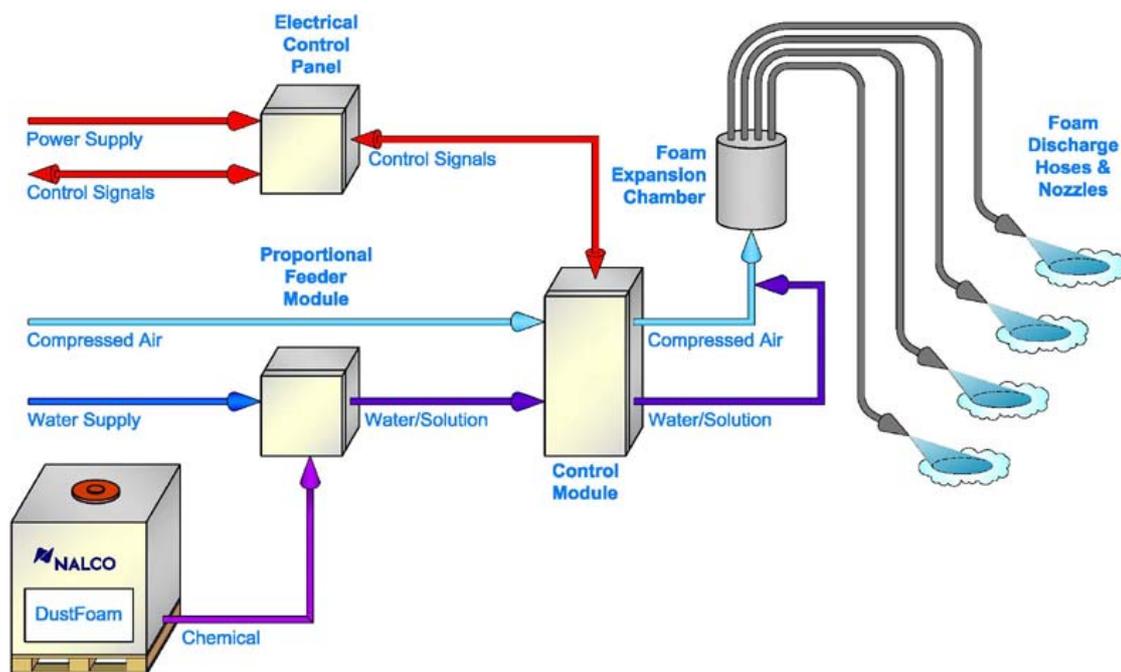
Foam Expansion Chamber where the compressed air and water/solution comes together. The foam is created by the interaction of these two flows. A number of flexible pipes are normally taken out from the foam expansion chamber to feed foam to the points of application. The foam expansion chamber is normally mounted as close to the application area as possible and the flexible pipes feeding each application point cannot be longer than around 9 metres.

Electrical Control Panel is provided with most applications. The panel contains stop/start switches, purge control, manual/automatic operation etc.

Sensors to monitor flow of product. These can be in the form of current sending relays for crushers, underbelt switches, etc. Alternatively the sprays can be controlled from within our control panel via the main PLC.

It is often the case that the above equipment is containerised in a standard shipping container and the equipment arrives on site installed in the container pre-piped, wired and complete with heating and lighting if appropriate. If the client's compressed air supply is inadequate then an air compressor is also installed in the container. Should the client's water supply not be of adequate capacity or pressure (around 6 Bar) then a tank and pump set would be included in the container.

Enviro DustFoam System Schematic



DustFoam Suppression



Typical stocking out Conveyor showing fine dust being blown from falling product

BEFORE Foam Application

AFTER Foam Application



Typical limestone Conveying, crushing and screening plant with no dust sealing

BEFORE Foam Application

AFTER Foam Application



Speciality Chemicals

Dust Control Products

In addition to **DustFoam** and **DustFoamPlus** chemicals, Nalco/Enviroflo can provide a wide range of additional chemicals, including:

Nalco DUST-BAN 7977: An organic-based surfactant and tackifier in easy-to-apply liquid form. The tacky characteristics provide residual dust suppression by agglomerating fine particles and holding them together even after the treated material has dried. This agent is mainly used to reduce dust emission during handling and processing.

Nalco DustCon: A surfactant to be added to water on the surface of the mine or underground to control dust on longwalls, on continuous miners, at transfer points and other underground mining processes.

Nalco HAUL-EZ: An effective proprietary residual road dust control product applied diluted with water using common road watering equipment. It has humectant and binding characteristics that help to provide longterm dust control reducing dust emission to atmosphere by heavy dump truck traffic.

Nalco Haulage DC: A blend of organic surfactants and other organic non-salt-based humectants diluted with water used to control dust on haul roads and improve water retention without the use of corrosive chloride compounds.

Nalco DUSTBIND: An encrusting agent diluted with water applied to open rail cars, stockpiles etc. to reduce dust during handling or wind erosion. It forms a crust on top of the sprayed area. It may be dispersed using water sprays, hydro-seeder or water cannon on watering trucks. For flat surfaces, it may be applied by watering truck.

Freeze Conditioning Agents

We are pleased to introduce our newest, patent-pending freeze protection products. Nalco's FCA (freeze conditioning agent), belt de-icing agent and SRA (side release agent) allow its customers to operate with no lost time expenses due to problems with frozen materials or demurrage.

These products are based on new chemistries that are not calcium chloride or diethylene chloride (DEG) and are non-toxic and biodegradable. Our products have been approved for use by the railroads and utility.

Nalcoal 8880: A better freeze conditioning agent (FCA) than either calcium chloride or DEG. In compression tests, Nalcoal 8880 outperforms both calcium chloride and DEG. It is less corrosive than calcium chloride, and has a lower freeze point than either calcium chloride or DEG.

Nalcoal 8882: A more effective in belt de-icing than either calcium chloride or DEG. It has a lower freeze point than either calcium chloride or DEG. It is more viscous than either calcium chloride or DEG, making it more effective in coating the belts.

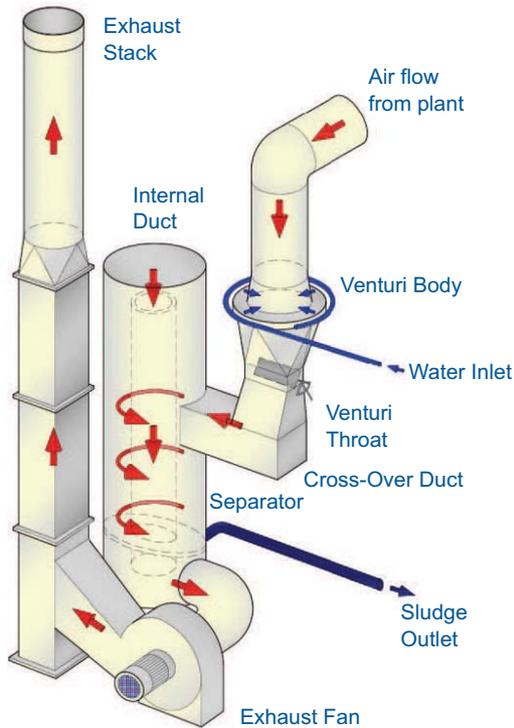
Nalcoal 8884: This is the optimum side release agent (SRA). It is more effective than either calcium chloride or DEG in leaving less clean coal carry back in the rail cars.

Application rates of FCA, belt de-icing and SRA programs vary for each customer, depending on percent fines, surface moisture, transit time and temperature.

Additionally, we can design, manufacture and install customised and automated feed systems for your application to properly treat each ton of material, belt or railcar.

A full set of details together with specifications and Material Safety Data Sheets can be supplied for all of the above products

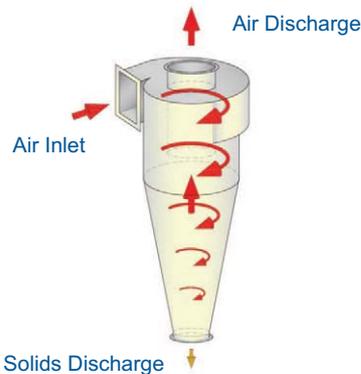
Other Products & Services



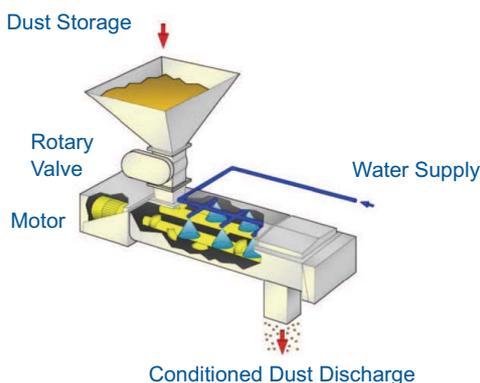
Enviro Venturi Scrubber

As an alternative to collecting dust in the dry form as in bag filter equipment part of the dust can be collected as a slurry using Enviro Venturi Scrubbing Equipment. This is normally a two or three stage system depending on the dust loading — the first stage would comprise a bank of cyclones for example. These would remove some 80-85% of the dust extracted from the process in the dry form. The remainder would then pass to the venturi scrubber where water is introduced into a venturi section. The exhaust gases are accelerated up to high velocity causing the added water to atomise into very fine mist particles. The dust particles in the exhaust gases mix with the fine water droplets producing a sludge. The sludge is then separated out in a centrifugal chamber and passed to a lagoon, filtering press, etc. The final emission to atmosphere from venturi scrubbing plants in the minerals industry is around 100 mg/Nm³ based on relatively low energy losses across the venturi throat (250 mmWG). If lower emissions are demanded then additional electrical energy is required to allow the exhaust fan to develop a greater suction and therefore to increase the velocity through the venturi throat thus producing a higher pressure loss across the venturi throat and smaller water droplets.

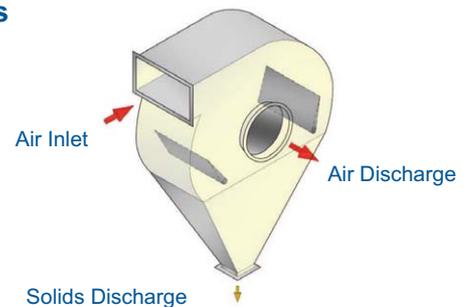
Cyclones



For the collection of dry dusts from a gas flow. Normally fitted prior to bag filters or venturi scrubbers.



Skimmers



For the collection of coarse dusts or precleaning of dust-laden gas flow prior to a bag filter or scrubber.

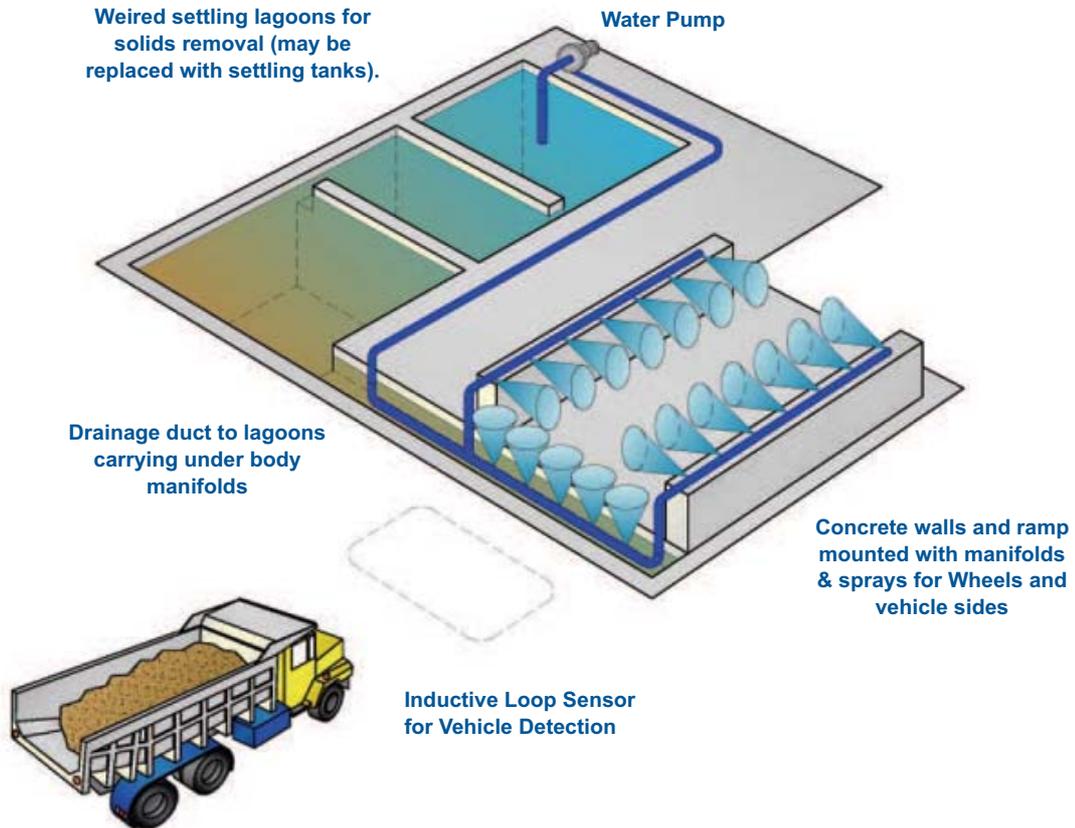
Enviro Dust Conditioner

For conditioning dry dust to enable this to be offloaded from a hopper with the minimum amount of dust release to the atmosphere.

- Capacity 20 tph.
- Water addition 10 to 15% typically.
- Surfactants can be added to improve wetting of some products, e.g. hot dust.

Other Products & Services

Enviro Vehicle Wheel & Underbody Wash



Typical Wheelwash Features

- Containerised pump house.
- Inductive loop Vehicle detection system.
- Motorised water valve to start/stop.
- Lagoon or concrete settling ponds.
- Alternative elevated tank for sludge settlement and disposal.

Other Products and Services

- Pneumatic conveying systems.
- Diverter valves for conveying lines.
- Dust silos.
- Double flap valves to replace rotary valves on abrasive products.
- Full consultancy services relating to dust control on Rotary and Fluid Bed Dryers, Asphalt Plants and minerals handling and processing.



About Us

About Enviroflo Engineering Limited

- We are part of Nalco Company, the world's leading water treatment and process improvement company, delivering significant environmental, social and economic performance benefits to a variety of industrial and institutional customers.
- We are an established Dust Control company based in the UK and operating since 1978.
- We dedicate most of our activities to the minerals handling and processing industry including quarry aggregates, coal, iron ore and metallic ore handling, etc.
- We also have considerable expertise in the application of filters to Asphalt plant dryers for producing bitumastic road surfacing materials.
- We can offer a range of filters suitable for application in the Biomass Energy and Energy from Waste industries.
- We offer a range of Dust Control techniques depending on application.
- We provide a consultancy service to evaluate the performance of existing plant or to recommend the best Dust Control solution for a particular new proposed project.
- We have a well-educated staff with many years experience in dust control and materials handling. We have a range of CAD, computer aided design and project management facilities.

Essential Expertise for Water, Energy and Air



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