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ABSTRACT

Soil erosion by wind is a serious problem throughout the United States and the world. Dust from wind erosion obscures visibility and pollutes the air. It fills road ditches where it impacts water quality, causes automobile accidents, fouls machinery, and imperils animal and human health. Dust and specifically particulate matter less than 10 microns (PM10), is regulated by the US-EPA National Ambient Air Quality Standards. The Wind Erosion Prediction System (WEPS) model was developed by the USDA Agricultural Research Service, primarily for the USDA Natural Resources Conservation Service to simulate wind erosion and develop conservation plans on cultivated agricultural lands. WEPS is a process based, daily-time step model that simulates hydrology, plant growth and decomposition, land management, and soil surface erodibility to simulate soil wind erosion loss (total, saltation/creep, suspension, and PM10 sizes) as affected by stochastically simulated local weather. The WEPS erosion sub-model has been developed into a stand-alone companion product that is known as the Single-event Wind Erosion Evaluation Program (SWEEP). SWEEP consists of the stand-alone WEPS Erosion sub-model combined with a user-friendly graphical interface and simulates soil loss and dust emissions from single wind storm events (i.e., one day). In addition to cultivated agricultural lands, wind erosion results in sediment and dust emissions from construction sites, mined and reclaimed land, landfills, and other disturbed lands. Such disturbed lands are often regulated by government agencies. The US-EPA sets limits on pollution levels and establishes permits for pollution release. In addition, state agencies develop State Implementation Plans (SIP's) and operate permit programs for release of fugitive dust. Although developed for agricultural situations, WEPS and SWEEP are useful tools for simulating erosion by wind for such lands where typical agricultural practices and control methods are not utilized. WEPS is suitable for simulating long term (multiple years) control strategies such as mulching, re-vegetation, and large roughness elements such as burms. SWEEP on the other hand can simulate the potential soil loss for site specific planned surface conditions and control practices for a given date. SWEEP also provides probabilities of dust events given the defined surface conditions for the specified location and date. This paper explores the use of WEPS and SWEEP for developing control strategies for fugitive dust on construction sites and other non-agricultural disturbed lands. Case studies and comparative scenarios with examples of modifying WEPS and SWEEP inputs and management files to simulate common erosion control strategies are presented. Control strategies discussed include the simulation of water and other dust suppressants, wind barriers such as silt and snow fencing and hay bales, anchored and crimped straw mulch, vertical mulches, erosion blankets, re-vegetation, gougers, basin blades, berms, and other roughening practices. For example, dust suppressants are simulated by creating a crusted soil with low loose erodible material on the surface. Example simulations will be demonstrated. The paper describes tools needed to design erosion control plans that are not only cost-effective but also demonstrate regulatory compliance by using a science-based approach to risk assessment.

KEYWORDS. Wind erosion, Construction sites, Disturbed lands.

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