DustScan

Dust Monitoring and Dust Consultancy Services

Guidance Note No. 3: Directional Dust Data Assessment

This guidance note discusses the use of directional dust monitoring data in assessing dust control and management measures. It is aimed at site operators and regulators alike and seeks to show how dust sampling data can be used to set site-wide or local targets for dust control. Datasets generated over reasonable periods of time can be used to compare site performance or dust conditions between operational phases or from one year to the next.

DustScan directional dust data

DustScan provides 2 measurements to show the directions from which dust has arisen:

- Absolute Area Coverage (AAC%) – the presence of dust *irrespective* of colour
- Effective Area Coverage (EAC%) – the *darkness* or *potential soiling* of dust

AAC% indicates the magnitude and significance of dust sources and EAC% rates the nuisance potential that may be caused by dust. Note that dust nuisance is not restricted to high levels of either EAC% or AAC%; the relationship of one to the other may be important.

For example, a pale dust such as chalk may have a high nuisance potential due to one highly significant source and the associated quantity of dust, even though it may never reach critical EAC limit percentages. In such cases it is possible to use source-specific AAC trigger levels that more accurately represent thresholds of nuisance and recognise excessive dust accumulation.

Potential uses of directional dust data

<u>Compliance Monitoring</u>

Dust nuisance limits can be agreed and tested by applying trigger or threshold values to EAC and AAC data on a sample-by-sample basis. Dust data can be classified by setting different AAC and EAC levels and displaying this information so that persistent directional concerns can be readily seen and acted upon.

<u>Rating Environmental Performance</u>

The environmental performance of a site can be assessed on either a site-wide or point-by-point basis to cover a particular location or periods of concern. For example, soil removal and stockpiling only takes place at specific stages of a site's operation and in certain weather conditions; dust monitoring data recorded during such processes can be reviewed in relation to the site's overall performance. With a well-designed monitoring programme dust can be categorised as from on- or off-site: off-site dust sources can be very important.

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Setting Site Performance Targets

Sites can monitor their own performance by setting site performance targets or thresholds once background data have been collected. This can be summarised to determine the contribution of the site and associated activities to ambient dust levels.

For example, site-specific thresholds, based on baseline data, could be set at the 95th percentile for directional EAC levels. Such thresholds would relate directly to the likely conditions at the individual site and provide a 5% margin of flexibility allowing sites the occasional acute dust episode. Likewise, reducing the number of 'Very High' AAC instances by a determined percentage can form location or source specific targets.

Improving Site Performance

Comparing directional data against known site parameters can be used to improve dust suppression methods and increase the efficiency of control measures. Dust Action Plans (DAPs) that include this type of approach can take changes in working method, weather conditions and times of the year into account.

Source Identification and Significance

To attribute a level of significance to an identified dust source the AAC% threshold values can be used as indicated. In addition, the angle of dust spread at saturation point (100%) can be used in assessing the significance of the source.

AAC Criteria

Source Significance		**AAC% Value**
Very Low	0	<80%
Low	1	80% - 95%
Medium	2	95% - 99%
High	3	99% - 100%
Very High	4	100% for 45º

Rating Potential Nuisance

AAC% may reach 100% quite frequently. EAC% is more widely and readily used to assess the likelihood of nuisance due to visual soiling effect. The following general assessment criteria are based on complaint thresholds suggested by Beaman and Kingsbury (1981) and an upper most limit suggested by Schwar (1994).

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The soiling effect of dust measured as an EAC% value depends on the type of dust and the colour and contrast of that dust, but it does not directly relate to the mass of dust.

EAC Criteria

Nuisance Potential		EAC% Value
Very Low	0	<2.5%
Low	1	2.5-5%
Medium	2	5-15%
High	3	15-25%
Very High	4	>25%

Data evaluation criteria

This technique naturally forms a two-stage assessment approach to the quantification of the impact of nuisance dust, very much like a hazard appraisal and risk assessment. AAC% thresholds can be used to identify the dust source and its magnitude (Hazard). EAC% thresholds can be used to rate the nuisance potential (Risk) of the dust. The significance levels for AAC and EAC may be combined in an assessment matrix for potential impact as shown.

Assessment Matrix for Potential Impact

		AAC – Source Significance Level				
		0	1	2	3	4
EAC – Nuisance Potential	0	V Low	V Low	V Low	Low	Med
	1	Low	Low	Low	Med	High
	2	Med	Med	Med	High	High
	3	High	High	High	High	V High
	4	V High	V High	V High	V High	V High

AAC% Significance Level 4 can be reached without a correspondingly high EAC% Significance Level at sites with sources of pale dust. In such situations it is necessary to examine the identified source(s) of dust and what factors may have contributed to the observed significant levels. This may be achieved by considering several monitoring periods to determine if this is a re-occurring dust source or a temporary, isolated event.

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AAC% and EAC% Significance Level data are given for each directional monitoring report (see example bottom left).

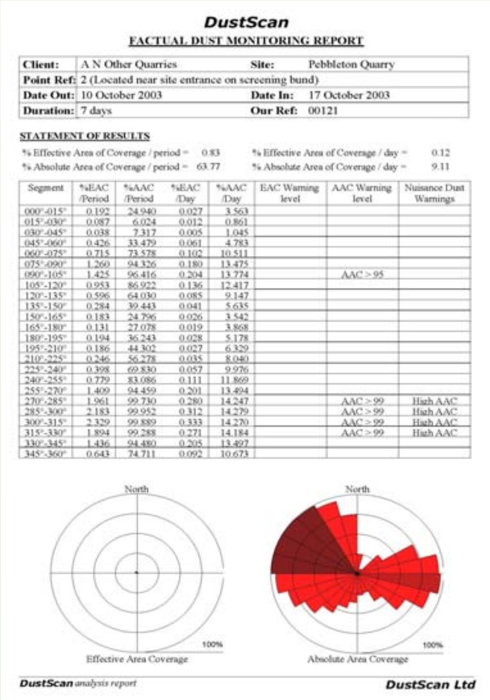
Methods for Summarising Data

Datasets can be summarised by using different criteria:

- Fixed AAC% criteria
- Fixed EAC% criteria
- Variable EAC% criteria

From our database it is possible to review a site's data over a predetermined period, such as a month, a quarter or a year, and indicate the frequency of occurrences where defined dusting levels were recorded. This is illustrated below right.

For the purposes of this exercise only three Significance Levels are used (1, 2 and 3 in the previous tables). This is shown in the matrix (page 3) where the potential impacts are Low, Medium and High.



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FACTUAL DUST MONITORING REPORT

Client:	A N Other Quarries	**Site:**	Pebbleton Quarry
Point Ref:	2 (Located near site entrance on screening bund)		
Date Out:	10 October 2003	**Date In:**	17 October 2003
Duration:	7 days	**Our Ref:**	00121

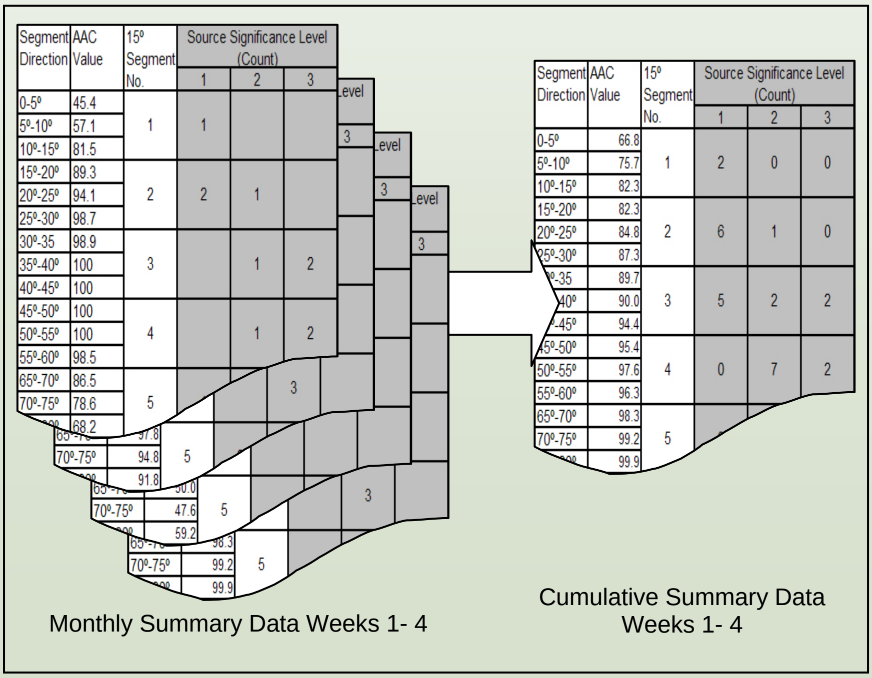
STATEMENT OF RESULTS

% Effective Area of Coverage / period = 0.83 % Effective Area of Coverage / day = 0.12
% Absolute Area of Coverage / period = 63.77 % Absolute Area of Coverage / day = 9.11

Segment	%EAC /Period	%AAC /Period	%EAC /Day	%AAC /Day	EAC Warning level	AAC Warning level	Nuisance Dust Warnings
000°-015°	0.192	24.940	0.027	3.563			
015°-030°	0.087	6.024	0.012	0.861			
030°-045°	0.038	7.317	0.005	1.045			
045°-060°	0.426	33.479	0.061	4.783			
060°-075°	0.715	73.578	0.102	10.511			
075°-090°	1.260	94.326	0.180	13.475			
090°-105°	1.425	96.416	0.204	13.774		AAC > 95	
105°-120°	0.953	86.922	0.136	12.417			
120°-135°	0.596	64.030	0.085	9.147			
135°-150°	0.284	39.443	0.041	5.635			
150°-165°	0.183	24.796	0.026	3.542			
165°-180°	0.131	27.078	0.019	3.868			
180°-195°	0.194	36.243	0.028	5.178			
195°-210°	0.186	44.302	0.027	6.329			
210°-225°	0.246	56.278	0.035	8.040			
225°-240°	0.398	69.830	0.057	9.976			
240°-255°	0.779	83.086	0.111	11.869			
255°-270°	1.409	94.459	0.201	13.494			
270°-285°	1.961	99.730	0.280	14.247		AAC > 99	High AAC
285°-300°	2.183	99.952	0.312	14.279		AAC > 99	High AAC
300°-315°	2.329	99.889	0.333	14.270		AAC > 99	High AAC
315°-330°	1.894	99.288	0.271	14.184		AAC > 99	High AAC
330°-345°	1.436	94.480	0.205	13.497			
345°-360°	0.643	74.711	0.092	10.673			

North
Effective Area Coverage
North
Absolute Area Coverage

DustScan analysis report **DustScan Ltd**



Monthly Summary Data Weeks 1- 4

Cumulative Summary Data Weeks 1- 4

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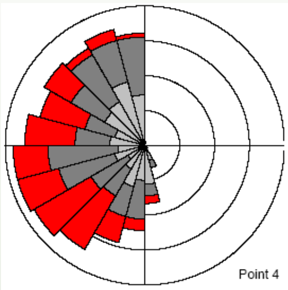
Note that an assessment of Very High potential impact levels is best done by inspection of the raw data; this would be indicated when any quadrant of the rose described below incorporates a significant proportion of Level 3 AAC readings.

Calculations are undertaken using the 5º EAC% and AAC% values listed in our database for every 15º segment.

The aggregated AAC% values for each 15º direction can be tallied against the appropriate Significance Level (1-3). This information is summarised graphically as shown in the rose diagram.



This shows that the highest levels of dust were more frequent from the west, with proportionally more occurrences from the south-west. Moderate and lower dust levels occurred more frequently from the north-west.

Conclusions

The methods outlined above provide a structured approach to reviewing directional dust data, and can be adapted to different site management and regulatory requirements.

The summary criteria can be used to assess dust data near inherently dusty activities including quarrying, waste management, construction and demolition sites. Summary information can be used to assess baseline and routine dust data over different time periods. It may also be used to look at the effect of specific operations on ambient dust levels by filtering for on-site and off-site directions.

Levels of dusting depend on many factors including wind direction and speed, antecedent rainfall, on- and off-site soil types and ground cover, traffic volumes, vehicle types and their speed, materials handled and the processes taking place both onsite and in the vicinity. Over a typical monitoring period of 1 – 2 weeks the Influence of different factors will vary.

The assessment criteria and summary methods described are an effective means of assessing the sources and frequency with which different levels of dusting occur over time. Supplementary information on site layout and conditions, site operations, relevant off-site activities and weather are highly desirable to maximise the effectiveness of these techniques.

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