



**NESANS**

COMPLIANCE & STANDARDS

# Aggregate Plant Dust Control: Meet TNPCB Standards While Maintaining Production

Control dust emissions at aggregate plants. Water spray systems, enclosures, and monitoring to meet TNPCB/KSPCB environmental requirements.

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Dust control is a critical compliance and operational requirement for aggregate plants in Tamil Nadu. TNPCB (Tamil Nadu Pollution Control Board) regulations mandate specific particulate matter limits, and failure to comply results in show-cause notices, penalties, and potential plant closure. Understanding effective dust suppression methods enables plant operators to maintain compliance while protecting equipment and worker health.

## TNPCB Regulatory Requirements

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### Emission Standards for Stone Crushers

TNPCB specifies particulate matter limits under various categories:

SOURCE	LIMIT (MG/NM <sup>3</sup> )	NOTES
Stack emissions (process)	100	At any crusher or screening point
Fugitive emissions	Limited visible dust	No dust crossing property boundary
Ambient air quality (PM10)	100 µg/m <sup>3</sup>	Annual average
Ambient air quality (PM2.5)	60 µg/m <sup>3</sup>	Annual average

## Compliance Documentation Requirements

TNPCB requires the following for operating consent:

- **Dust suppression system details:** Design, capacity, coverage
- **Water supply certification:** Source and adequacy
- **Stack monitoring reports:** Quarterly third-party testing
- **Ambient monitoring:** Regular monitoring at boundary
- **Green belt development:** Plantation around boundary
- **Maintenance records:** Log of dust control system upkeep

## Dust Generation Sources in Aggregate Plants

### Primary Dust Sources

SOURCE	DUST INTENSITY	PRIMARY CONTROL METHOD
Crusher feed point	High	Enclosure + water spray
Crusher discharge	Very high	Enclosure + wet suppression
Screen decks	High	Enclosure + spray system
Conveyor transfer points	Medium-high	Enclosure + spray
Stockpile loading	Medium	Water spray, low drop
Truck loading	Medium	Water spray, enclosure
Haul roads	High	Water tanker, surfacing

## Factors Affecting Dust Generation

FACTOR	EFFECT	CONTROL STRATEGY
Material moisture	Dry material = more dust	Maintain >3% moisture
Fines content	More fines = more dust	Remove fines early
Wind speed	Higher wind = more dispersion	Windbreaks, enclosures
Drop height	Greater drop = more dust	Minimize free fall
Processing rate	Higher rate = more dust	Scale suppression accordingly
Rock type	Sofite rocks = more dust	Adjust suppression

## Wet Dust Suppression Systems

### Water Spray System Design

Wet suppression is the primary dust control method for crushers and screens:

#### System components:

- **Water supply:** Adequate quantity and pressure
- **Pump station:** Dedicated high-pressure pump
- **Distribution piping:** Corrosion-resistant materials
- **Spray nozzles:** Selected for coverage and droplet size
- **Control system:** Interlocked with equipment operation

#### Water consumption guidelines:

APPLICATION POINT	WATER RATE	PRESSURE
Crusher feed	1-2 L/tonne	3-5 bar
Crusher discharge	2-4 L/tonne	4-6 bar
Screen deck (each)	1-2 L/tonne	3-5 bar
Transfer points	0.5-1 L/tonne	3-5 bar

APPLICATION POINT	WATER RATE	PRESSURE
Stockpile spray	Variable	4-6 bar

## Nozzle Selection and Placement

NOZZLE TYPE	SPRAY PATTERN	DROPLET SIZE	APPLICATION
Full cone	Circular coverage	200-400 µm	General suppression
Hollow cone	Ring pattern	100-300 µm	Fine mist, fogging
Flat fan	Line coverage	200-500 µm	Conveyor, linear sources
Air atomizing	Very fine mist	50-150 µm	Airborne dust capture

### Placement principles:

- Position nozzles upstream of dust generation point
- Ensure complete coverage without gaps
- Avoid overspray that creates puddles or runoff
- Protect nozzles from impact damage
- Provide access for cleaning and maintenance

## Fog/Mist Suppression Systems

High-pressure fog systems for airborne dust capture:

### System characteristics:

PARAMETER	CONVENTIONAL SPRAY	HIGH-PRESSURE FOG
Pressure	3-6 bar	50-150 bar
Droplet size	200-500 µm	10-50 µm
Water consumption	Higher	50-80% less
Dust capture efficiency	Good for settling	Better for airborne
Capital cost	Lower	Higher

PARAMETER	CONVENTIONAL SPRAY	HIGH-PRESSURE FOG
Operating cost	Higher water	Higher power

## Dry Dust Collection Systems

### Baghouse Collectors

For applications where wet suppression is not suitable:

#### System components:

- **Capture hoods:** Enclose dust source with suction
- **Ductwork:** Transport dust-laden air
- **Collector unit:** Filter bags capture particles
- **Discharge system:** Rotary valve or screw
- **Fan:** Creates suction for system

#### Design parameters:

PARAMETER	TYPICAL VALUE	NOTES
Air-to-cloth ratio	2-4 m/min	Lower for fine dust
Capture velocity	1.0-1.5 m/s at hood	Higher for heavy particles
Duct velocity	18-22 m/s	Maintain particle transport
Outlet emission	<50 mg/Nm <sup>3</sup>	Better than spray alone

### Cyclone Collectors

Pre-collection for large particles before baghouse:

- Removes particles >10-20  $\mu\text{m}$  efficiently
- Reduces load on baghouse filters
- Lower pressure drop than baghouse alone
- Returns collected material to process

# Enclosures and Containment

## Crusher and Screen Enclosures

Effective enclosure design minimizes dust escape:

### Design principles:

- Enclose dust source as completely as possible
- Provide access doors for maintenance
- Include negative pressure ventilation
- Install rubber curtains at material entry/exit
- Seal gaps and openings

### Enclosure materials:

MATERIAL	APPLICATION	ADVANTAGES
Steel sheet	Permanent enclosure	Durable, rigid
Rubber curtains	Access points, conveyors	Flexible, replaceable
Polycarbonate	Inspection windows	Visibility, impact resistant
Fabric screens	Large openings	Low cost, replaceable

## Transfer Point Design

Proper transfer design reduces dust at source:

- **Reduce drop height:** Use rock ladders or cascade chutes
- **Center loading:** Material impacts material, not belt/chute
- **Controlled trajectory:** Hood design captures dust plume
- **Settling zone:** Allow dust to settle before exit
- **Skirt sealing:** Extend skirting to contain dust

# Haul Road Dust Control

## Water Truck Application

Most common method for unpaved road dust control:

### Application guidelines:

CONDITION	APPLICATION RATE	FREQUENCY
Dry season, heavy traffic	2-3 L/m <sup>2</sup>	Every 2-3 hours
Moderate conditions	1.5-2 L/m <sup>2</sup>	Every 4-6 hours
Low traffic	1-1.5 L/m <sup>2</sup>	2-3 times daily

## Chemical Suppressants

For extended dust control with less water:

TYPE	MECHANISM	DURATION	APPLICATION
Calcium chloride	Hygroscopic (absorbs moisture)	2-4 weeks	Spray or dry spread
Magnesium chloride	Hygroscopic	2-4 weeks	Spray application
Lignosulfonate	Binding agent	2-6 weeks	Spray application
Polymer emulsion	Surface binding	4-12 weeks	Spray with sealing

## Road Surface Treatment

Permanent solutions for high-traffic areas:

- **Paving:** Concrete or asphalt (most effective)
- **Surface sealing:** Bitumen emulsion treatment
- **Crushed aggregate:** Coarse stone reduces dust
- **Regular grading:** Maintain smooth surface

## Green Belt and Natural Barriers

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### Vegetation Requirements

TNPCB mandates green belt development:

- **Width:** Minimum 10m around plant boundary
- **Species:** Dense foliage trees and shrubs
- **Density:** 2000+ trees per hectare
- **Maintenance:** Regular watering and care

### Effective species for Tamil Nadu:

TREE TYPE	GROWTH RATE	DUST CAPTURE
Neem (Azadirachta indica)	Fast	Excellent
Pongamia (Pongamia pinnata)	Moderate	Good
Cassia (Cassia siamea)	Fast	Good
Casuarina (Casuarina equisetifolia)	Fast	Moderate

### Windbreaks

Physical barriers to reduce wind-blown dust:

- Natural vegetation barriers (trees)
- Artificial windbreak fabric
- Permanent walls at critical locations
- Stockpile orientation to reduce wind exposure

## System Maintenance and Monitoring

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### Daily Maintenance Checklist

- Check all spray nozzles for blockage
- Verify water supply pressure

- Inspect enclosures for damage or gaps
- Confirm dust collection system operation
- Check road conditions and schedule watering
- Document any visible dust issues

## Weekly Maintenance

- Clean or replace clogged nozzles
- Inspect and repair enclosure damage
- Check baghouse differential pressure
- Service water pumps
- Review dust monitoring data

## Monitoring Requirements

PARAMETER	METHOD	FREQUENCY
Stack emissions	Third-party testing	Quarterly
Ambient PM10	High-volume sampler	Monthly or continuous
Ambient PM2.5	Gravimetric sampler	Monthly or continuous
Visual assessment	Observation log	Daily

## Cost-Benefit Analysis

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### System Cost Estimates

SYSTEM COMPONENT	CAPITAL COST (RS)	ANNUAL OPERATING
Wet suppression system	10-25 lakhs	3-5 lakhs
Enclosures (basic)	5-15 lakhs	1-2 lakhs
Baghouse collector	25-50 lakhs	5-10 lakhs
Haul road maintenance	5-10 lakhs	8-15 lakhs

SYSTEM COMPONENT	CAPITAL COST (RS)	ANNUAL OPERATING
Green belt development	3-8 lakhs	1-2 lakhs

## Cost of Non-Compliance

TNPCB penalties and consequences:

- **Show-cause notice:** Administrative time and cost
- **Bank guarantee forfeiture:** Rs 25 lakhs or more
- **Closure order:** Complete loss of production
- **Legal costs:** Appeals and litigation
- **Community relations:** Long-term reputation impact

Effective dust control requires a comprehensive approach combining wet suppression, enclosures, collection systems, and operational practices. Investment in proper dust control systems ensures TNPCB compliance while protecting worker health and maintaining good community relations.

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**Topics:**

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