Uncontrolled dust and erosion can cause a multitude of problems for quarry operators. For example, the build-up of dust on site machinery can cause frequent and expensive breakdowns, while dust that exits the site boundary through wind effect or on vehicles can be a nuisance to neighbouring communities.

Operators should be aware that the operational consequences of failing to minimize dust generation and surface erosion can be costly, and that the legal, compliance and publicity implications can be significant. There are, however, a number of effective steps that can be taken to tackle dust generation and surface erosion.

This paper aims to highlight why it is necessary to control dust and erosion, what the consequences of failing to act may be, and how a quarry operator might set about taking control.

The need for dust control
Failure to limit dust and control erosion on site can have serious consequences, both in terms of operational efficiency and legal or statutory compliance. For example:

— the build-up of dust and deposits on operating equipment such as crushers, conveyors and screens increases the likelihood of component failure, longer periods of machine downtime, rising maintenance costs and greater inefficiency. These factors disrupt day-to-day working and have a negative affect on profitability.

— high levels of airborne dust inevitably affect site employees through inhalation, skin and eye contact, and ingestion. This can lead to greater levels of absenteeism and ultimately disrupt the ability to resource operations consistently.

— the deterioration of on-site haul road surfaces by heavy equipment and weather conditions may lead to increased vehicle breakdowns, again adversely affecting working efficiency.

— wind-blown dust can cause a significant nuisance to residential and commercial neighbours. The most common areas of complaint relate to dust on roofs, walls, windows, paths and gardens, and on residents’ cars and washing.

Neighbours may contact the quarry directly, but are equally likely to complain to their local authority.

—when material is transported off site the problem of dust once again becomes a very public issue, as delivery trucks and staff/visitors’ vehicles joining the public highways can lead to the build-up of dust and deposits on road surfaces, creating hazardous driving conditions for other road users.

—changes in weather conditions can magnify the problems caused by dust. Wind is obviously the most significant cause of dust.
emission. Research has shown that large dust particles (larger than 30µm) will be dispersed within 100m of the source. Intermediate sized particles (10–30µm) are likely to travel 200–500m. However, smaller particles (less than 10µm) can travel much further from the source.

Consequences of inadequate control
Assuming that a quarry’s neighbours choose not to complain to the site directly, but instead take their grievances to the local authority, what is likely to happen?

Complaints from commercial and residential neighbours may give rise to local authority investigation, as dust generation constitutes a statutory nuisance under the Environmental Protection Act 1990. If there is found to be a nuisance, the local authority Environmental Health Officer and the Environment Agency are legally bound to serve an Enforcement Notice. The Environment Agency states that such a notice may:

- Require the operator to abate the nuisance (ie, lessen or reduce the nuisance).
- Prohibit or restrict the nuisance.
- Require the operator to carry out works or other steps to abate, restrict or remove the nuisance.

Failure to comply with a Notice can result in prosecution, a costly fine and even site closure. However, the problem does not stop there. Not only are regulatory bodies empowered to act, but individuals are also able to take legal proceedings at a local magistrates’ court under the same legislation (Section 82 of the EPA 1990). In fact, many local authority web sites encourage residents to take action.

As well as the environmental compliance and prosecution issues, operators should also consider the publicity angle. A good reputation in the community can be destroyed by a single legal action. The media feasts on such news, while the NIMBY (not in my back yard) community is always looking for ammunition to further its interests. Operators must take reasonable and proactive action to maintain a good reputation and to minimize the risk of attracting bad publicity.

What options are available?
In the first instance, a quarry should be organized or worked in such a way so as to minimize the generation of dust and erosion. This might include:
- locating dust-generating activities only in areas where maximum protection can be obtained from the topography, adjacent woodland or other features. Unfortunately, not all sites can boast such protection.
- considering the prevailing wind conditions and placing processes that generate dust away from sensitive areas. This is not always possible as the site may be surrounded by residential and commercial property.
- minimizing the requirement to transport and handle materials by utilizing storage facilities close to processing areas. If space is at a premium this may not be possible.
- using a water bowser to provide a short-term solution throughout the site. This method is extremely labour intensive and requires multiple applications, resulting in significant cost. This solution would also be unsuitable for sites that have a limited water supply.
- restricting vehicle speed to minimize dust creation. This will need to be policed and does not account for the dust generated by static machinery and materials handling.

If these suggestions do not appear to provide a realistic solution to the problem, what else can be done to proactively minimize dust generation? Various measures can be adopted depending on where the problem is being experienced on site.

Large open extraction areas and stockpiles — In these areas dust is best controlled through the use of rain guns and static sprinkler systems. These are usually used to spray water and a suppressing agent to create a ‘wide-area’ rain curtain, or barrier, so that dust is prevented from leaving...
Dust Control

Wheel-wash systems prevent the transfer of dust on to public highways

the site boundary. The suppressing agent improves the absorptive properties of the water droplets, allowing them to capture airborne dust particles more efficiently and bring them quickly to the ground.

Roadways and material-handling yards — To prevent disturbed dust contaminating roadways and handling yards, pop-up sprinklers can be used to create an effective barrier by spraying water and a suppressing agent with localized concentration.

Specially concentrated suppressants can be applied to roadways without the need for dilution or surface preparation. These provide a long-term solution to dust suppression, negating the need for frequent re-application while also reducing water consumption.

Polymer emulsions are also available that stabilize road surface particles by bonding them together to form larger agglomerations, resulting in a highly durable surface capable of enduring the stresses of climatic extremes and heavy traffic.

Loading bays, discharge conveyors and crushers — For many sites, spray bars and nozzle-lines provide an effective solution at material-handling points where focused dust control is required. These systems can deliver foam or diluted suppressing agents to specific problem areas. Foam suppression provides a particularly efficient means of controlling dust at crusher and conveyor points by creating a barrier from which the dust particles cannot escape.

Vehicle exit points — Wheel-wash systems are an essential requirement to prevent the transfer of dust on to public highways.

Implementing a solution

To determine whether action is needed, how a system of dust control might be implemented and what such a system should consist of, a number of simple steps can be taken. First, dust emissions should be checked near the boundary of the site. This should be done at different times of the day and under different operating and weather conditions. Secondly, all dust emission sources on site should be identified. Once these have been successfully pinpointed, an informed decision can be made as to how each one should be tackled.

These initial steps are generally undertaken by means of a site survey carried out by a dust specialist. The results of this survey will allow the specialist to identify and recommend the most effective course of action to minimize dust generation and surface erosion at the site. Where the source and extent of dust and erosion problems on site are particularly obvious, the specialist should quickly be able to recommend an appropriate solution. Installation should then be carried out by specialist dust-control engineers with experience of systems specific to the quarrying industry.

What will it cost?

Dust and erosion control solutions vary in complexity depending largely on the size and location of the site and its neighbouring environment. The cost of implementation varies widely as most systems are site-specific. However, experience of effective solutions has proven that the return on investment occurs very quickly. Moreover, the real benefits are perhaps best measured in terms of continuous operational efficiency and neighbourhood satisfaction.

Conclusion

Dust is easily and quickly generated during many processing operations on site. Quarries may also experience erosion from vehicular activity on roadways. Prevailing weather conditions may also impact to increase the severity of both.

It is clear that failing to control dust and erosion on site can create significant and expensive operational issues. Operators are also legally bound not to cause nuisance to their neighbours. If found to be causing annoyance, regulatory bodies have the enforcement power to ensure that corrective measures are put in place. Failure to satisfy the authorities can result in a substantial fine being bestowed upon the operator.

Suitable controlling measures are available to ensure that sites do not experience costly operational issues caused by dust and erosion, although some methods are more effective than others.

When considering installing an appropriate controlling method it is essential that the sources of dust generation are properly located. Although the site manager may have a good idea of the source, the assistance of a dust-control professional, who can propose a suitable method of control, will enhance the outcome.

The cost of controlling methods is highly variable depending on the size and scale of the problem. While operators are likely to feel the most immediate benefit in terms of improved operational efficiency, arguably the greatest benefit will be in the avoidance of an enforcement order being served and the threat of a fine or site closure.

A proactive approach to the control of dust and erosion on site will not only improve the operational efficiency and profitability of a business, but will also help to improve community relations and establish an environmentally sound image for the company concerned.