4K Evaluation of Street Sweepers

Table 4-1
SUMMARY OF STREET SWEEPING STUDIES (from Santa Clara Literature Review)

Study Title	Objectives	Equipment Evaluated	Locations	Results on Street Sweeping Effectiveness
Evaluation of Regenerative-air, Vacuum street Sweeping on Geological Contributions to PM^{10} (Chow *et al.* 1990)	Effect of street sweeping on air quality	Tymco 350 regenerative air, FMC mechanical sweeper, mobil AV345L blow air suction, re-circulating air sweeper	Reno, Nevada	Small particles of 10 microns are often impacted back into the street by regenerative air. Regenerative-air ineffective for particles smaller than 10 microns. Mobil sweeper appeared to leave dust after sweeping Regenerative air seems to resuspend more small particles.
Bellevue Urban Runoff Program (Pitt and Bissonette, 1984), and Quantity and Quality of Storm Runoff from Three Urban Catchments in Bellevue, Washington (Pyrch and Ebbert 1986).	Street sweeping effectiveness, equipment performance, across street distribution	Broom, regenerative air	Bellevue, Washington	Water quality is not significantly improved from street sweeping. There is less dirt on swept streets than unswept streets.

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Evaluation of Urban Non-Point Source Pollution Management in Milwaukee County, Wisconsin, Vol. 1 &2 (Bannerman *et al.* 1983).	Compare the following options: 1. Increase frequency during March and October. 2. Increase frequency during March through November. The control and increased sweeping rates were as follows: commercial - weekly, 2 to 3 times per week, residential - monthly, weekly or twice weekly parking Lot - bi-monthly, bi-weekly or weekly	Mechanical	Milwaukee	Street sweeping results in a 10 percent reduction of pollutant loadings. Only a slight reduction for option 2 compared to option 1. Street sweeping is effective at removing winter residue (after snowmelt) and for leaf removal.
An Evaluation of Street Sweeping as a Runoff Pollutant Control (U.S. EPA 1983).	Street pollutant accumulation rate, pollutant particle size across street distribution, street sweeping effectiveness, and water quality effectiveness	Tymco sweepers	Winston-Salem, North Carolina	Average pickup was 393lbs/mi/day in business dist. 281lbs/mi/day in residential Most pollutants are within 1 ft of the curb Smaller particles have a higher concentration of pollutants Highest removal efficiency for particles bigger than 45 microns No benefit to water quality from street sweeping

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Washoe County Urban Stormwater Management Program, Vol. 2: Street Particulate Data Collection and Analysis (CH2MHill 1982).	Street pollutant accumulation rates, no of passes, street texture, equipment performance, speed tests, street distribution of pollutants	Ecolotec vacuum assisted mobil, mechanical sweepers	Reno, Nevada	Rough streets have more particles than others. Street texture, street/gutter interface, and wind are the most important factors for accumulation. Fugitive dust affects accumulation rates. Multiple passes are not better. 4 mph minimizes residual loading. Driving lanes have less particles except on rough surface where they have the most). Driving lane particles are not easily swept or washed off.

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Nationwide Urban Runoff Project, Champaign, Illinois; Evaluation of the Effectiveness of Municipal Street Sweeping in the Control of Urban Storm Runoff Pollution (Terstrierp *et al.* 1982)	Street pollutant accumulation rate, pollutant particle size, water quality effectiveness	1973 Elgin model Pelican S (3-wheeled mechanical sweeper)	Champaign, Illinois	Mechanical sweeping with frequencies of up to 2 times per week is not effective at reducing the mean concentration or load. Mechanical sweeping at a frequency of once per week does reduce the amount and variability of street dirt. The overall removal efficiency for mechanical sweeper was 30 to 67 percent.
A Demonstration of Non-Point Source Pollution Management on Castro Valley Creek (Pitt and Shawley 1981).	Street pollutant accumulation rates, sweeping frequency, equipment performance	Mobil-broom sweeper, regenerative air	Castro Valley, California	Regenerative air sweepers are effective in removing particles from street surfaces for areas that have a low quality of dust/dirt or trash. As the quantity of street dust/dirt increases, regenerative air sweeper effectiveness diminishes. Mechanical sweepers are best for trash and large particles. Broom sweeper efficiency was 40 percent After 2 to 3 sweepings per week, there is little improvement in material removed from the street surfaces.

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Demonstration of Non-Point Pollution Abatement through Improved Street Cleaning Practice (Pitt 1978).	Street pollutant accumulation rates, sweeping frequency, equipment performance	Sweeper, vacuum assisted sweepers	San Jose, California	Graphs to determine street sweeping frequency. 2 passes better than one except for oily areas. Median particle size in hopper larger than on street Street sweeping can reduce particle emission rates from asphalt to the atmosphere by 2/3 if done weekly compared to every 2 to 3 months.
System Analysis of Street Cleaning Techniques (Pitt *et al.* 1976)	Literature review of previous studies			Parking restrictions are needed. 50% of the particles larger than 1/4in. are removed. Fast broom rotations are better
Water Pollution Aspects of Street Surface Contaminants (Sartor and Boyd 1972)	Simulated runoff, removal effectiveness (using control areas and artificial contaminant)	Broom sweepers	Milwaukee, Baltimore, Scottsdale, Atlanta, Tulsa Phoenix, San Jose	Fine particles have a higher concentration of metals, pesticides, and organics than larger particles. Street sweeping effectiveness for removing fine particles is low. Street parking reduces the efficiency of sweepers.

Source: Literature Review for Santa Clara Non Point Source Control Program (WCC 1993)