Protecting Communities from Coal Dust

A guide to international best practice techniques to minimise and control dust from coal mining and export activities from pit to port.

This guide has been developed for people living in coal-affected communities. It is a tool to assess what coal companies are doing to protect local residents from the harms of dust pollution. The guide describes 103 techniques, drawn from national and international literature that coal companies can implement to minimise and stop dust pollution at each stage of the coal chain from pit to port.

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Purpose

This guide has been developed for people living in coal-affected communities living near ports, along coal train lines and near mines. It is a tool to assess what coal companies are doing to protect local residents from the harms of dust pollution. The guide describes over a hundred techniques drawn from national and international literature that coal companies can implement to minimise and stop dust pollution at each stage of the coal chain.

The health and social harms of coal mining and coal transport are well documented. Studies have shown that people living in coal-affected communities are more likely to suffer heart, lung and kidney cancer, respiratory and cardiovascular disease and birth defects (Colagiuri, Cochrane and Girgis, 2012). There is a direct link between long-term exposure to dust pollution and a range of respiratory ailments and hospital admission and emergency department attendance (Colagiuri *et al*, 2012). Government and industry standards and regulations have thus far failed to protect the community from these harms.

This guide is intended provide communities with a 'one stop shop' for dust minimisation techniques for coal activities from the pit to port. It is a live document and will be updated as new information and measures are understood and developed. Updated versions will be accessible through the Hunter Community Environment Centre website.

How to use the guide

The first column describes the mining activity indicating the source of dust pollution. Some activities take place at multiple points along the coal chain from pit to port while others are solely pit activities. The second column describes the approach taken to deal with the dust. Arguably it is best practice to avoid activities that generate dust pollution, to limit or minimise the amount of dust generated and to contain what dust pollution does occur. The third column describes the specific techniques that can be used to avoid, limit, suppress and contain dust pollution from the mining activity or process. The fourth column is simply to mark if the technique is being implemented or not.

Best practice involves implementing an overall strategy that addresses these approaches and techniques in a comprehensive way that stops dust impacting on neighboring communities.

Mining activity (dust source)	*Approach*	*Mitigation measure (technique used to minimise dust)*	*Used Y/N*	*Comments*
A. Blasting and Drilling	Avoidance	A1. Plan activities using forecast and real-time weather-monitoring data^		
	Limitation	A2. Minimise area blasted*		
	Containment	A3. Fabric filters when drilling*		
		A4. Cyclone or multi-clone when drilling#		
		A5. Electrostatic precipitator when drilling#		
		A6. Water injection when drilling*		
	Best Practice	**A1 + A2 + A4**		
	See http://www.miningonlineexpo.com/content.php/6/27/mining_multiclone_multicyclones.html for examples of A3, A4 and A5 dust control systems.			
B. Loading, dumping and transporting overburden (Overburden is the surface soil and rock material that is removed to reveal the coal seams).	Limitation	B1. Minimise drop height from excavator from 3m to 1.5m*		
		B2. Minimise drop height from truck dumping from 3m to 1.5m*		
		B3. Modify activities in windy conditions*		
	Suppressant	B4. Water application when truck dumping*		
		B5. Water application to load when transporting*		
	Best Practice	**All of the above**		
	 Example of dust generated when transporting overburden. Source: http://www.neosolutionsinc.com/images/truck%20dust.jpg			

Mining activity (dust source)	*Approach*	*Mitigation measure (technique used to minimise dust)*	*Used Y/N*	*Comments*
C. Bulldozers on overburden	Vehicle restrictions	C1. Minimise travel speeds and distance*		
		C2. Use the most direct travel routes*		
	Stabilisation	C3. Keep materials moist*		
	Best Practice	**All of the above**		
D. Wind erosion on exposed areas and overburden emplacements	Management	D1. Training and implementation of standard operating procedures^		
		D2. Develop and employ a rehabilitation strategy*		
		D3. Minimise pre-strip*		
	Surface stabilisation	D4. Watering*		
		D5. Chemical dust suppressants*[i]		
		D6. Paving and cleaning*		
		D7. Application of gravel to disturbed open areas*		
		D8. Vegetative ground cover*		
	Wind speed reduction	D9. Erect artificial wind barriers[#]		
		D10. Fencing, bund walls[ii], shelterbelts or in-pit dump*		
		D11. Vegetative wind barriers*		
	Best Practice	**D1-3 + D6 + D8 + D9**		
	 Example of steel wind barriers. Source: http://www.wmitc.com/?info-389-111.html			

Mining activity (dust source)	*Approach*	*Mitigation measure (technique used to minimise dust)*	*Used Y/N*	*Comments*
E. Pre-strip (Pre-stripping occurs after blasting. Excavators and shovels uncover the more shallow coal seams and dig a deep strip for draglining).	Management	E1. Training and implementation of standard operating procedures^		
		E2. Minimise pre-strip exposed areas*		
	Surface stabilisation	E3. Application of level 2 watering*		
		E4. Revegetation of top soil stockpiles*		
	Containment	E5. Replacement of 'truck and shovel' operations with dragline~		
	Best Practice	**All of the above**		
F. Draglines (Draglines are machines that move large quantities of material faster than a truck and shovel or excavator).	Management	F1. Minimise drop height to less than 5m~		
		F2. Suspend activities in dry, windy conditions*		
	Limitation	F3. Minimise side casting*		
		F4. Ensure the bucket is lifted cleanly away from the dig face, walls and batters and is hoisted with minimum spillage~		
		F5. Avoid over-dragging and overflowing the material in the bucket~		
		F6. Ensure materials are place in such a way to avoid large rocks rolling down the spoils~		
	Surface stabilisation	F7. Apply water sprays*		
	Best Practice	**All of the above**		
	 Example of dust caused by draglines Source: http://www.coalmarketinginfo.com/assets/1656/dragline_callide_w.jpg			

Mining activity (dust source)	*Approach*	*Mitigation measure (technique used to minimise dust)*	*Used Y/N*	*Comments*
G. Hauling on unsealed roads (Haul road are the main roads in a mining operation used for hauling coal or waste material from the mining area).	Avoidance	G1. Real-time weather monitoring data and local activity-based observations of dust emissions should be used to direct the application of dust controls^		
	Vehicle restrictions	G2. Install speed humps^		
		G3. Speed reduction from 75 km/h to 50 km/h*		
		G4. Speed reduction from 65 km/h to 30 km/h*		
		G5. Grader speed reduction from 16 km/h to 8 km/h*		
	Surface improvement	G6. Pave the surface*		
		G7. Low silt aggregate*		
		G8. Oil and double chip surface*		
	Surface treatments	G9. Watering (standard procedure)*		
		G10. Watering Level 1 (2 litres per square metre per hour ($l/m^2/h$)*		
		G11. Watering Level 2 (>2 L/m2/h)*		
		G12. Watering grader routes*		
		G13. Watering twice a day for industrial unpaved road*		
		G14. Chemical dust suppressants*		
		G15. Regularly resurface high-traffic areas^		
	Other	G16. Design haul roads for vehicles to take the most direct route^		
		G17. Use of larger vehicles*		
		G18. Usage of conveyors in place of haul roads~		
	Best Practice	**G18 or G4 + G5 + G6 + G11 + G16**		
H. Hauling on sealed road	Surface stabilisation	H1. Remove deposits on road as soon as they occur[#]		
		H2. Water flushing/sweeping[#]		
		H3. Improve sanding/salting applications and materials[#]		
		H4. Prevent trackout[iii] by installing curbs and providing shoulder stabilisation[#]		
	Containment	H5. Cover haul trucks[#]		
	Best Practice	**All of the above**		

Mining activity (dust source)	*Approach*	*Mitigation measure (technique used to minimise dust)*	*Used Y/N*	*Comments*
I. Loading and dumping ROM coal (Run Of Mine or Raw Ore Material coal is coal that has been taken from the ground and has not been treated or washed).	Avoidance	I1. Bypass ROM stockpiles*		
	Limitation	I2. Minimise drop height when loading or dumping coal from 3m to 1.5m*		
	Suppressant	I3. Water sprays on ROM pad when loading or dumping coal*		
		I4. Water sprays on ROM hopper*		
	Containment	I5. Three sided and roofed enclosure of ROM hopper*		
		I6. Three sided and roofed enclosure of ROM hopper + water sprays*		
		I7. Enclosed ROM hopper with control device*		
	Best Practice	**I1 + I2 + I7**		
	"An enclosed ROM hopper with a control device provides 90-98 percent effectiveness in reducing particulate emissions, compared to a three sided and roofed enclosure with water sprays that provides 85 percent effectiveness" (MAC-ENC-PRG-003 - Assessment of Coal Mine Particulate Matter Control Best Practice Pollution Reduction Program: pp. 15).			
J. Conveyors and transfers (Conveyors are used at various sites along the coal chain to move materials from one stage to the next).	Containment	J1. Fully enclose conveyors^		
		J2. Partially enclose conveyors^		
		J3. Use of laterally displaceable hopper cars with discharge conveyors and transfer chutes+		
		J4. Enclosed transfer towers~		
		J5. Soft-loading chutes`		
	Wind reduction	J6. Provide wind shielding - roof OR side walls of conveyors*		
		J7. Provide wind shielding - roof AND side walls of conveyors*		
	Management	J8. Belt cleaning and spillage minimisation of conveyors*		
	Best Practice	**J1 + J4 + J6 + J7**		
	"In a detailed review of best practice and benchmarking study...Connell Hatch found that the design of the conveyors and transfers within the material transport system has a large bearing upon their potential to emit particulate matter. Water application and wind shielding were the most important items in reducing the quantity of particulate matter emitted from coal whilst being transported by conveyor" (Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining - 2011: pp. 189).			

Mining activity (dust source)	*Approach*	*Mitigation measure (technique used to minimise dust)*	*Used Y/N*	*Comments*
K. Conveyor belts	Management	K1. Belt maintenance and training[>]		
		K2. Clean belt by scraping and washing[>]		
		K3. Use rotary brush to clean the conveying side of the belt[>]		
	Suppression	K4. Wet dry belts[>]		
	Best Practice	**All of the above**		
L. Stage loader/crusher (The mechanical compression of material to reduce the size).	Management	L1. Use a high-pressure water-powered scrubber[>]		
		L2. Wet coal in the crusher and stage loader area[>]		
		L4. Use scrubber technology in the stage loader/crusher area[>]		
	Containment	L5. Fully enclose the stage loader/crusher[>]		
		L6. Install and maintain a gob curtain[>]		
		L7. Install wing or cut-out curtains between the panel side rib & the stage loader[>]		
	Best Practice	**L1-L5**		
M. Wind erosion and maintenance on coal stockpiles (Coal stockpiles are found at various stages of the coal chain: pits, coal processing plants and ports).	Avoidance	M1. Bypassing stockpiles*		
	Surface stabilisation	M2. Watering - use automatic sprinklers that are triggered by wind speed/direction or vibration^		
		M3. Chemical wetting agents*		
		M4. Surface crusting agent*		
		M5. Carry over wetting from loading*		
	Containment	M6. Silo with bag house*		
		M7. Cover storage pile with a tarp during high winds*		
		M8. Erect three-sided enclosure around storage piles*		
		M9. Reduced pile height*		
	Wind speed reduction	M10. Wind screens/fences*		
		M11. Pile shaping/orientation*		
		M12. Vegetative windbreaks*		
	Best Practice	**M1 + M6 (or M8) + M10-11-12**		

Mining activity (dust source)	*Approach*	*Mitigation measure (technique used to minimise dust)*	*Used Y/N*	*Comments*
	The Fog Cannon® has been shown to suppress up to 95% of airborne dust particles. The smaller units are ideal for suppressing dust where it is generated in high concentrations at easily defined point sources such as discharging onto stockpiles, discharging into ships, reclaiming from stockpiles, dumping, crushing and loading/unloading trucks. In this case the Fog Cannon is directed at the point source of dust and it rapidly suppresses the emitted dust before it can disperse. The larger units are where the Fog Cannon® are unique, as they are able to suppress general airborne open area dust through fogging the general area. The larger units are also capable of suppressing dust caused by high volume dust events such as blasting - and the long throw distance is usually necessary for this. Fog Cannons are also useful for dust suppression of stockpiles where their low water use is an advantage. Source: http://www.wetearth.com.au/Fog-Cannon-Airborne-Dust-Control 			
N. Stacking and reclaiming product coal (Stackers can be used to form standardised stockpiles along the length of a conveyor, and reclaimers used to retrieve the coal).	Avoidance	N1. Bypass coal stockpiles*		
	Containment	N2. Cover stockpiles+		
	Limitation	N3. Variable height stack when loading coal stockpiles*		
	Stabilisation	N4. Boom tip water sprays when loading coal stockpiles*		
		N5. Telescopic chute with water sprays when loading coal stockpiles*		
		N6. Use bucket-wheel, portal or bridge reclaimer with water application when unloading coal stockpiles*		
	Best Practice	**N1 + N2**		
O. Train transportation	Containment	O1. Cover load with custom fit lids<		
		O2. Use gondola style train carriages with rotary dump capabilities<		
		O3. Cover load with custom fit tarpaulin*		
		O4. Use bed liners to minimise seepage in bottom opening carriages*		
		O5. Limit load size to ensure coal is well below sidewalls*		
		O6. Maintain a consistent load profile*		

Mining activity (dust source)	*Approach*	*Mitigation measure (technique used to minimise dust)*	*Used Y/N*	*Comments*
	Suppression	O7. Conduct train wheel, carriage and undercarriage washing after loading and unloading*		
		O8. Wetting the coal product during transport[>]		
		O9. Reduce train speeds[=]		
	Best Practice	**O1 + O2 + O7**		
	Coal wagon covers provide a number of benefits including: • Eliminates coal wagon dusting • Avoids ballast contamination • Avoids product loss • Improves fuel efficiency • Improves coal wagon unloading • Responsible corporate image • Railcars are kept free from contamination • No cross-contamination of other products on railcars • Empty trains can operate on a faster schedule • No railcar loading restrictions, i.e. can load (concentrate) fines • Delivered product is the same as was loaded, therefore: Source: http://www.ecofab.com/benefits.html			
P. Coal Terminal	Containment	P1. Completely enclosed terminal system		
	Ambre Energy's proposed coal export terminal (design shown below) at Port of Morrow in Boardman US. Conveyer belts, stockpiles and barges will all be fully enclosed.			

Mining activity (dust source)	*Approach*	*Mitigation measure (technique used to minimise dust)*	*Used Y/N*	*Comments*
	 Source: http://www.oregonlive.com/environment/index.ssf/2012/12/planned_oregon_coal_export_ter.html			

Sources

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[<] Waratah Coal Supplementary EIS (2013) http://www.waratahcoal.com/publications.htm

[#] WRAP Fugitive Dust Handbook – US Colorado (2006) http://www.wrapair.org/forums/dejf/fdh/content/fdhandbook_rev_06.pdf

+Amber Energy – proposed coal terminal Oregon http://www.morrowpacific.com/the-project

http://www.ecofab.com/flex_cover.html (Coal wagon train covers)
http://www.ecofab.com/benefits.html (Benefits of covering coal wagons)
http://veestaar.webs.com/apps/photos/photo?photoid=44775205 (enclosed conveyors)
http://www.canoseco.com/general-description/cano-seco-policies/modern-coal-mine-development-policies.html (enclosed stockpiles)
http://www.oregonlive.com/environment/index.ssf/2012/12/planned_oregon_coal_export_ter.html (enclosed terminal systems)
http://www.ambreenergy.com/morrow-pacific-project v's http://cdn.fairfaxregional.com.au/silverstone-feed-data/e27df999-121d-49a4-90d3-43e292c12089.jpg (enclosed terminal systems v's current Newcastle terminal)

Explanatory notes

[i] Chemical suppressants are generally classified as: *Salts*—hygroscopic compounds such as calcium chloride, magnesium chloride, hydrated lime, sodium silicates, etc. Salts increase roadway surface moisture by extracting moisture from the atmosphere. *Surfactants*—such as soaps and detergents that decrease the surface tension of water. *Soil cements*—compounds that are mixed with the native soils to form a new surface such as calcium or ammonium lignon sulphonate, portland cement, etc. *Bitumens*—compounds derived from coal or petroleum such as coherex peneprime, asphalt, oils, etc. And *Films*—polymers that form discrete tissues, layers, or membranes such as latexes, acrylics, vinyls, fabrics, etc. Kissell, Fred N., (2003) *Handbook for Dust Control in Mining*, Information Circular 9465 . http://www.uow.edu.au/eng/longwall/pdf/dust_control.pdf

[ii] A bund wall is a safety barrier constructed from material (usually broken rock) on the side of a ramp, pit edge or vertical opening to prevent vehicles from entering or passing over it (http://www.minesurveyor.net/dictionary.php).

[iii] Trackout occurs when dust is carried by a vehicle and redistributed as it passes from an unpaved road to a paved road. These junctions are significant dust problem areas (Kissell, 2003: 79).