

Guidelines on DUST mitigation measures in handling Construction material and C&D wastes



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CENTRAL POLLUTION CONTROL BOARD

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Guidelines on DUST mitigation measures in handling Construction material and C&D wastes

DUST – environmental pollutant generated during handling of Construction material and C&D wastes.

The concerns of controlling dust / fine particles generated during handling of Construction material and C&D wastes on site include:

- a. Dust emissions are an environmental nuisance both on-site and off-site.
- b. Dust during handling (loading / unloading) release a wide range of particle sizes and material types that can cause serious health problems ranging from eye irritation, nose, mouth to affecting the respiratory system.
- c. The larger heavier particles settle out of the air quickly and are hazard to the operators of plant and equipment (on-site) and to those in the immediate vicinity (off-site). The finer particles (usually invisible) are transported further can cause health hazards (off-site).



Introduction to Guidelines

Unlike other rules that have been revised namely those addressing key urban wastes such as MSW, plastic wastes, BMW, however the Construction and Demolition (C&D) Waste Management Rules, 2016 are NEW rules that were notified on 29th March, 2016 by the Ministry of Environment, Forest and Climate Change (MoEF&CC). In compliance of Rule 10 sub-rule 1(a) of C & D Waste Management Rules, 2016 the '*GUIDELINES ON ENVIRONMENTAL MANAGEMENT OF C&D WASTES (March 2017)*' were prepared under the guidance of the Committee for implementation of C&D Waste Management Rules 2016. In compliance of Rule 10 sub-rule 1(a) of C & D Waste Management Rules, 2016, the focus was on Schedule III w.r.t. environmental concerns in C&D waste management facilities.

The present report i.e. *Guidelines on DUST mitigation measures in handling Construction and Demolition material / wastes* addresses DUST abatement measures arising measures during handling of Construction material and C&D wastes on-site and off-site.



This report has also been prepared under the guidance of the Committee (**Annexure A**) for implementation of C & D Waste Management Rules 2016. The areas covered include the following:

1. Major DUST generating activities
2. Composition of Construction and Demolition wastes / material
3. Major dust borne material
4. Dust management in C&D Waste Management Facilities
5. Dust management during transportation
6. Dust control measures during storage

7. Dust control measures at site
8. Other dust mitigation measures
9. NGT Order w.r.t. Compensation on Construction related works for DELHI

DUST management in C&D Waste Processing Facilities

The Swachh Bharat Mission (under MoUD) envisages processing of 100% solid waste generated in cities / towns by 2nd October, 2019 as a key objective, the wastes include Construction & Demolition (C&D) wastes. Ministry of Urban Development (MoUD) vide its circular dated 28th June, 2012 directs all states to set up Construction & Demolition Waste recycling / processing facilities in cities with population of over ONE million (10 lakhs).

The Construction and Demolition (C&D) Waste Management Rules, 2016 apply to every waste resulting from construction, re-modeling, repair and demolition of any civil structure of individual or organization or authority generating construction and demolition waste such as building materials, debris, rubble.

In March 2017, 'GUIDELINES ON ENVIRONMENTAL MANAGEMENT OF C&D WASTES' were prepared under the guidance of the Committee for implementation of C&D Waste Management Rules 2016. The focus was on the environmental concerns in C&D waste processing facilities with attention on Schedule III. Timelines for implementation of C&D Waste Management Rules 2016 focus on establishment of C&D waste management facilities as provided under Schedule III as given hereunder.

Timelines for implementation of C&D Waste Management Rules 2016

Schedule III [See Rule 13]

Compliance Criteria	Cities with population of >=one million	Cities with population of 0.5-01 million	Cities with population of < 0.5 million
Formulation of policy by State Government	12 months	12 months	12 months
Identification of sites for collection & processing facility	18 months	18 months	18 months
Commissioning and implementation of the facility	18 months	24 months	36 months
Monitoring by SPCBs	3 times a year / in 4 months	2 times a year / once in 6 months	2 times a year / Once in 6 months

The two main environmental concerns highlighted under the Guidelines were DUST and NOISE. In SECTION VIII of the Guidelines, DUST management was discussed covering the following areas:

- i. DUST – environmental pollutant in C & D waste operations

- ii. Guidelines for DUST mitigation in C & D operations
 - a. Dust Noise abatement - Dust from loading / unloading operations
 - b. Dust abatement - due to vehicle movement
 - c. Dust abatement – due to machinery used in C & D operations
 - d. Compliance of National Ambient Air Quality Standards (NAAQS)
- iii. Other dust abatement measures and safety issues
 - a. Water requirement
 - b. Use of treated waste water (preferably) in sprinklers for dust suppression
 - c. Waste water management
 - d. Residual waste disposal
 - e. Diesel use
 - f. Plantation / greenery
 - g. Emergency facilities
 - h. Protective gear
 - i. Training / Awareness program

The Guidelines are presently on display in CPCB's website at:

http://cpcb.nic.in/upload/NewItems/NewItem_228_Final_C&D_March_2017.pdf



Air Quality Index (AQI) w.r.t DUST (PM₁₀ & PM_{2.5})

Air Quality Index (AQI) is a tool for effective communication of air quality status to people in terms, which are easy to understand. It transforms complex air quality data of various pollutants into a single number (index value), nomenclature and colour (see - http://cpcb.nic.in/FINAL-REPORT_AQI_.pdf)

There are SIX AQI categories, namely GOOD, SATISFACTORY, MODERATELY POLLUTED, POOR, VERY POOR, and SEVERE. Each of these categories is decided based on ambient concentration values of air pollutants and their likely health impacts (known as health break-points). The index has SIX colours schemes indicating the six categories. AQ sub-index and health breakpoints are evolved for eight pollutants which include PM₁₀, PM_{2.5} besides, NO₂, SO₂, CO, O₃, NH₃, and Pb for which short-term (upto 24-hours) National Ambient Air Quality Standards are prescribed. The worst sub-index determines the overall AQI. AQI categories and health breakpoints for PM₁₀ and PM_{2.5} are given below.

Table: IND-AQI w.r.t. PM₁₀ and PM_{2.5}
(See - http://cpcb.nic.in/About_AQI.pdf)

AQI category	AQI Category Colour scheme	AQI Range µg/m ³		Break point 24 - hourly	
		PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
I.	Good	0 – 50	0-30	50	30
II.	Satisfactory	51 – 100	31-60	100	60
III.	Moderate	101 – 250	61-90	250	90
IV.	Poor	251- 350	91-120	350	120
V.	Very Poor	351 – 430	121-250	430	250
VI.	Severe	430 ⁺	250 ⁺	430 ⁺	250 ⁺

Graded Response Action Plan (GRAP) for Delhi & NCR addresses DUST control (particulate matter) measures

In pursuant to the Hon'ble Supreme Court's order dated December 02, 2016 in the matter of M. C. Mehta vs. Union of India regarding air quality in National Capital Region of Delhi, the Ministry of Environment, Forests & Climate Change (MoEF&CC) notified for implementation of GRAP through Environment Pollution (Prevention & Control) Authority vide S.O. 118 (E) dated January 12, 2017. The Graded Response Action Plan is displayed at- http://cpcb.nic.in/final_graded_table.pdf).

As per National Air Quality Index, FOUR different Air Quality Index (AQI) categories were identified i.e. MODERATE & POOR, VERY POOR, SEVERE and SEVERE⁺ (this new category of ‘Emergency’ has been added). The PM levels (PM₁₀ and PM_{2.5}) are summarized in Table below:

Table: GRAP addresses ambient air quality w.r.t. particulate matter (dust)

Air Quality Index (AQI) categories	Ambient PM _{2.5} / PM ₁₀ concentration values (µg/m ³)	Concentration values (µg/m ³)	
		PM _{2.5}	PM ₁₀
Severe⁺ or Emergency	ambient PM _{2.5} or PM ₁₀ concentration values of 300µg/m ³ or 500 µg/m ³ respectively persist for 48 hours or more	300µg/m ³ respectively & persisting for 48 hours or more	of 500 µg/m ³ respectively & persisting for 48 hours or more
Severe	ambient PM _{2.5} or PM ₁₀ concentration value is more than 250 µg/m ³ or 430µg/m ³ respectively)	more than 250 µg/m ³	more than 430µg/m ³
Very Poor	ambient PM _{2.5} or PM ₁₀ concentration value is between 121-250µg/m ³ or 351-430 µg/m ³ respectively)	concentration value is between 121-250µg/m ³	concentration value is between 351-430 µg/m ³
Moderate to poor	ambient PM _{2.5} or PM ₁₀ concentration value is between 61-120 µg/m ³ or 101-350 µg/m ³ respectively	concentration value is between 61-120 µg/m ³	concentration value is between 101-350 µg/m ³

National Ambient Air Quality Standards - includes PM₁₀ and PM_{2.5}

The basis of development of standards is to provide a rational for protecting public health from adverse effects of air pollutants, to eliminate or reduce exposure to hazardous air pollutants, and to guide national/local authorities for pollution control decisions. CPCB revised and notified in year 2009 the National Ambient Air Quality Standards (NAAQS) (<http://www.cpcb.nic.in>) for TWELVE parameters viz. carbon monoxide (CO) nitrogen dioxide (NO₂), sulphur dioxide (SO₂), particulate matter (PM) of less than 2.5 microns size (PM_{2.5}), PM of less than 10 microns size (PM₁₀), Ozone (O₃), Lead (Pb), Ammonia (NH₃), Benzo(a)Pyrene (BaP), Benzene (C₆H₆), Arsenic (As), and Nickel

(Ni)]. The first eight parameters include PM (**PM₁₀** and **PM_{2.5}**), have short-term (1/8/24 hours) and annual standards (except for CO and O₃) and rest four parameters have only annual standards. The standards are laid down in Schedule VII of the Environment (Protection) Rules, 1986 and are given in Table below.

**Table: National Ambient Air Quality Standards (NAAQS, 2009)
w.r.t. PM₁₀ and PM_{2.5}**

Pollutant	PM by size	Time weighte d Average	Concentration ($\mu\text{g}/\text{m}^3$) in Ambient Air		
			Industrial, Residential, Rural & Other Area	Ecologically Sensitive Area (notified by Central Govt.)	Methods of measurement
Particul ate Matter - PM ₁₀	< 10 μm	Annual*	60	60	- Gravimetric - TOEM - Beta attenuation
		24-hrs**	100	100	
Particul ate Matter - PM _{2.5}	< 2.5 μm	Annual*	40	40	- Gravimetric - TOEM - Beta attenuation
		24-hrs**	60	60	

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year, 2% of the time; they may exceed the limits but not on two consecutive days of monitoring.

Note - Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigations.

Major DUST generating activities during in handling Construction material and C&D wastes

Major activities generating DUST during handling (loading / unloading) C & D wastes / material are summarized below:

Dust generating sources	Major activity
a) Demolition of existing / old dilapidated structures	Generation
b) Renovation of existing buildings / concrete structures	(on-site)
c) Construction of new infrastructure (buildings, bridges etc)	
d) Storage of construction material	Storage
e) Storage of C&D wastes	(on-site or off-site)
f) Transportation of C&D wastes and construction material	Transportation (on-site or off-site)

Composition of Construction material and C&D wastes

1. Construction and Demolition wastes

As per Rule 3 (c) "construction and demolition waste" means waste comprising of building materials, debris and rubble resulting from construction, re-modeling, repair and demolition of any civil structure.

Composition of demolition wastes is project specific and varies depending on age of building being demolished / renovated or the type of buildings being constructed. Under Rule 4 sub-rule (3) of the C & D Waste Management Rules, 2016 the segregation by bulk C & D waste shall be done into four streams such as:

- i. Concrete
- ii. Soil
- iii. Steel, wood and plastics
- iv. Bricks & mortar

Wastes like surplus and damaged products and materials arising in the course of construction work or used temporarily during the course of on-site activities come under C&D wastes.

Key characteristics of C&D wastes include:

a) Demolition waste characteristics: In India, when old buildings are demolished the major demolition waste is soil, sand and gravel accounting for bricks (26%) & masonry (32%), Concretes (28%), metal (6%), wood (3%) others (5%).

b) The major constituents are concrete, soil, bricks, wood, asphalt and metal. Brick & masonry, soil, sand & gravel account for over 60% of total waste. (Source - Municipal Corporation of Delhi, Burari facility).

2. Construction material

Common construction material includes bricks, cement, sand / gravel, soil (earth) and stone aggregates of various sizes.



Major dust borne material in handling Construction material and C&D wastes

The major dust borne material generated during construction / demolition and renovation activities are soil, sand, gravel and cement.



Dust abatement measures during transportation of Construction material and C&D wastes

The C&D wastes and construction material are stored / transported generally without proper coverage and necessary precautionary measures thereby contributing to dust to the ambient air.

Common dust management measures reported regarding transportation of C&D wastes / construction material include the following:

1. Transport routes for carrying construction material / C&D wastes to be identified – preferably to avoid residential, schools / institutional and hospital areas.
2. Transport material that are easily wind borne need to be covered by a sheet made of either jute , tarpaulin, plastic or any other effective material.
3. Trucks / lorries should not be overloaded to avoid overflow of material (C&D wastes / construction material) during transportation.

4. As the transport vehicles move generally during night time, the transport permit should also indicate the material / waste being transported, quantity being transported and place of loading and unloading destinations.

5. As most cities propose to have one C&D waste facility, the locations of all temporary / intermediate C&D wastes



storage dumpsites to be placed in public domain for stakeholders by the concerned department.

6. The unloading activities at temporary / intermediate C&D waste dumpsites to ensure that dust borne particles are damped either by water spray or aligning the waste disposal in such a way that minimizes dust dispersal (wind breakers).
7. The unloading activities of construction material at site / off site to ensure that dispersal of dust borne particles are minimized by either location of dumpsite or using water sprinklers or covered by a sheet made of either jute, tarpaulin, plastic or any other effective material.
8. Roads surfaces to be well maintained so that transport vehicles are not subjected to jerks resulting in ejection of C&D wastes / construction material on roads.
9. In many cases the transportation route may cover several kms, wet damping would be a major challenge, regular sweeping (or vacuum sweeping) would assist in reducing re-suspension of dust due to movement of vehicles, particularly in cities.

Dust control measures - Storage of Construction material and C&D wastes

As mentioned in the previous section, management (transportation & storage) of C&D wastes and construction material generally lack dust abatement measures thereby contributing to dust to the ambient air. The dust control measures w.r.t. storage of construction material include:

All areas for storing C&D wastes / construction material to be demarcated and preferably barricaded particularly those materials that have potential to be dust borne.

i. Off-site :

Contractors / builders / sellers / related stakeholders prohibited from storing / dumping C&D wastes / construction material on metalled (pucca) roads as it obstructs traffic flow - a case of encroachment inviting penalties.



ii. On-site :

a. Locations of storage / dumping wastes within site are to be such that dust dispersal during handling (loading / unloading) is minimum.

b. The Contractors / builders associated in construction works to ensure quantity of construction material available at site synchronizes with its utilization so that the storage period is minimal



thereby reducing dust dispersal.

c. Sites of demolition activities to be cordoned off and adequate measures to reduce dispersal of dust beyond site limits.

iii. Dust borne particles into the air can be reduced by addressing :

a. Sand/ gravel: Sand and other fine aggregates be stored in demarcated areas and given a covering.

- b. Cement: Cement bags to be stored in enclosed areas; loose cement to be stored in silos.
- c. Other fine material: preferably to be kept in sealed bags.

Dust control measures at site - construction / demolition / renovation activity

Dust control measures at site - construction / demolition activity to include:

- i. Raise barricade along the perimeter depending on the nature of adjoining regions.
- ii. Mount dust barrier sheet ex tarpaulin / plastic on scaffolding around the construction / demolition building – particularly side facing residential areas.
- iii. Selective mechanization (deployment of construction / demolition) of handling material / wastes helps in better management and reduction of dust generation at site.

NGT directions w.r.t. Compensation on Construction related works for DELHI

National Green Tribunal in OA 21 of 2014 titled “Vardhaman Kaushik Vs Union of India & Ors.” regarding Air Pollution **in DELHI** vide its order dated 10.04.2015 has imposed compensation on construction related works as under:(XVII) (b) *“If any person, owner and or builder is found to be violating any of the conditions stated in this order and or for their non-compliance such person, owner, builder shall be liable to pay compensation of Rs. 50,000/- per default in relation to construction activity at its site and Rs. 5,000/- for each violation during carriage and transportation of construction material, debris through trucks or other vehicles, in terms of section 15 of the NGT Act on the principle of polluter pay....”* Measures taken by Delhi Govt. available at web-link:

<http://www.delhi.gov.in/wps/wcm/connect/538125004cb89776bec6bf2446aafa27/PPT+on+AIR+%26+DUST+POLLUTION+.pdf?MOD=AJPERES&lmod=-1632379739&CACHEID=538125004cb89776bec6bf2446aafa27>

Other State governments can address dust control measures on similar lines taking into account the regional influences to bring out guidelines as initiated by the Delhi Government.



Overview of dust abatement measures in handling construction of C&D material / wastes

The environmental concerns during handling (loading / unloading) of Construction material and C&D wastes include:

- a. Generation of dust emissions impact environmental quality both on- site and off-site.
- b. Dust generated during handling (loading / unloading) release a wide range of particle sizes and material types that can *affect health and* cause problems ranging from eye, nose and throat irritation besides affect the respiratory system.
- c. The larger heavier particles settle out of the air quickly and are hazardous to the workers and construction equipment (on-site) and to those in the immediate vicinity. The finer particles (usually invisible) are transported further can cause health hazards (off-site).

GRAP & AQI focus on dust reduction (includes PM_{10} and $PM_{2.5}$), overview of dust abatement measures in handling of C&D material / wastes include:

1. Sprinkling of water / fine spray from nozzles to suppress dust re-suspension at site.
2. C&D wastes or construction material whether stored or transported (Lorries / tractors) to be preferably covered depending on the dust that is generated.

3. Areas where loading / unloading (fugitive dust) activities to be demarcated and located such that dust dispersal is minimized.



Indiscriminate dumping of C&D waste along roadsides (illegal activity) generates dust into the atmosphere (Photos - above & below)



4. Operations of equipment / machineries include transporting (conveyor belt) crushing / hammering etc deployed at site generate dust - these areas need to be bounded (enclosed) and use of water sprinklers suppress dust emissions.
5. Gensets (DG sets) be well maintained to ensure low emissions.
6. The transport vehicles engaged be well maintained (PUC compliance).

7. Routes of transport vehicles within construction site be damped by water (preferably treated waste water) sprinklers.
8. Dry sweeping of work areas to be prohibited.
9. For construction activities simultaneous development of green buffer would assist in arresting dispersal of dust (preferably shrubs & trees that have low uptake of water).
10. Workers to be provided necessary safety equipment - Workers at construction / demolition, Loading / unloading activities are provided with face mask to prevent inhalation of fine dust.
11. All builders / contractors engaged in construction & demolition activities to submit an undertaking to the concerned government department on measures adopted to control dust.
12. Use of covering sheets (plastic, tarpaulin etc) on:
 - a. Construction material heaps that are easily air borne
 - b. C&D debris that are dumped at temporary storage sites
 - c. Adequate covering on construction works, particularly side facing residential areas
13. Use of water sprinklers is commonly recommended as a dust mitigation measure, however there water is a precious commodity and its use needs to be rationalized. It is thereby important to adopt alternate measures that are effective ex location of loading / unloading sites, build higher barricades to arrest dust generated at ground levels and adopt covering (jute, plastic, tarpaulin etc) of construction material / wastes.
14. Sale of construction material from road-sides to be prohibited.
15. Dumping (unloading) and storage of construction material for use in on-going projects on public road-sides is prohibited.
16. Dumping (unloading) and disposal of C&D wastes on non-designated sites (ex road-sides, vacant plots, water bodies, drains etc) be prohibited.
17. Demand for construction material at site to synchronizes with its utilization, so that the storage period of un-used construction is minimal thereby reducing dust dispersal.
18. Construction projects to be encouraged to utilize products manufactured from C&D waste processing – this step improves organized collection of C&D wastes, stops indiscriminate dumping of C&D wastes thereby reducing dust load escaping into the atmosphere during dry weather.



19. Inclusion of condition(s) by concerned agencies for adoption of dust mitigation measures in approvals / permits / consent provisions / environmental clearances for construction projects.
20. There is a need to highlight the environmental concerns & disseminate information on the matter.

All contractors associated in construction works and C&D waste handling need to display a board at the site indicating dust control measures being adopted, a sample display is given below for guidance:

- a. *Dust affects health* cause problems ranging from eye, nose and throat irritation besides the respiratory system
- b. *This project site adopts dust reduction measures*
- c. *All light (potential to be wind blown) construction material is covered or put in sealed bags*
- d. *Loading / unloading areas are barricaded*
- e. *Water sprinkling for dust reduction is being practiced*
- f. *Adequate covering material shall be used to reduce dust generation*
- g. *Workers health & safety is our concern*
- h. *Staff at site have been apprised of CPCB's Guidelines on DUST reduction w.r.t. handling of C&D wastes & construction material.*

REFERENCES:

1. Graded Response Action Plan (see - http://cpcb.nic.in/final_graded_table.pdf)
2. National Ambient Air Quality Standards (2009) (see -<http://www.cpcb.nic.in>)
3. Air Quality Index (AQI) (See - http://cpcb.nic.in/FINAL-REPORT_AQI_.pdf and http://cpcb.nic.in/About_AQI.pdf)
4. CPCB's Guidelines on Environmental Management of C&D Wastes (March 2017) (See - http://cpcb.nic.in/upload/NewItems/NewItem_228_Final_C&D_March_2017.pdf)
5. Measures taken by Delhi Govt w.r.t. on Construction related works for DELHI at web-link: <http://www.delhi.gov.in/wps/wcm/connect/538125004cb89776bec6bf2446aafa27/PPT+on+AIR+%26+DUST+POLLUTION+.pdf?MOD=AJPERES&lmod=-1632379739&CACHEID=538125004cb89776bec6bf2446aafa27>

ANNEXURE A

Committee for implementation of “C & D Waste Management Rules 2016”

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