Basics of Dust Control and Wind Erosion

Dallas Grossman
Division of Water Quality
(701) 328-5242

NORTH DAKOTA DEPARTMENT OF HEALTH
C. Storm Water Pollution Prevention Plans

2. Operational Controls

b. Good housekeeping practices to maintain a clean and orderly facility. Litter, debris, chemicals and parts must be handled properly to minimize the exposure to storm water. This includes measures to reduce and remove sediment tracked off-site by vehicles or equipment, and the *generation of dust*. 
Wind Erosion

- Major contributor to erosion of fine-grain soils.
- A thick layer of accumulated sand and silt may not support plant growth.
Wind Erosion

- Wind erosion can be a problem in most states.

Figure 39. Areas of Highest Potential for Wind Erosion (SCS, 1989)

Wind Erosion

- An issue during dry conditions when soil is exposed to wind.
- Unlike water-borne sediment, wind-borne sediment does not flow downhill.
Wind Erosion

Methods of Soil Particle Transportation

– Surface Creep
– Saltation
– Suspension

Figure 40. Mechanisms of Wind Erosion and Sedimentation (SCS, 1989)
Surface Creep

- The rolling and sliding movement of particles across a surface.
- Can represent 5 – 25% of total soil loss from a construction site.

Figure 40. Mechanisms of Wind Erosion and Sedimentation (SCS, 1989)

Saltation

• The hopping and bouncing movement of particles.
• The particles are small enough to be lifted by wind, but are too large to stay in the air.
• Upon returning to the ground they dislodge more particles.
• Can represent approximately 50 – 80% of total soil loss due to wind.
Suspension

- Particles small enough to be suspended by wind.
- Remain in suspension for long durations and can travel great distances.
- Can represent less than 10% of total soil loss due to wind.

Figure 40. Mechanisms of Wind Erosion and Sedimentation (SCS, 1989)

Size Distribution

Figure 41. Relative Size Distribution of Wind-Borne Particles (Fifield, 1995)
Erosion Rates

- Depend on erodibility of the soil and erosivity of the wind.

- Erosivity falls into two categories
  1. Atmospheric Flow
     - The rate of soil movement is proportional to the cube of the wind velocity.
  2. Surface Roughness
     - Five major categories:
       - Vegetation height and density
       - Clods and non-erodible fractions
       - Ridges
       - Field shelterbelts (or windbreaks)
       - Local changes in topography.
Surface Roughness

1. Vegetation height and density
   • Determines the extent wind contacts the soil surface

2. Clods and non-erodible fractions
   • Provide cover for smaller soil particles

3. Ridges
   • Shelter and trap suspended particles when the wind is perpendicular to them
   • Provide little protection when wind is parallel to them

4. Field shelterbelts or windbreaks
   • Intercept suspended particles
   • Particles deposit on the leeward side of the barrier

5. Local changes in topography
   • Wind shear is greatest in upper part of the windward slope
Erodibility

- Erodibility of soil is dependent upon
  - Diameter
  - Density
  - Shape

- Most soil is held together in clods in the following ways:
  - Water tends to hold soil grains together
    - Sands tend to dry quickly
    - Finer grains retain moisture longer and are more cohesive
  - Texture relates to a soil’s moisture-retention capability
    - More silt and clay results in more clods
    - More sand results in fewer clods
  - Organic cements resulting from breakdown of organic material
  - Desegregating processes
    - Freeze-thaw breaks down clods
Minimizing Wind Erosion

- Things to consider:
  - Control methods available during major grading activities
  - Control methods to use after major grading activities
  - Amount of area exposed
  - Dust generating activities (cutting concrete)
  - Location (near populated areas)
  - Time of year
  - Type of people affected
    - People with health issues
    - “Concerned citizens”
Control Methods

- Minimize amount of soil exposed
- Mulch and seeding
- Mulch
- Structural Barrier and windbreaks
- Surface Roughening
- Dust suppression chemicals
- Water
Mulch

- Straw or other organic material
Mulch

- In order to prevent mulch from blowing away, it should be disc-anchored into the soil, hydraulically bonded, or covered with netting and stapled
- Mulch may help when optimum germination conditions do not exist (i.e., midsummer, early winter)
Structural Barrier and Windbreaks

- Deposition zone of 10 feet for every 1 foot of fence height
  - Soil deposition zone = 10 x fence height

- Spacing between barriers depends on soil erodibility
  - Low (erodibility) = 1,000 ft
  - Moderate = 200 ft
  - High = 50 ft

- The best sediment collection occurs when 40% to 50% of the fence is open (porosity)
Structural Barrier and Windbreaks

- Caution should be used when placing barriers before snow fall, then the deposition zone is 35 feet for every 1 foot of fence
  - Snow deposition zone = 35 x fence height
Control Methods

• Surface Roughening
  – Construct ridges perpendicular to the prevailing wind or to the direction you want to protect
  – Ridges should be 6 inches in height

• Water
  – Useful when equipment is available and water retention capability of the soil

• Dust Suppression Chemicals
  – Apply according to directions (do not over apply) or NDDoH guidelines (e.g., oilfield salt brine)
  – Use caution when applying near waters of the state (do not violate a water quality standard)
  – A significant amount of time should be provided prior to a rain event to allow the product to set and avoid being washed away by stormwater
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Questions?

References

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