



# Specialization Course in Dust and Spill Control

Class 01: Introduction, Particulate  
Matter, and Regulatory Framework



# Introduction



Dust control in the mining environment is one of the most persistent and critical challenges facing the mining industry today.



This problem not only affects the health of workers and nearby communities, but also has significant environmental and economic consequences

- The current systems used in mining usually have very low efficiency for local control and lack effectiveness in global control.



- Persistence in applying the same traditional systems in mining for dust control despite their failure will not lead us to reduce fugitive dust, much less PM10.



## Objective

The objective of the course is to provide fundamental tools to develop real and sustainable solutions that allow efficient control of particulate matter and spills both in existing plants and in future projects.

# Scope

This specialization course is aimed at students, technicians, and engineers in the following sectors:

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Maintainability and reliability

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Plant operation

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Desing of dust control systems

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Occupational hygiene and safety

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Envioronment

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Fire protection

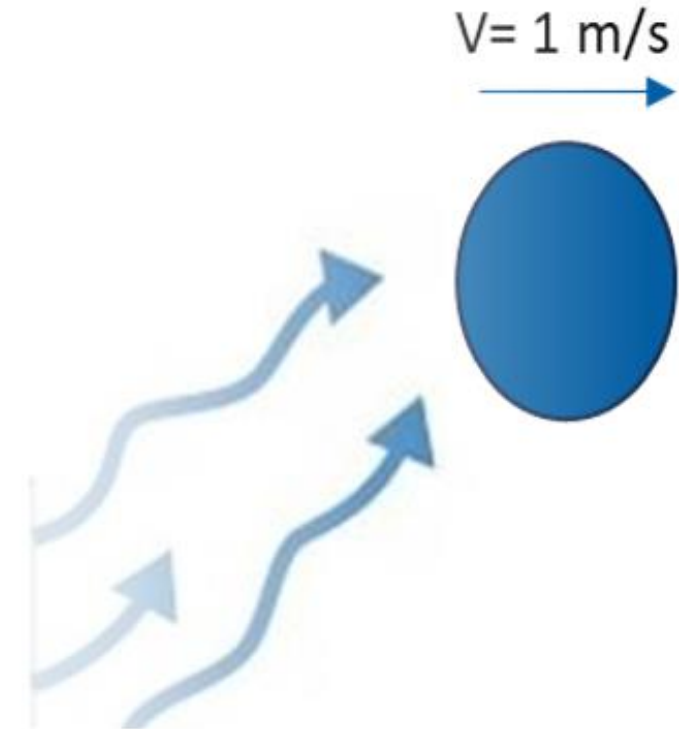
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# Definitions of Particulate

**Dust or particulate matter (MPS or TPS)** is the dispersion of solid particles in the environment smaller than 100 microns that can be kept in suspension with an approximate speed of 1 m/s. It can settle a few meters from the emitting source or several meters away kilometres.

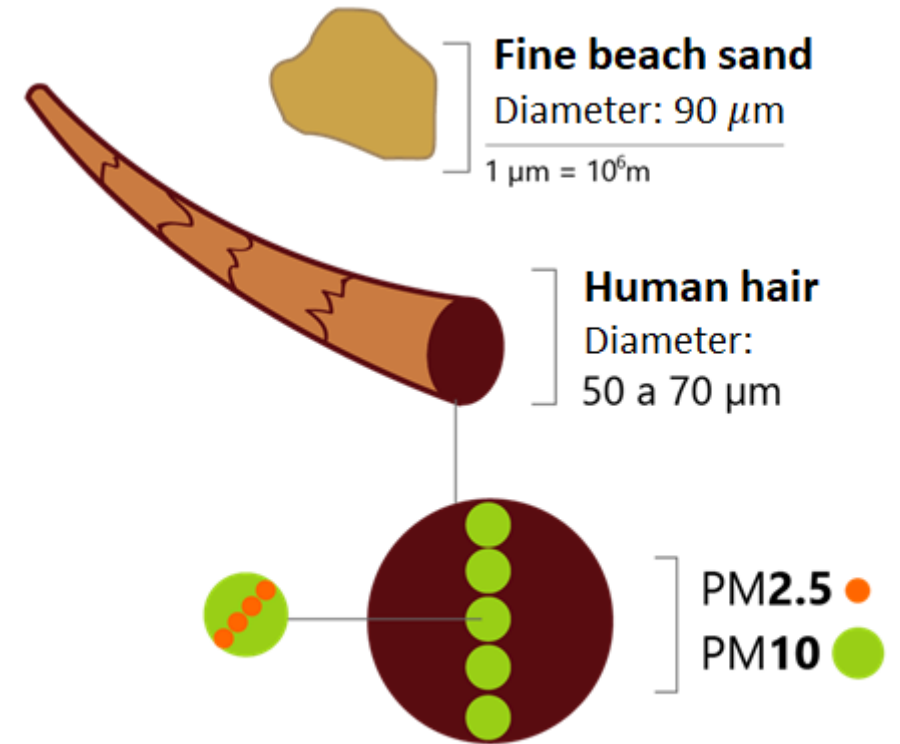
**Visible dust** is that with particles larger than 40 microns. As a reference, human hair has an approximate thickness of 70 microns.



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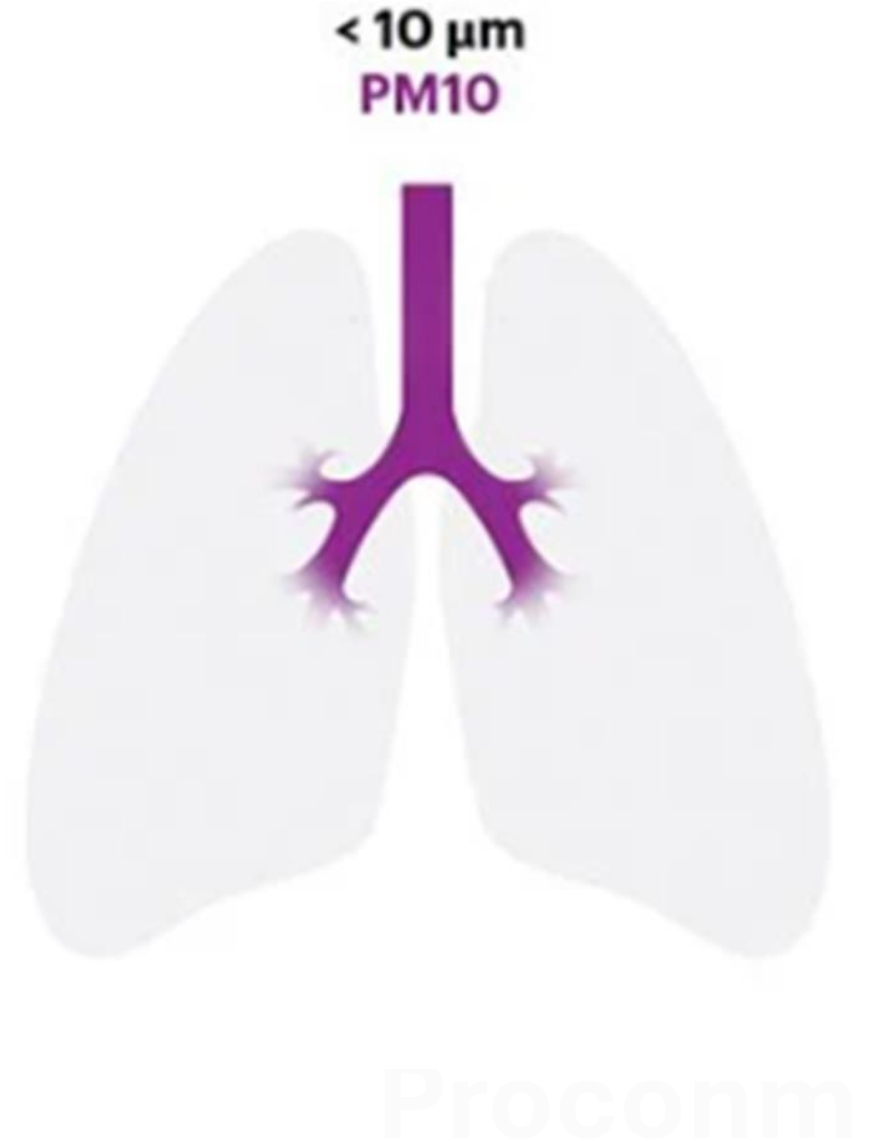
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**PM10** is the particulate matter that enters through the nasal passage and remains in the thorax. **VL=MP10: 0,03 m/s (0,108 km/h)**

**PM5 (breathable)** is the fraction dangerous to health, it does not settle and remains longer in the air and can penetrate the lungs.

**PM2.5 (thin breathable)** is the most dangerous particulate matter for health since it can penetrate the smaller diameter ducts in the lungs, the alveoli. **VL=0,002 m/s (0,007 km/h)**

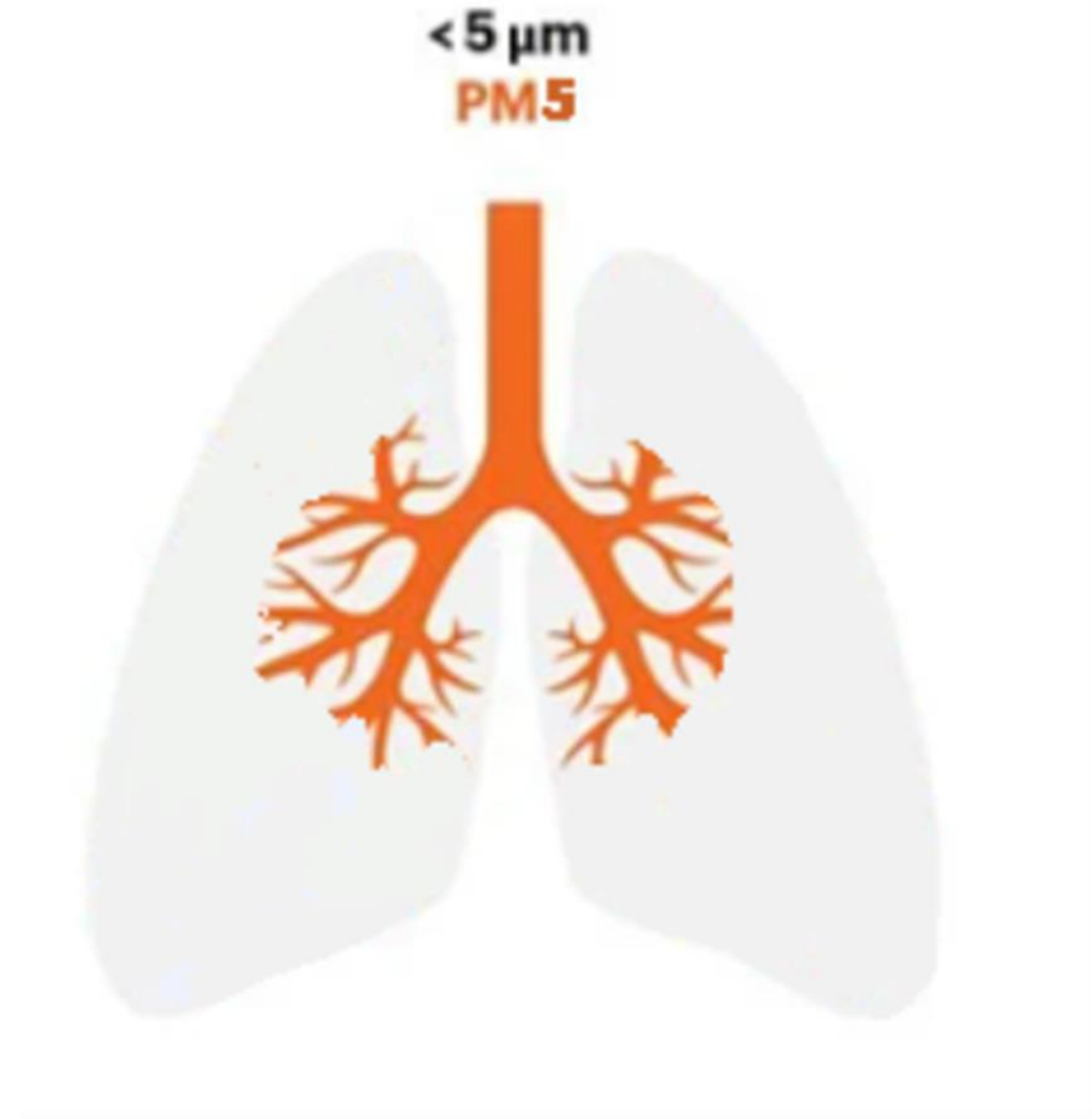




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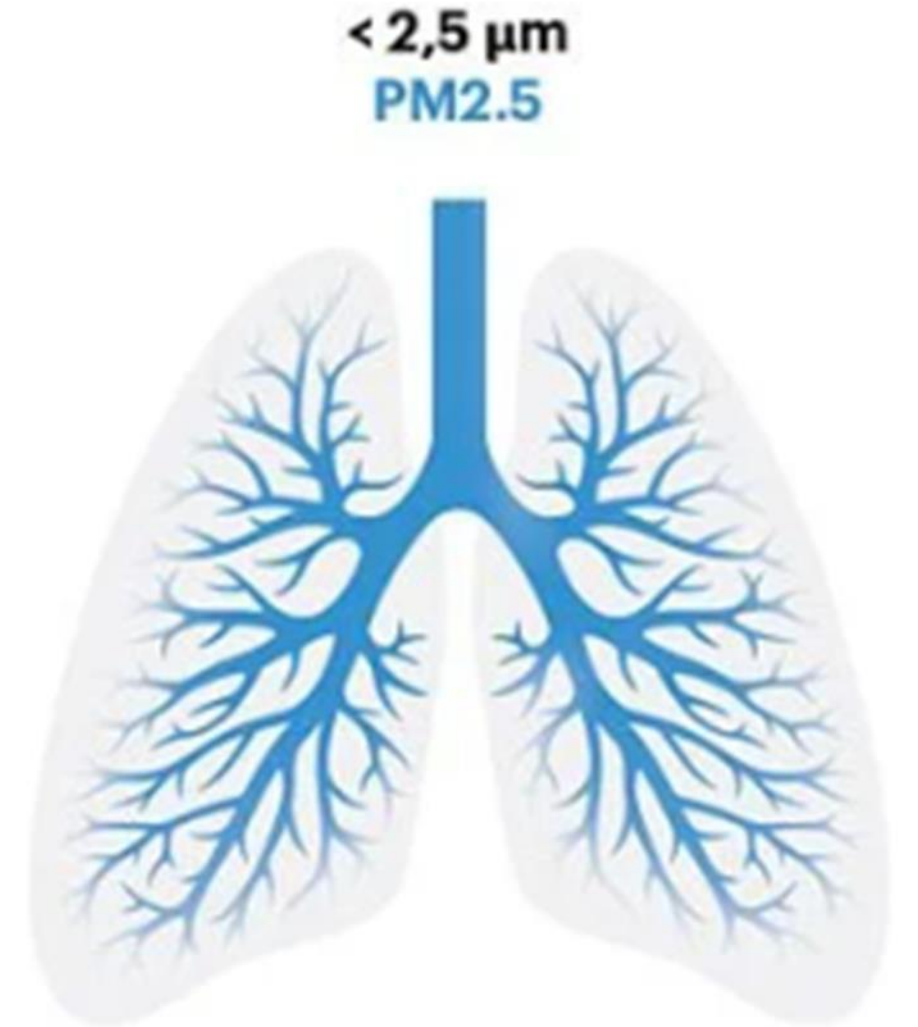
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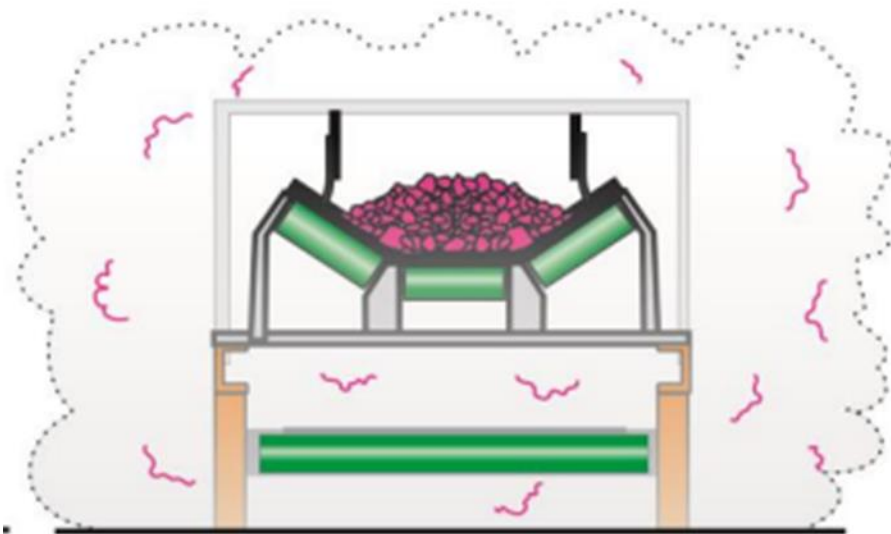
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Photos by NIOSH



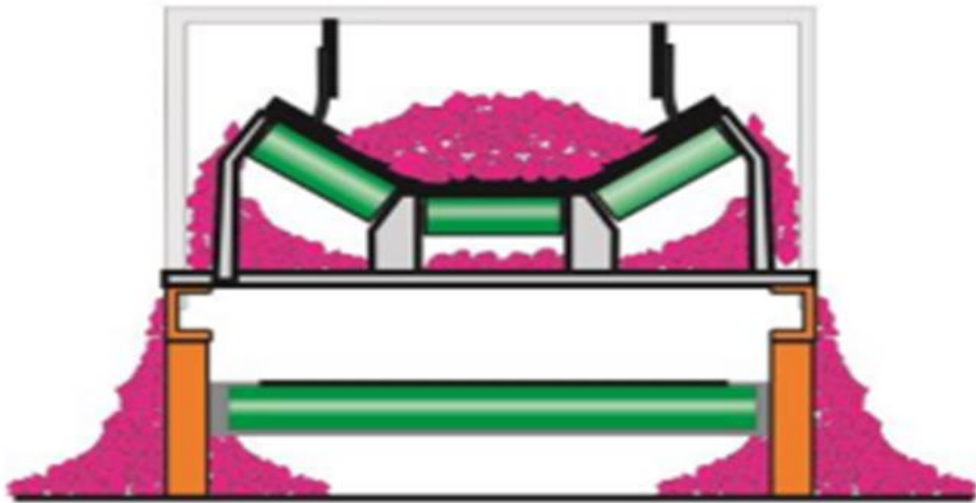
**Dust Fugitive:** Fugitive dust is uncontrolled particulate matter that escapes into the environment from a generating source or due to inefficient confinements or non-existent.



Airborne dust



**Spills:** Spills are uncontrolled materials that escape to surrounding areas, onto the floor, or remain attached to components. Adhered mud is an eternal source of polluted air.

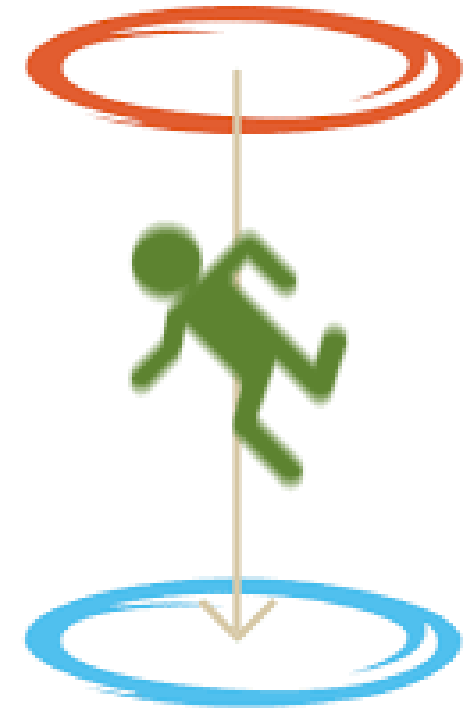


Spillage

# Definitions of Terminal Velocity

Terminal velocity, or limit, is the maximum speed reached by a body moving through the air under the influence of gravity. In other words, when the acceleration is zero, or the air resistance or drag equals gravity

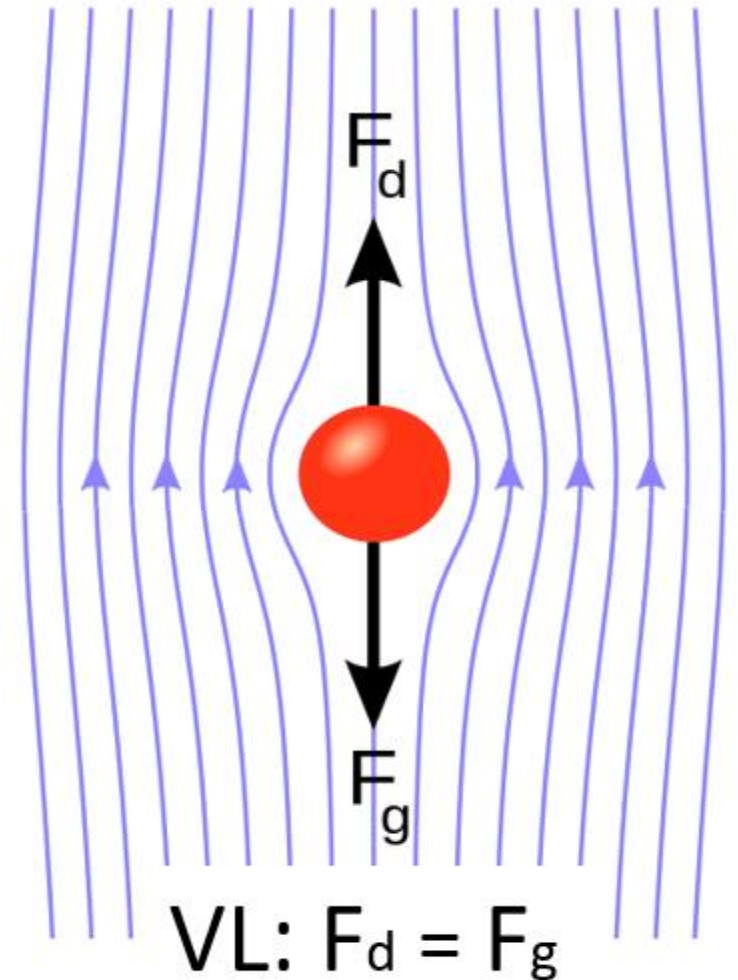
The speed limit for laminar flow can be obtained using the Stokes' equation or law, either in the laboratory or theoretically. And for turbulent flow, it can be determined using the equation for Rayleigh drag force.



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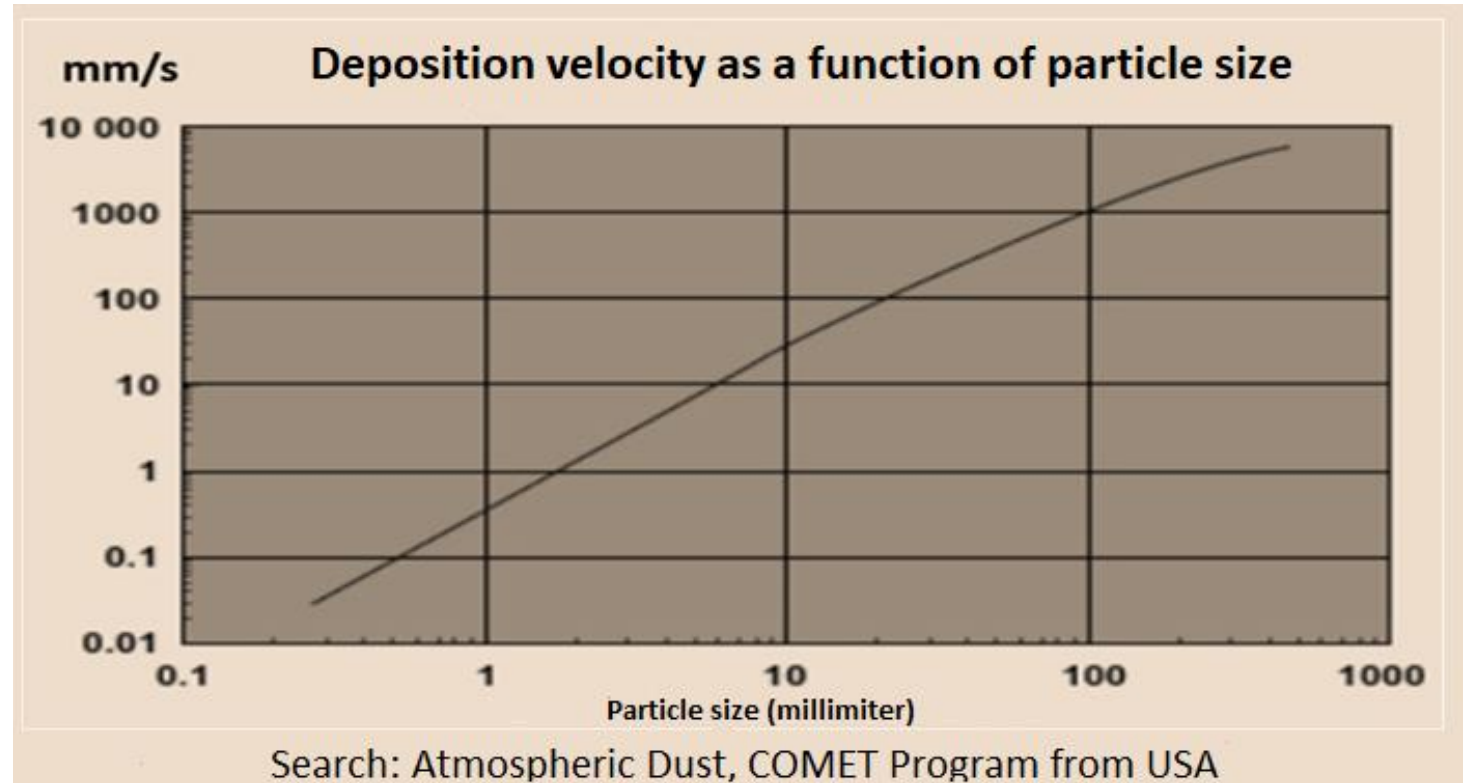
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## Diagram COMET - Zender

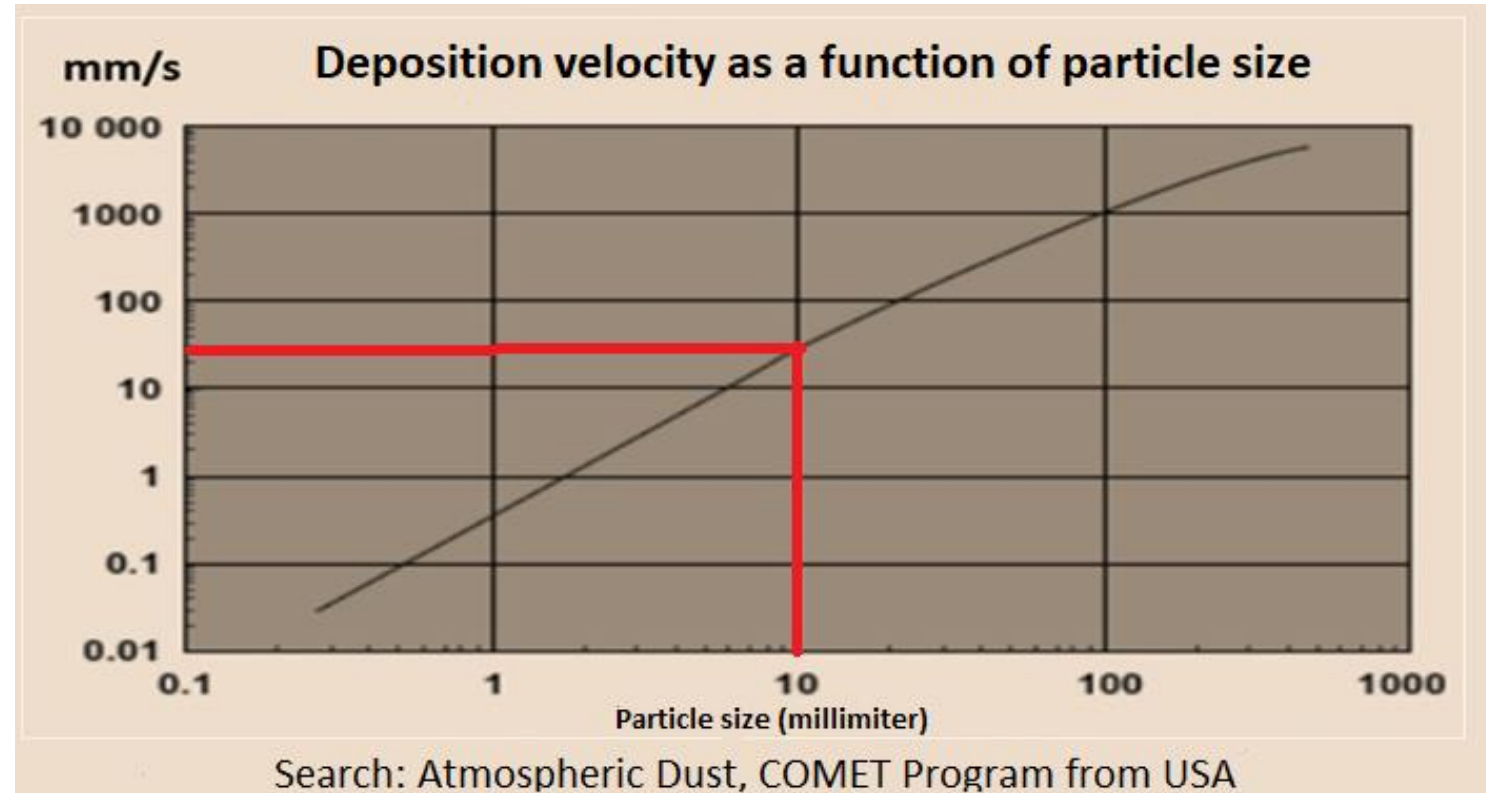
- The COMET program [1] is an organization dedicated to education and training in the USA, which constructed this terminal velocity diagram as a function of particle size, based on the predictive model developed by Zender [2] for climate. In other words, it considers hurricanes and very turbulent air.





## Diagram COMET - Zender

- This diagram is recommended for determining the terminal velocity of different particle sizes. For example, PM10 requires a minimum speed of 30 mm/s (0.1 km/h) to avoid falling. For this reason, it is considered non-sedimentable.



# Regulatory Framework

## Chile

- PTS o Total unclassified dust : Decreto 594 [3]
- PM10: Decree 12 [4]
- PM5: Decree 594 [3]
- PM2.5: Decree 12 [5]
- Crystalline free silica: Decree 594 [3]

## USA

- PM10 y PM2.5: 40 CFR [6]
- Crystalline free silica: 29 CFR [7]

# References

1] El Polvo Atmosférico. Publicado por COMET, Cooperative Program for Operational Meteorology, Education and Training de USA.

[2] Mineral Dust Entrainment and Deposition (DEAD) Model: Description and 1990s Dust Climatology. Publicado el 2003 en el Journal of Geophysical Research por: Charles S. Zender, Huisheng Bian, and David Newman

[3] Decreto 594. Aprueba Reglamento Sobre Condiciones Sanitarias y ambientales Básicas en los Lugares de Trabajo. Decreto publicado por MINSAL. Última versión abril del 2000

Decreto 594. Condiciones Sanitarias y Ambientales en los Lugares de Trabajo

[4] Decreto 12. Establece Norma Primaria de Calidad Ambiental para Material Particulado Respirable MP10. Decreto publicado por MINSAL en junio del 2022.

[Ley Chile - Decreto 12 04-JUN-2022 MINISTERIO DEL MEDIO AMBIENTE](#)

[5] Decreto 12. Establece Norma Primaria de Calidad Ambiental para Material Particulado Respirable Fino MP2,5. Decreto publicado por MINSAL en mayo del 2011.

[Ley Chile - Decreto 12 09-MAY-2011 MINISTERIO DEL MEDIO AMBIENTE](#)

[6] 40 CFR Part 50, Review of the National Ambient Air Quality Standards for Particulate Matter. Environmental Protection Agency (EPA), USA

[2020-27125.pdf \(govinfo.gov\)](#)

[7] 29 CFR 1910.1053, Occupational Exposure to Respirable Crystalline Silica, Occupational Safety and Health Administration (OSHA). USA

<https://www.osha.gov/silica-crystalline/general-industry-info>



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