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NAPSA
North American Power Sweeping Association

July 3, 2009

To Whom It May Concern:

Please allow me to introduce Mr. Jay Wells as the current California Chapter Chairman of the North American Power Sweeping Association (NAPSA). As Chapter Chairman Mr. Wells is tasked to monitor regulations affecting our industry and to work with state and local government agencies regarding these issues.

The power sweeping industry is often overlooked for its huge contribution to environmental protection. Street sweepers provide the first line of defense for our environment by picking up harmful particulates and polluting debris before it reaches our water ways and clean air. This industry has been "green" decades before the term became popular.

NAPSA is a nonprofit trade association made up of 300+ contract sweepers, service providers, sweeping equipment dealers, manufacturers and suppliers. NAPSA is dedicated to providing support to its members and enhancing services to the power sweeping industry. NAPSA is also committed to promoting the power sweeping industry and enlightening the public and its officials to the benefits that this industry provides to the community.

More information can be found at www.powersweeping.org.

Sincerely,

Sarah Gazi, CAE
Executive Director

15000 Commerce Parkway, Suite C, Mount Laurel, NJ 08054
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Date: July 3, 2009

To: Mr. Darrell Steinberg – State Senator
From: Jay S. Wells – Business owner, DVBE & SBE certified, NFIB member, Farm Bureau Member, Chairman of CA Chapter of The North American Power Sweeping Association.

Subject: On Road Diesel Regulations – Street Sweepers / Water Quality

Dear Mr. Darrell Steinberg,

I have owned a small commercial sweeping company here in the Sacramento area for 30 years. Over the last year and a half I have discovered some important and critical information regarding the ARB's implementation of the On-Road Diesel regulations affecting street sweepers and water quality here in California. Street sweepers play a critical remediation role in city and urban roads to remove harmful debris that would otherwise enter our streams and waterways.

On April 7th, 2009 the environmental group, American Rivers (Exhibit "A"), released its 2009 list of the nation's 10 most endangered rivers. The Sacramento-San Joaquin river system is number one on this list. This includes water pollution from cities and urban areas. President Obama recently appointed a task force to create national policy on ocean-quality issues across the country. (See Exhibit "B") The federal EPA has mandated that street sweeping programs be established under the National Pollutant Discharge Elimination System (NPDES) by the states and then down to counties and cities to address pollutant runoff. Enclosed is an Environmental Technology Verification Report (Exhibit "C") which describes the performance conditions and applicability of street sweepers. When our industry discovered that these new diesel regulations would jeopardize the mandates and remove sweepers from service or severely cut back on the sweeping frequency, we began discussions with ARB staff.

We formed a California chapter of our National Association to better inform the ARB that these new rules, if not reasonably implemented, could degrade water quality throughout the state. After almost a year in discussion and providing in-depth information such as water quality, economic feasibility, adoption and implementation of this rule, we seek your help to provide a reasonable solution for a critical issue.

As the chairman of The California Chapter of The North American Power Sweeping Association (NAPSA) and a concerned citizen of the state and business community, I hereby request your help regarding this matter. We believe we should be able to balance air quality and water quality in a more productive way than the current proposed rules developed by the ARB effecting street sweepers. I will enclose all information regarding meetings with ARB staff and information provided for their review.

I look forward to meeting with you on this matter.

Jay S. Wells, Wells Sweeping
Chairman, CA Chapter of NAPSA

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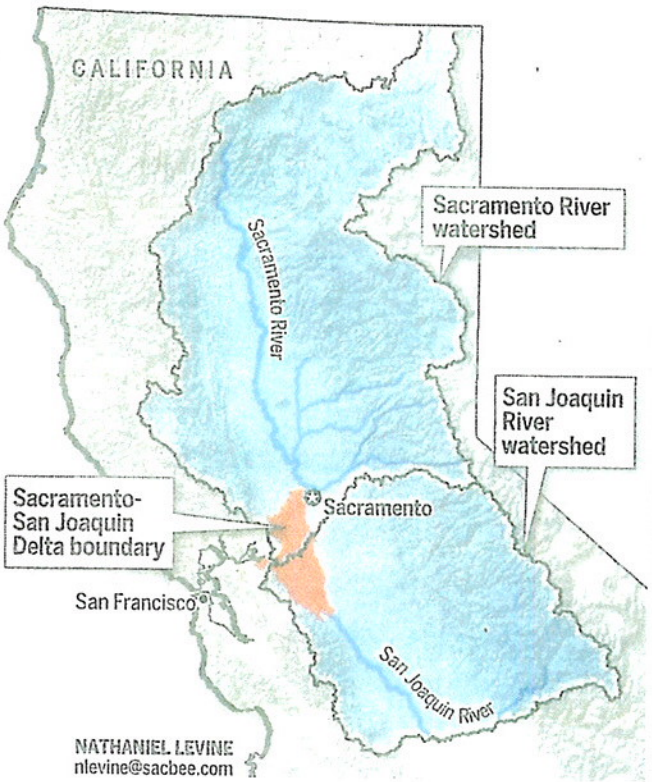
THE DELTA RIVER SYSTEM

The environmental group American Rivers today named the Sacramento and San Joaquin rivers and their Delta confluence as America's most endangered river system. The two rivers are the largest in California and drain about 40 percent of the state's land area and half its precipitation.



NATHANIEL LEVINE
nlevine@sacbee.com

ing us described as the most endangered puts a lot of additional focus on the debate, and I think that is immensely healthy. But behind all the recognition comes the tough political questions."

Rothert acknowledged the Delta presents a thornier set of problems than most waterways his group has highlighted over the past 23 years. Yet he believes the attention can help.

As examples, the group points to San Mateo Creek in Southern California, where a proposed freeway extension threatened Trestles Beach, and a dam proposed on the Mattaponi River in Virginia. Both projects were shelved thanks, in part, to attention prompted by the "endangered" status.

"We don't have a choice but to develop a workable solution," Rothert said of the Sacramento and San Joaquin waterways. "The alternative is status quo and stagnation, and in time that will certainly lead to catastrophe. We certainly can't afford that and I think people recognize that."

Call The Bee's Matt Weiser, (916) 321-1264.

Shallit: $150 raffle tickets sell steadily

Exhibit "A"

FROM PAGE B1
available at www.harlows.com or at Centro restaurant.

A 'real' McMansion

These aren't easy times for charity fundraisers.

But the one hosted by the **Ronald McDonald House of Northern California** appears to be thriving.

"We're right on target," says spokeswoman **Stacey Hodge**, who's overseeing raffle ticket sales for a $1.9 million Auburn-area "dream house."

As we reported in January when the charity campaign benefiting ill children was launched, organizers must sell at least 29,000 tickets – at $150 a pop – by May 15. The winner gets a choice: the 5,700-square-foot mansion or $1.5 million in cash. Take your pick.

If fewer tickets are sold, the winner splits the total proceeds with the charity. But Hodge says she expects to reach the 29,000-ticket goal. (For details, go to www.sacramentoraffle.com.)

The charity already has held a series of "early bird" drawings, giving away cash and other prizes. Several people have collected $1,000 and $5,000.

One man got $25,000. When organizers called to break the big news, the lucky winner was surprisingly blasé, Hodge reports. It was a very short conversation.

Turns out he was in a business meeting and distracted.

"He called back a few minutes later," she says, " 'Did you say I just won $25,000?' "

Gone with the wind?

Filmmaker **Zac Greenbaum** was back in his hometown last week to sh vo TV commercials fo **Ramirez**

Exhibit "B"

THE ORANGE COUNTY
REGISTER
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Exhibit "B"

Tuesday, June 16, 2009

Obama announces plan to protect O.C. beaches

President appoints task force to create national policy on ocean-quality issues across country.

By JAIMEE LYNN FLETCHER

The Orange County Register

HUNTINGTON BEACH – A new national policy to address beach water-quality issues and other environmental concerns could help rehabilitate and protect seven Orange County beaches that have been dubbed some of the dirtiest in the state, officials say.

President Barack Obama on Friday set up a task force to devise the first national policy for sustaining and managing oceans and conserving natural resources, according to a memorandum released by the White House.

"We are taking a more integrated and comprehensive approach to developing a national ocean policy that will guide us well into the future," Obama wrote. "This policy will incorporate ecosystem-based science and management and emphasize our public stewardship responsibilities."

The group will be headed by Nancy Sutley, chairwoman of the Council on Environmental Quality, and various high-level officials.

This is the first time the federal government has created a national policy regarding beach environmental issues; however it is not the first time an administration has looked to protect beaches.

Mark Gold, president of the nonprofit environmental group Heal the Bay, said he is cautiously positive about the plan, but hopes the federal government keeps its promise.

"I think it's a good sign," Gold said. "But obviously there were incredible recommendations that came from U.S. Ocean Commission in the Bush Administration and those got completely ignored."

Vern Goehring, president of the California Fisheries Coalition, said he is also wary of the president's plan.

"I think it's really vague," Goehring said. "I think it sounds like a nice concept but there are lots of details that need to be worked out."

Beaches across the country face an array of serious issues including pollution from urban and agricultural runoff, overfishing and climate change, which can alter the acidity of the ocean and harm marine life, Gold said.

However, Goehring said overfishing isn't a grave concern in California .

Reducing runoff

Here are several ways to reduce urban runoff and pollution.

Landscape watering
Adjust sprinklers to avoid hitting streets. Reduce water used for irrigation. Excessive watering after fertilizing can carry chemicals into gutters.

Exhibit "B"

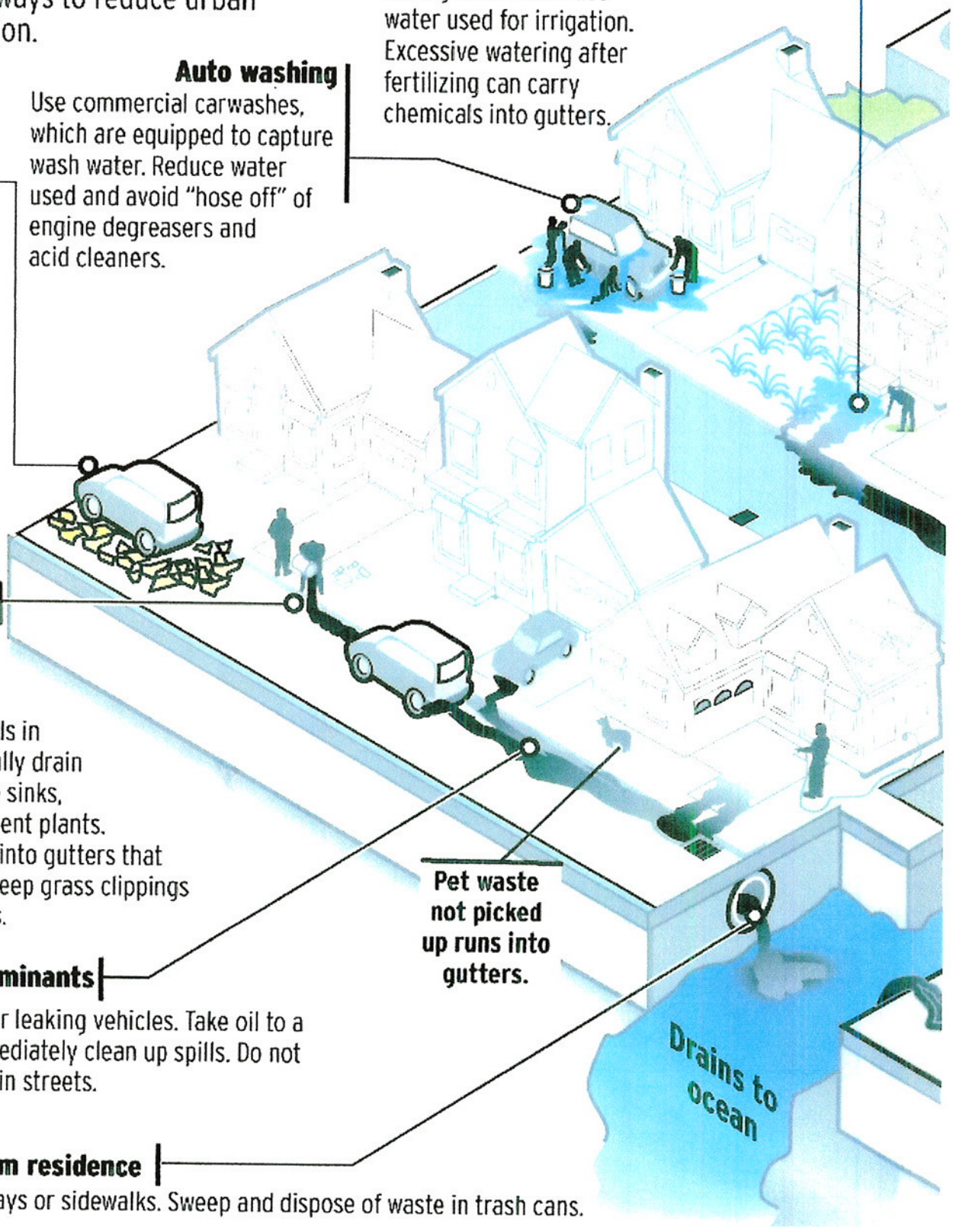
Auto washing
Use commercial carwashes, which are equipped to capture wash water. Reduce water used and avoid "hose off" of engine degreasers and acid cleaners.

Move cars out of way on street sweeping days
Allows debris to be removed on a regular basis, reducing the amount that flows into drains

Don't dump into street gutters
Don't clean paint equipment or wash cement mixers or tools in gutters, which generally drain directly to ocean. Use sinks, which drain to treatment plants. Don't dump anything into gutters that contains chemicals. Keep grass clippings from clogging gutters.

Automobile contaminants
Place a drip pan under leaking vehicles. Take oil to a recycling center. Immediately clean up spills. Do not perform auto repairs in streets.

Control runoff from residence
Don't hose off driveways or sidewalks. Sweep and dispose of waste in trash cans.



Source: Orange County Health Care Agency

The Register

Environmental Technology Verification

ETV Canada Verified

Elgin Crosswind® NX Street Sweeper

Technology Fact Sheet for Elgin Sweeper Company

Performance Claim

The Elgin Crosswind® NX Street Sweeper is a truck-mounted regenerative-air street sweeper, which was operated by a Vendor's representative at an average speed of 5 km per hour in a controlled space where no water or any other liquids were permitted. The sweeper was operated with right-hand side broom (gutter broom) and the center broom operating. In addition, neither water spray nor gutter broom shrouds were used during testing.

The final average performance indicators – at the 95% confidence interval – of the Elgin Crosswind® NX Street Sweeper are as follows:

1. Maximum concentration of PM_{10} air contamination of 0.010 ± 0.002 $mg \bullet m^{-3} \bullet kg^{-1}$;
2. Total concentration of PM_{10} air contamination of 6.12 ±0.43 $mg \bullet m^{-3} \bullet kg^{-1}$;
3. Maximum concentration of $PM_{2.5}$ air contamination of 0.008 ±0.002 $mg \bullet m^{-3} \bullet kg^{-1}$;
4. Total concentration of $PM_{2.5}$ air contamination of 4.71 ±1.93 $mg \bullet m^{-3} \bullet kg^{-1}$;
5. A removal efficiency of test material from surface of 81.8% ± 3.6%; and
6. Deposit of test material on sidewalk of 0.03% ± 0.03%.

Technology Application

Elgin's Crosswind® recirculating vacuum sweeper efficiently cleans large flat paved areas such as streets, parking lots, and airport runways. Mounted on the short-wheelbase chassis of either conventional or cab-over chassis, the Crosswind® is operated by simple rocker switches and comes with a complete set of gauges. A combination of large hopper and water tank provides the sweeper with a long work period between trips to dumping, re-watering and fueling sites.

Performance Conditions

The Elgin Crosswind® NX Street Sweeper was tested at the Prairie Agricultural Machinery Institute (PAMI) facility (Test Agent, TA) in Humboldt, Saskatchewan over three test days in October of 2008. The test facility was an enclosed tent about 80m x 11m. The test material was Camel-Wite®, manufactured by Debro Chemicals and Pharmaceuticals, a calcium carbonate-based powder with a mean diameter of about three microns. A total of 271 ± 3 kg were applied to the test track, which consisted of two strips that were 2.75 m x 30 m each. The TA conducted the testing and measurement according to the "PM_{10} and $PM_{2.5}$ Street Sweeper Efficiency Test Protocol Version 1" (City of Toronto, April 2008).

etv canada

Canada

Environmental Technology Verification

Technology Description

The Elgin Crosswind® NX applies the Vendor's patented NX filtration technology (Federal Signal Corporation) as an optional feature to a standard Elgin Crosswind® sweeper. A regenerative-air sweeper incorporates a wide, laterally-positioned pick-up head (hood) that is drawn along the pavement by the truck.

Materials from the curb areas are moved into the pick-up head's path by side broom(s) (also known as gutter broom(s)) located on one or both sides of the sweeper. Within the pick-up head, a high velocity air flow is created across its entire width to loosen, lift and accelerate particles on the pavement and pneumatically convey them to a large diameter outlet duct, which is connected to the main collection hopper. Material and air enters the Crosswind®'s main collection hopper where conveying velocities are rapidly reduced by volumetric expansion, which causes most materials to separate from the air stream. As the air is drawn out of the hopper, it passes through an inertial separator (centrifugal type) designed to further remove particles from the air stream.

The total air flow is then separated into two flows, each having a dedicated air mover. The first flow is drawn through the patented, fine particulate filtration system before entering the air mover and being exhausted to the atmosphere. The second flow is drawn to the Crosswind®'s abrasion resistant fan and is returned to the pick-up head. Within the pick-up head, the return air is distributed to areas where its velocity acts upon materials on the pavement to accelerate and direct them toward the pick-up head outlet. This distribution is through a full-width pressure slot aimed at the ground and toward the direction of travel.

The pick-up head is equipped with flexible curtains to closely follow the road surface and assist in channeling the pick-up head airflow to the outlet duct with minimal leakage. By exhausting air from the first flow noted above, the street-facing portions of the pick-up head remain at a pressure slightly lower than atmospheric while the vehicle progresses and ingests particles, debris and some atmospheric air. The pick-up head is equipped with an optional center broom, which assists the high velocity air flows in loosening and lifting particles and debris from the pavement. This broom is laterally positioned relative to the direction of travel and is located behind the full-width pressure slot. Particles removed from the air stream by the NX technology filter are directed to an airlock device, which allows the particles to be disposed of when desired. This dust can be directed into a disposal receptacle or conveyed back to the main collection hopper (optional).

Verification

The verification was conducted by ORTECH Environmental of Mississauga, Ontario as the Verification Entity using ETV Canada's General Verification Protocol (February, 2007). The verification was based on information supplied by Elgin Sweeper Company, and the performance tests conducted by the TA on the Elgin Crosswind® NX Street Sweeper in October of 2008 according to the "PM_{10} and $PM_{2.5}$ Street Sweeper Efficiency Test Protocol Version 1" (City of Toronto, April 2008).

What is the ETV Program?

The Environmental Technology Verification (ETV) Program is delivered by ETV Canada under a license agreement from Environment Canada. The ETV Program is designed to support Canada's environment industry by providing credible and independent verification of technology performance claims.

For more information on Elgin Crosswind® NX Street Sweeper, please contact:

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Printed March 2009 Expires February 2012

Environmental Technology Verification

ETV Canada Verified

Tymco DST-6 Regenerative Air Street Sweeper

Technology Fact Sheet for Tymco International LTD.

Performance Claim

The Tymco DST-6 Regenerative Air Street Sweeper was operated according to the vendor specification at a speed limit of about 5 km/h in a controlled space where no water or any other liquids were permitted. No water sprays or gutter broom shrouds were used in the testing.[1]

The sweeper was delivered in its optimum balance of dry dust-less operational mode while also maximizing the pick-up and removal of test material (mean size of test material is 3 microns).

The Tymco DST-6 Regenerative-Air sweeper achieved the following:

i) A removal efficiency of test material from surface greater than 90% (90% confidence)

ii) Deposit on sidewalk efficiency less than 0.16% (95% confidence)

iii) Maximum concentration of PM10 air contamination less than 0.08 mg/m^3-kg (95% confidence)

iv) Total concentration[2] of PM10 air contamination less than 10.0 mg/m^3-kg (95% confidence)

v) Maximum concentration of PM2.5 air contamination less than 0.02 mg/m^3-kg (95% confidence)

vi) Total concentration of PM2.5 air contamination less than 5.0 mg/m^3-kg (95% confidence)

[1] As listed in "Street Sweeper Efficiency Test Report – Tymco DST – 6 dated January 20 2006 from City of Toronto, Transportation Services, and Environmental Services.

[2] Total concentration calculated by summing the 1200 readings taken at 1 second intervals over a 20 minute period starting at about 5 minutes before the maximum reading following the sweeper's pass and divided by the kilograms of material picked up and entrained inside the hopper

Technology Application

The Regenerative Air Street Sweeper Technology is designed to thoroughly clean roads and streets while minimizing the dust released into the air. The street sweeper can have a positive environmental effect by reducing the amount of materials entering the storm sewers which may otherwise end up contaminating surface waters. Additionally, removal of particulate from streets may help reduce airborne contamination by such particulate matter.

Performance Conditions

The analysis is based on data collected over the three test days of September 27, 28 and 29, 2005. The test facility was an enclosed tent about 80 x 11 m. The test material was Camel Wite, which is a white powder with a mean diameter of about 3 microns. Approximately 270 kg were applied to the test track, which consisted of two strips that were 2.75 m x 30 m.

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Canada

Performance Conditions (cont'd)

The sweeper was operated by a manufacturer representative at about 5 km/h in the 'dry' mode (no water spray) with the right gutter broom operating. The City of Toronto staff conducted the testing and measurement according to their Street Sweeper Test Protocol.

Technology Description

The main components of the Regenerative Air Street Sweeper are the blower, pickup head, pressurized hopper, multipass cylindrical centrifugal dust separator, and air filters. The closed loop regenerative air system uses a large blower to develop airflow. The air enters a distribution manifold that runs across the pickup head, which has a discharge opening that directs a high velocity blast of air down and onto the pavement and into the cracks releasing dirt. The air and all captured dirt and debris are then drawn out of the pickup head through a hose and directed into the hopper. An operator controlled cylindrical broom rotating in the pickup head also assists in loosening material and releasing it into the air stream.

After the debris-ladened air stream is drawn into the large hopper, the air loses velocity allowing the larger debris to fall to the bottom. A screen at the top of the hopper prevents items such as leaves, paper, cans, and rocks from leaving the hopper. The air then enters the centrifugal dust separator. The centrifugal dust separator further cleans the air as it spins on the curved wall of the centrifugal chamber skimming off dust particles and returning them into the hopper. The cleaned air is returned thorough the blower to the pickup head to start the regenerative air cycle again.

A small portion of the air leaving the blower is exhausted to atmosphere so that less air enters the pickup head than is being drawn off, thus maintaining the necessary vacuum in the pickup head. Prior to being exhausted, this small portion of air is further cleaned by being first run through a bank of small cyclone pre-cleaners and then through four membrane filters.

Verification

City of Toronto's test protocol was used for testing a Tymco DST-6 street sweeper. The testing took place at Disco Yard, Toronto. The verification was completed by Prairie Agricultural Machinery Institute (PAMI), Saskatchewan, using ETV General Verification Protocol (March 2000).

What is the ETV Program?

The Environmental Technology Verification (ETV) Program is delivered by ETV Canada under a license agreement from Environment Canada. The ETV Program is designed to support Canada's environment industry by providing credible and independent verification of technology performance claims.

For more information on DST–6 Regenerative Air Street Sweeper, please contact:

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Exhibit "B"

THE ORANGE COUNTY REGISTER
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Exhibit "B"

"It's easy and cheap to throw in the concern about overfishing," he said. "There are really no reports of overfishing going on in California ."

Goehring added he is concerned if more fishing restrictions are implemented it could mean less attention paid to pollution in the ocean.

"If they presume that shutting down fishing is ecosystem-based management then, of course, I don't think it does help," he said. "We see it frequently - they increase the restrictions on fishing then move on to something else."

One of the biggest challenges Orange County beaches face is ensuring that plastics don't get into the ocean, Gold said.

"This is a very critical issue for Orange County," he said. "Not only do we see plastic-strewn shores in some of the most remote places ... but we're also seeing devastating impacts on marine life."

Heal the Bay releases weekly reports on hundreds of California beaches and once a year releases a comprehensive study.

The annual report released in May shows that 97 percent of Orange County beaches have excellent water quality during dry summer months. Orange County's cleanest beaches stretch from Seal Beach just north of San Juan Creek and from Avenida Pico to San Clemente state and city beaches.

Seven Orange County beaches failed the test, including Poche Beach in San Clemente and some smaller areas at Doheny State Beach, both of which made Heal the Bay's Beach Bummer list of the top 10 dirtiest beaches in the state.

But during the rainy season, water quality drops significantly countywide, the study shows.

Just 48 percent of Orange County's beaches received favorable marks. Last year, 58 percent of local beaches were considered to have good water quality during winter months, Heal the Bay reported.

The county also saw 18 sewage spills in 2008 totaling 668,000 gallons, many resulting in beach closures. Laguna, Doheny and Moulton Niguel Water District all closed beaches for at least four days.

Obama's task force will have three months to come up with recommendations for improving U. S. beaches and a strategy for how to implement the plan, according to the president's memorandum.

The task force is expected to work with the public and within six months produce the framework to conserve and protect the oceans.

Obama also released a proclamation naming June National Oceans Month to coincide with his push for cleaner beaches.

Contact the writer: 949-553-2932 or jfletcher@ocregister.com

EXHIBIT [B]

U.S. ENVIRONMENTAL PROTECTION AGENCY

National Pollutant Discharge Elimination System (NPDES)

Menu of BMPs Home

BMP Background

Public Education & Outreach on Stormwater Impacts

Public Involvement/ Participation

Illicit Discharge Detection & Elimination

Construction Site Stormwater Runoff Control

Post-Construction Stormwater Management in New Development & Redevelopment

Pollution Prevention/Good Housekeeping for Municipal Operations

Measurable Goals

Stormwater Home

Search BMPs All of the words

Filter by Minimum Measure All

GO Browse Fact Sheets Search Help

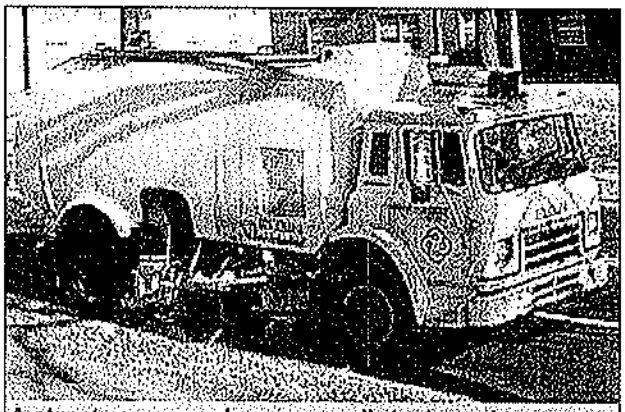
Parking Lot and Street Cleaning

Click here to comment on this fact sheet

Minimum Measure: Pollution Prevention/Good Housekeeping for Municipal Operations

Subcategory: Municipal Activities

Description



A street sweeper cleans up pollutants and sediments on the street to reduce the amount of pollutants entering receiving waters

Streets, roads, highways and parking lots accumulate significant amounts of pollutants that contribute to stormwater pollutant runoff to surface waters. Pollutants, including sediment, debris, trash, road salt, and trace metals can be minimized by street sweeping. Street sweeping can also improve the aesthetics of municipal roadways, control dust and decrease the accumulation of pollutants in catch basins. An effective municipal street sweeping program can meet regulatory requirements, assess street sweeping effectiveness, and minimize pollutants in roadways.

Street Sweepers

Municipalities can choose between the three different types of street sweepers (mechanical, regenerative air and vacuum filter) keeping in mind the targeted pollutants, pollutant type (large debris to particles less than 10 microns in diameter (PM10)), types of surfaces, travel distances, noise ordnances, and costs. Municipals often find it useful to have a compliment of each type of street sweeper in their fleet (CASQA, 2003).

Each type of street sweeper has it advantages and disadvantages concerning pollutant removal effectiveness, traveling speed, and noise generated by the street sweeper. With the different types of modern street sweepers capable of removing PM10 particles, price and personal preference are the primary selection criteria for most users (Keating, no date). No definitive independent studies have yet been staged to determine "the best" sweeping system. Anecdotal data has also been inconclusive (Keating, no date).

Applicability

Street sweeping is practiced in most urban areas, often as an aesthetic practice to remove

trash, sediment buildup, and large debris from curb gutters (RIPDES, no date). Effective street sweeping programs can remove several tons of debris a year from city streets minimizing pollutants in stormwater runoff. In colder climates, street sweeping can be used during the spring snowmelt to reduce pollutants in stormwater runoff from road salt, sand and grit.

Implementation

An effective municipal street sweeping program should address at a minimum the following components:

Street Sweeping Schedule: Designing and maintaining a street sweeping schedule can increase the efficiency of a program. A successful program will need to be flexible to accommodate climate conditions and areas of concern. Areas of concern should be based on traffic volume, land use, field observations of sediment and trash accumulation and proximity to surface waters (CASQA, 2003). Street sweeping in these areas may need to be increased and the schedule amended. It is recommended that schedules include minimum street sweeping frequencies of at least once a year. In cold climates prone to snowfall the Connecticut Department of Environmental Protection recommends that municipalities conduct street sweeping as soon as possible after the snow melts (McCarthy, 2005). Removal of the accumulated sand, grit, and debris from roads after the snow melts reduces the amount of pollutants entering surface waters.

To evaluate the effectiveness of a street sweeping program, municipalities should maintain accurate logs of the number of curb-miles swept and the amount of waste collected (CASQA, 2003). Monthly or yearly intakes (per ton) can be measured per district, road, season, or mile. This information can be used to develop a written plan, schedule, and periodic re-evaluation for street sweeping that would target the following:

- those roadways with contributing land uses (high level of imperviousness, high level of industrial activity) that would be expected to show high pollutant concentrations and
- those roadways that have consistently accumulated proportionately greater amounts of materials (pounds per mile swept) between currently scheduled sweeps (Curtis, 2002).

Gross intake amounts can be presented to regulatory agencies and to finance directors to measure performance. The City of Dana Point, California reported that when sweeping was conducted twice a month, the monthly debris intake was 23 tons. Dana Point then increased street sweeping frequency to a weekly basis and the monthly total increased to 46 tons of debris (City of Dana Point, 2003).

Street Sweepings Storage and Disposal: Street sweeping material often includes sand, salt, leaves, and debris removed from roads. Often the collected sweepings contain pollutants and must be tested prior to disposal to determine if the material is hazardous. Municipals should adhere to all federal and state regulations that apply to the disposal and reuse of sweepings.

Municipalities are encouraged to develop comprehensive management plans for the handling of sweepings. A critical aspect of a management plan is selecting a location for storing and processing street sweepings (McCarthy, 2005). Storage locations should be equipped with secondary containment and possibly overhead coverage to prevent stormwater runoff from contacting the piles of sweepings. It is also recommended to cover the piles of sweepings with tarps to prevent the generation of excessive dust. Storage locations should be sized accordingly to completely contain the volume of the disposed sweepings. To estimate the size of the storage location, estimate the volume of sweepings either on a ton-per-street mile or on pounds-per-capita basis (McCarthy, 2005). An average figure for urban areas is 20.25 tons-per street-mile (McCarthy, 2005).

Street Sweepings Reuse Practices: Although sweepings may contain pollutants, federal and state regulations may allow the reuse of sweepings for general fill, parks, road shoulders and other applications as long as the material is not a threat to surface waters.

Prior to reuse, trash, leaves, and other debris from sweepings should be removed by screening or other methods (MPCA, 1997). Trash and debris removed should be disposed of by recycling or sent to a landfill (MPCA, 1997).

Parking Policy: Established parking policies increases the effectiveness of a street sweeping program. Parking policies can be established as city ordinance and incorporate the following:

- Institute a parking policy to restrict parking in problematic areas during periods of street sweeping.
- Post permanent street sweeping signs in problematic areas; use temporary signs if installation of permanent signs is not possible.
- Develop and distribute flyers notifying residents of street sweeping schedules (CASQA, 2003).

Operation and Maintenance Program: A municipality should dedicate time for daily and weekly equipment maintenance. Regular maintenance and daily start up inspections insures that street sweepers are kept in good working condition (City of Greeley, 1998). It is vital for municipals to inventory and properly stock parts to prevent downtime and decrease productivity. Old sweepers should be replaced with new technologically-advanced sweepers, preferably modern sweepers that maximize pollutant removal (CASQA, 2003).

Limitations and Cost Considerations

Street sweeping programs are limited by costs. The largest expenditures include staffing and equipment (CASQA, 2003). The capital cost for a conventional street sweeper is between $60,000 and $120,000 with newer technologies approaching $180,000 (CASQA, 2003). Street sweepers have an average life span of 4 years yet more modern street sweepers have been reported to surpass the 4 year average, therefore programs must budget for equipment replacement. The following table shows cost estimates compared to equipment life span and operation and maintenance for two types of sweepers: mechanical and vacuum.

Table 1. Estimated costs for two types of street sweepers

Sweeper Type	Purchase Price ($)	Life (Years)	O&M Cost ($/curb mile)	Sources
Mechanical	75,000	5	30	Finley, 1996 SWRPC, 1991
Vacuum-assisted	150,000	8	15	Finley, 1996 Satterfield, 1991

Cost data for two cities in Michigan provide some guidance on the overall cost of a street cleaning program. Table 2 contains a review of the labor, equipment, and material costs for street cleaning for the year 1995 (Ferguson et al., 1997). The average cost for street cleaning was $68/curb mile and approximately 11 curb miles/day were swept.

Table 2. The cost of street cleaning for two cities in Michigan

City	Labor	Equipment	Material and Services	Total
Livonia	$23,840	$85,630	$5,210	$114,680
Plymouth Township	$18,050	$14,550	$280	$32,880

Effectiveness

Street sweeping can be an effective measure in reducing pollutants in stormwater runoff. During the year 2000, the Department of Highway Services and Bethesda Urban

Partnership in Montgomery County, Maryland swept approximately 14,373 miles of roadways and removed 2,464 tons of materials (Curtis, 2002). Decreasing the amount of pollutants in roads before they are picked up by stormwater runoff reduces pollutants in surface waters.

Using modern efficient street sweepers may reduce the need for other structural stormwater controls. Municipal stormwater managers should compare potential benefits and costs of street sweeping. Street sweeping may prove to be more cost-effective than certain structural controls, especially in more urbanized areas with greater areas of pavement (SMRC, Rhode Island).

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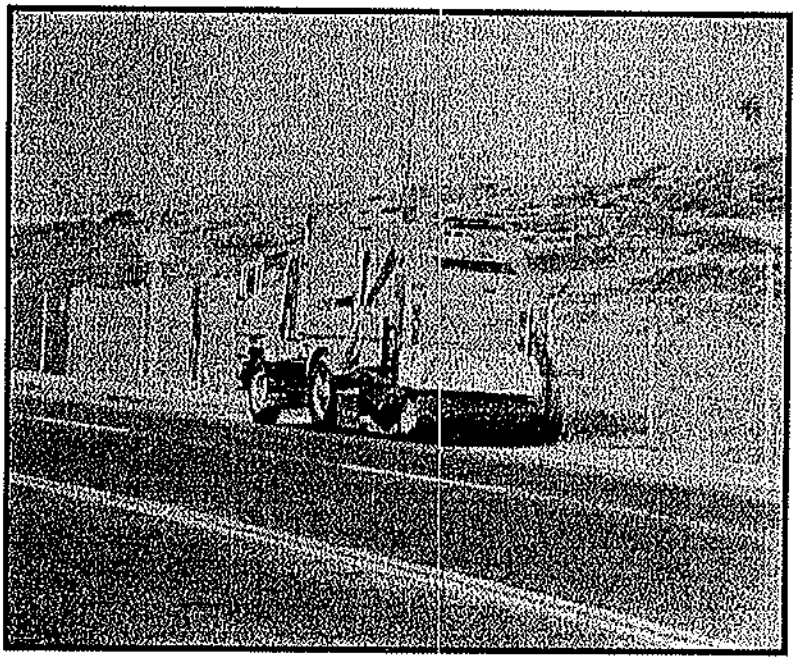
EXHIBIT [D]

Road and Street Maintenance SC-70



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Description

Streets, roads, and highways are significant sources of pollutants in stormwater discharges, and operation and maintenance (O&M) practices, if not conducted properly, can contribute to the problem. Stormwater pollution from roadway and bridge maintenance should be addressed on a site-specific basis. Use of the procedures outlined below, that address street sweeping and repair, bridge and structure maintenance, and unpaved roads will reduce pollutants in stormwater.

Approach

Pollution Prevention

- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal)
- Recycle paint and other materials whenever possible.
- Enlist the help of citizens to keep yard waste, used oil, and other wastes out of the gutter.

Suggested Protocols

Street Sweeping and Cleaning

- Maintain a consistent sweeping schedule. Provide minimum monthly sweeping of curbed streets.
- Perform street cleaning during dry weather if possible.

- Avoid wet cleaning or flushing of street, and utilize dry methods where possible.
- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc. For example:
  - Increase the sweeping frequency for streets with high pollutant loadings, especially in high traffic and industrial areas.
  - Increase the sweeping frequency just before the wet season to remove sediments accumulated during the summer.
  - Increase the sweeping frequency for streets in special problem areas such as special events, high litter or erosion zones.
- Maintain cleaning equipment in good working condition and purchase replacement equipment as needed. Old sweepers should be replaced with new technologically advanced sweepers (preferably regenerative air sweepers) that maximize pollutant removal.
- Operate sweepers at manufacturer requested optimal speed levels to increase effectiveness.
- To increase sweeping effectiveness consider the following:
  - Institute a parking policy to restrict parking in problematic areas during periods of street sweeping.
  - Post permanent street sweeping signs in problematic areas; use temporary signs if installation of permanent signs is not possible.
  - Develop and distribute flyers notifying residents of street sweeping schedules.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- If available use vacuum or regenerative air sweepers in the high sediment and trash areas (typically industrial/commercial).
- Keep accurate logs of the number of curb-miles swept and the amount of waste collected.
- Dispose of street sweeping debris and dirt at a landfill.
- Do not store swept material along the side of the street or near a storm drain inlet.
- Keep debris storage to a minimum during the wet season or make sure debris piles are contained (e.g. by berming the area) or covered (e.g. with tarps or permanent covers).

Street Repair and Maintenance

Pavement marking

- Schedule pavement marking activities for dry weather.

EXHIBIT [E]

structural and nonstructural control strategies designed to reduce metals loading in urban runoff. Structural and non-structural control strategies can be based on specific land uses, sources, or periods of a storm event, and are described in general below. Nonstructural BMPs are generally designed to control or eliminate the sources of pollutants to a watershed. Structural BMPs include source control as well as treatment control BMPs designed to remove pollutants from runoff. In order to comply with these TMDLs, emphasis should be placed on BMPs that control the sources of pollutants and on the maintenance of BMPs that remove pollutants from runoff. Some examples of BMPs that may be implemented by the dischargers to meet the WLAs are described below. These examples are general, (not specific to metals treatment and not specific to Chollas Creek), and are not meant to be exhaustive of the suitable suit of appropriate BMPs.

The City of San Diego, in its comments, suggested that large areas of private property would need to be condemned and demolished in order to build large detention basins and treatment works as a BMP option. This BMP option was not considered in the analysis because significantly cheaper and smaller BMPs are available to meet the WLAs of these TMDLs.

Nonstructural Controls

1. **Education and Outreach**: Conduct education and outreach to residents and businesses to discourage over-watering. Conduct education and outreach to residents, businesses, and municipal fleets to encourage vehicle and equipment practices that minimize the potential for contamination of stormwater runoff.

2. **Road and Street Maintenance**: Increase the frequency of street sweeping to maintain clean sidewalks, streets, and gutters. Street sweeping reduces non-point source pollution by five to 30 percent when a conventional mechanical broom and vacuum-assisted wet sweeper is used. The USEPA reported that the new vacuum assisted dry sweepers can achieve a 50 to 88 percent overall reduction in the annual sediment loading for a residential street, depending on sweeping frequency. A reduction in sediment load may lead to a reduction in metals being carried to the MS4, and ultimately to Chollas Creek, since sediment, or road dust, has been found to adsorb metals (Birch and Scollen, 2003). Researchers have found that the metals concentrations in road dust increases with traffic volume. High traffic areas should be given a priority when scheduling street sweepings.

3. **Illicit Discharges**: Identify and eliminate illicit discharges to the storm drain system.

4. **Inspections**: Conduct inspections of commercial and industrial facilities for compliance with local ordinances and permits, as well as copper, lead, and zinc load reductions required under these TMDLs. Conduct inspections of treatment control BMPs to ensure their adequacy of design and proper function.

EXHIBIT F

Power Sweepers Remove Stormwater Pollutants

Better Roads
Celebrating 75 years serving highway professionals

From the *Road Manager* section of the March 2007 issue of 'Better Roads Magazine'

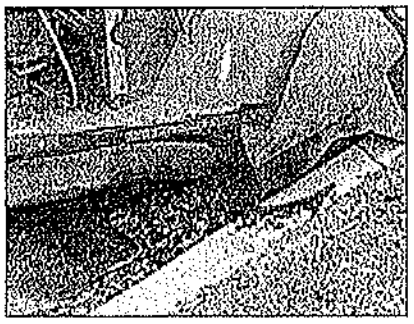
by Ranger Kidwell-Ross, editor of WorldSweeper.com

Designers of sweeping programs need to learn about the relatively inexpensive role sweeping has in removing pollutants from the runoff stream. Street cleaning has the broadest potential for reducing stormwater pollution in the urban environment. That's because half of all the rain that falls on impervious surfaces connected to urban stormwater collection systems is falling on pavement.

In the past five years, updated sweeper designs that are much more efficient at picking up accumulated contaminants have entered the market. Yet, many jurisdictions that are now imposing stormwater runoff taxes and spending high dollars in an attempt to reduce their runoff pollution have, at the same time, cut back on their sweeping efforts. The only rational reason can be that they lack knowledge about the positive, relatively cost-effective impact a well-planned environmental sweeping program now can attain.

CWA Requirements

Wherever Clean Water Act compliance is required, sweeping program designers need to learn about the role newer sweepers can have in removing pollutants from the runoff stream.



This close-up shot shows how a sweeper picks up leaves before they enter stormwater drains.

Studies confirm the real-world pickup efficiency of today's broom sweepers is probably only between 20 and 35%. Despite this fact, mechanical broom sweepers continue to be the leading type used by municipalities in the United States. As municipalities struggle to reduce non-point source pollutants and meet the Best Management Practices requirements of Phase I and II, newer technologies of regenerative air and vacuum sweeper models are clearly a better choice. These have both been

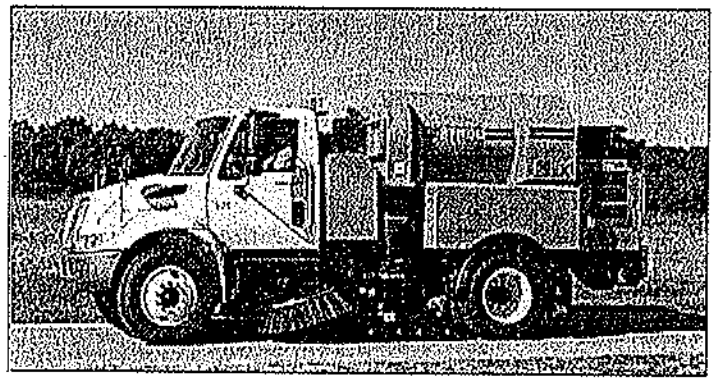
shown to raise pickup efficiencies into the 60 to 90% and above range.

A study of structural BMPs by the California Department of Transportation indicates the cost per pound of pollutant removed (as Total Suspended Solids) runs $10 to $60, not including land costs. In contrast, sweeping industry studies by well-known researcher, Roger Sutherland, of Oregon-based Pacific Water Resources, indicate that newer mechanical broom sweepers reduce TSS in stormwater at a cost of $5 to $10 per pound. Regenerative air and vacuum-assisted sweepers offer an even higher level of efficiency, removing TSS at a cost of $2 to $5 per pound.

Sutherland's company has also developed modeling software that uses historic rainfall data, which in most locales spans over 50 years, to accurately predict sweeping efficiencies for watersheds. This has aided a number of municipalities in determining relative pickup volume at given sweeping frequency intervals without having to conduct costly studies of their own.

Sutherland's Livonia, Michigan, study found the optimal frequency (during the nine months when sweeping can occur in snowbelt areas) for residential areas was about once every three weeks. Every two weeks is typically reasonable for higher-density residential and general commercial. In major traffic areas, like arterials, optimal sweeping was determined to be once per week. Optimal frequency depends, however, upon accumulation of the contaminated material typically called street dirt.

Monitoring accumulation can be of great value, as well as determining the chemical component of what is collecting on given roadways. Not only can a correctly designed sweeping program remove a significant amount of targeted chemicals; correct sweeping also has a positive impact on the gross pollutants that contribute sediment, silt, and organic debris to streams and other waterways.



A Tymco 500X gets set to remove debris that might otherwise pollute water.

Another efficiency sweeping offers is that it prolongs the operational efficiency of structural-based devices, as well as reduces the ongoing maintenance they require. Although by no means a silver bullet, widespread agreement is developing that sweeping should begin taking a more central role in stormwater runoff plans.

Charging Off Costs

Well-informed NPDES managers, aware of how cost-effective sweeping is when compared to infrastructure-based solutions, are now making an increase in air sweeping frequency a foundation of their stormwater runoff plans. The problem they're faced with is that, even in the face of the EPA mandates, their budgets are still largely based on the frequency of sweeping needed to provide a pleasing aesthetic value and, to a lesser extent, keep storm drains flowing.

Because of sweeping's now-demonstrated lower-cost-per-pound of pollutant removal, jurisdictions under Phase I or II mandates clearly should develop an optimal sweeping frequency designed to minimize the overall cost of meeting their non-point pollutant reduction goals.

Only by comparing sweeping to end-of-the-pipe solutions, like sedimentation tanks and filters, grassy swales, detention ponds, and all the other infrastructure-based solutions now emerging, can the most cost-effective mix of sweeping and other technologies be attained.

An Elgin Eagle sweeper picks up leaves along a curb.

Once an optimal, least overall cost for achieving TMDL limits (or attainment of other goals) has been established for a given watershed, the next question is figuring out how to pay for that mixture of solutions. Some cities are now including the sweeping department within the overall budget for stormwater runoff reduction. That way, if a stormwater utility fee is being collected through NPDES mandates, the cost of sweepers and sweeping can be funded as a component.

Key Points

Here are the main points to consider when trying to assess how sweeping should fit into an overall NPDES pollution reduction plan:

• Answer the question "Why are we sweeping?" Is it just for cosmetic/aesthetic reasons, or are there water quality aspects to consider? If the answer includes water quality, then collaborate with your stormwater people to examine your current program. As you redefine your budget allocations, you'll also want to put a larger value on the small-micron pickup effectiveness of the sweeper you choose. In addition, evaluate both the sweeping frequency and the conditions under which sweepers will be used.

• If your target is water quality goals, forget about sweeping areas without curb-and-gutter, since there will be no appreciable accumulation. • Review sweeping studies available, most of which are available at www.WorldSweeper.com. Use the information, especially results from geographical areas similar to the one you're in, to make future sweeper purchase decisions that maximize the potential for solving both water and air pollution problems in your particular area.

• If you truly want a sweeper that will make a difference, do not simply rely on the well-known certification process for sweepers that was designed and conducted by a California agency, the South Coast Air Quality Management District. SCAQMD's PM10 Certification is now widely used by manufacturers to tout that the machines in their product line are effective environmental sweepers. The fact is that, over time, sweeper manufacturers have been able to find a way to certify virtually all makes and models of street sweepers. Over 50 models Ñ

including almost every type and configuration of street sweeper on the market Ñ have gained certification via compliance with the brief SCAQMD test, rendering any given machine's compliance essentially meaningless.

• Probably the single biggest factor driving street sweeping effectiveness is removal of vehicles on sweeping days. This is vitally important: a single car represents three spaces that can't be swept, since the sweeper operator must swing out around a car and then can't get back to the curbline until well past each parked vehicle. Develop and print brochures on the topic, and find innovative ways to distribute the information. For example, send the information out in city billing envelopes, put them onto your Web site as .pdf files, and provide them to environmental groups for distribution.

Many cities are now using the Internet creatively in this regard. Consider developing an e-mail signup Web site location that automatically reminds citizens to move their cars prior to sweeping days. Once in place, fines from vehicle citations will create an income stream that may even pay for a major portion of the sweeping program.

• Also consider contracting out sweeping services, which can often provide significant cost and service advantages. In England, statutes require that cities bid in-house sweeping against contractors every few years. This tends to keep municipal operations more efficient. Some larger U.K. municipalities even bid on providing sweeping to smaller cities nearby.

• Some innovative U.S. sweeper dealers are now offering cradle-to-grave sweeper purchases, another standard practice in Europe. With these arrangements, the cost is actually a monthly payment that includes all standard repair items and upkeep for the pre-agreed life of the sweeper and chassis, usually five years. This type of arrangement provides municipalities with the advantage of a predictable, steady budget item.

• Another way to potentially save money when using a contractor is to issue computerized fuel cards for the municipal contract. When the city pays the tab for fuel, fuel excise taxes are refundable.

• Remove disposal costs from your sweeping bids. Because future cost increases in this area are an unknown, experienced sweeping contractors typically realize they must overbid to account for unforeseen tipping fee increases that may not ever occur. Plus, when the contractor pays for disposal, there is actually a disincentive to doing a great job; the more material that is removed from the roadway, the less money the contractor makes.

• Be sure to test sweepers according to your particular requirements. If leaves are your biggest problem, then finalize your sweeper purchase in the fall when you can compare the current sweeper models on their ability to pick them up. If snow (i.e., sand and cinders cleanup) is the central issue, then test under those conditions. I've seen cities in all parts of the country test sweepers by putting an impossible amount of material down in some municipal parking area and then eyeballing which sweeper appears to leave behind the smallest pile. This methodology is especially senseless when choosing a sweeper for environmental reasons.

• If you're in the snowbelt, investigate the new crop of waterless sweepers designed to let you sweep all year.

• A number of sweeper models can also be operated on compressed natural gas or other diesel alternatives. However, since by 2010 the emissions of diesel engines will be cleaner than the current CNG engines, most CNG conversion companies have already exited the marketplace. Further, CNG appears to only be widely accepted in Southern California where it's mandated. Paradoxically, the mandate has actually eliminated the ability to sell some high-efficiency sweeper models since they are unable to use the limited number of CNG options available.

• Is most of the material within 3 feet of the curbline? One of the current models of vacuum sweepers offers a side-shift sweeping head that allows it to employ suction right up next to the curb.

• Need to find ways to get more bang for your buck? You may be able to work creatively with sweeping contractors in other ways than hiring them to sweep. These may include sweeper repair and assistance with sweeper selection.

• Establishing a debris-screening and/or composting program can save over 50% on disposal costs. If one of your local sweeping contractors operates a debris-screening program, the company may have enough capacity to add city debris to its existing operation.

• If your city is small, investigate sharing a sweeper and its usage with one or more neighboring districts. Some smaller California cities have found value in combining budgets to fund a stormwater-runoff compliance official in charge of keeping up with the information needed to assure each of the cities stays compliant.

• Some cities have found other ways for their sweepers to pull double duty. The City of Palmdale, California uses a video camera system that's mounted on the dash of its sweepers. Drivers are trained to look for problem areas and the system makes it easy to create a report flag on the video. Since the sweeper is traversing most areas of a city, it can be an inexpensive way to spot graffiti, signs down, lights out, curbs needing repair, overhanging trees, pothole problems, and so on. The system also documents exactly when sweeping occurred at any particular location.

• Both sweeping personnel and citizens need to be educated about the latest in industry findings. Educate your sweeping managers, as well as rank-and-file sweeper operators, about why a different sweeping frequency, type of sweeper, or switching to air-based technology now makes more sense. Doing so can even have positive implications for how well any new sweepers will be operated and maintained.

• Another way to reduce overall sweeping costs is to switch to one of the variety of high-dumping sweepers that are now available. These are designed to dump into dump trucks or roll-off containers, instead of using the sweeper for transport to a disposal facility. This keeps the relatively more expensive sweeper on the job, as well as keeps small-micron material from escaping due to double handling.

• In order to make your sweeping program more efficient, upgrade part of your road system, especially in runoff non-attainment areas. Steep curb cuts and potholes degrade performance of all types of sweepers, but more so regenerative air and, to some extent, vacuum sweepers.

EPA Phase I permits now need to prove they are achieving BMP results, and Phase II permits

will soon need to do the same. Before you spend significant dollars on retro-fitting and other relatively expensive infrastructure-based projects, learn how sweeping your streets with today's new technology is able to address runoff pollution on the order of 100 to 1,000% more cost-effectively.

Street Contents

Street/Best Practices Contents

Site Map / Table of Contents

EXHIBIT B

AN ANALYSIS OF POLLUTION RESULTING FROM POWER SWEEPER ENGINE EMISSIONS AS COMPARED TO SMALL-MICRON PARTICLE REDUCTION DURING OPERATION

prepared for

CALIFORNIA AIR RESOURCES BOARD

submitted March 27, 2008

Executive Summary and Author Overview:
The following information is being submitted to the Califomia Air Resources Board in order to further the Agency's understanding of the link between street sweeping and removal of pavement-based, small-micron particulates from fugitive air entrainment and the storm water runoff stream. Further, it discusses typical scenarios that occur in terms of reductions in sweeper usage with an increase in cost of sweeping per mile and/or per hour.

Author is Ranger Kidwell-Ross, editor of WorldSweeper.com. Since 1988, Kidwell-Ross has been the world's most published author of articles and information about power sweeping. He has interviewed and consulted with a variety of government organizations, and others, on the topic of Best Management Practices in regard to power sweeping, throughout Asia, Europe and Australia, as well as in his native United States.

Overview and Analysis:
The role that modern day street sweepers play in removal of small-micron (PM-10 and smaller) particles, in addition to gross amounts of 'street dirt,' is little recognized. In speaking to groups of public works directors and others at national tradeshows and conventions, I routinely ask if they saw dirt in the curb line of the host city while they've been there. The answer is, invariably, "Yes."

However, when I then inquire if they've seen any dirt roads during their visit, or other 'dirt areas' where the dirt on the roads might have originated, they indicate they have not. And, many go on to admit they haven't previously made a connection in that regard.

The point is that even public works professionals typically fail to recognize that street debris is no longer 'dirt' in the traditional, farming-type sense in which the word has long been used. Rather, it is increasingly composed of a wide variety of

pollutants, from hydrocarbons to heavy metals and more. And, because relatively few national studies have targeted this area, the linkage between street dirt removal and fugitive dust and storm water runoff pollution is also little recognized.

In 2006, WorldSweeper.com sponsored two seminars for storm water runoff professionals in California. With almost complete unanimity, the 100+ participants were very familiar with the monies being collected via storm water runoff fees based on impervious surface area, as well as knew in a general sense how the monies were being spent for pollution reduction in their jurisdiction.

Yet, when asked essentially the same question about sweeping frequency, the typical agency manager attendee responded that sweeping frequency was whatever their current, often-shrinking, budget would allow. Astonishingly, little-to-zero linkage existed for them between air and water pollution, street sweeping frequency and relative efficiencies of sweeper types.
After attending the seminar and learning the facts, the average attendee expressed an opinion that their jurisdiction would benefit environmentally by sweeping from twice to four times more often.

In today's environmental climate, not recognizing the positive value street sweeping provides to the reduction in fugitive dust and storm water runoff pollution is an enormous oversight. The practice is also a bargain, as compared to other pollution reduction methods available.

The California Department of Transportation (Caltrans) recently completed an assessment of the cost of pollutant removal from urban highway runoff using structural BMPs. Using the CalTrans data, noted Seattle area stormwater consultant, Gary Minton, of Seattle-based Resource Planning Associates, concluded that the average cost of removing one pound of total suspended solids (TSS) from the runoff stream ranged from $10 to $60, depending on the device (and not including any land costs associated with the treatment method).

In contrast, several detailed studies by arguably the leading power sweeping researcher in the United States, Roger Sutherland, of Oregon-based Pacific Water Resources, Inc. (www.pacificwr.com) indicate that mechanical broom sweepers remove TSS from stormwater at a cost of $5 and $10 per pound.

Regenerative air and vacuum-assisted sweepers offer an even higher level of efficiency, removing TSS at a cost of $2 to $5 per pound of pollutant that would otherwise be transported in runoff. These figures show clearly that when considering storm water runoff pollutants, power sweeping is an absolute bargain.

However, I am aware that my reading audience, in this instance, is the California *Air* Resources Board. Therefore, since a similar lack of knowledge may currently

prevail, let's explore the linkage between power sweeping and the reduction of fugitive dust emissions, especially as compared to emissions from Tier Zero engines.

Most would agree that removal of particles sized 10-microns in diameter and under, commonly termed PM-10s, are central to the fugitive dust issue. The Clean Air Act addresses removal of particles of size PM-2.5. A central question is, what is the ability of street sweepers to pick up such small particles, when they are actually constructed so as to maximize the removal of larger, gross debris?

Unfortunately, since the marketplace has, to date, been unwilling to pay a premium for sweepers designed to do both, there is no question that street sweepers, both mechanical broom and air-based, are not as good at small-micron pickup as available technology might allow. However, because of the sheer volume of material that sweepers remove during operation, the results they achieve are still far from insignificant.

When it comes to comparing the small-micron efficiency of air sweepers (which employ a vacuum component) and mechanical broom sweepers (which have little or no air component), the relative efficiencies are generally illustrated by the CalTrans comparative example, above. The small-micron removal of air sweepers is estimated to be as much as a factor of 10 times better than that of mechanical broom sweepers.

However, the question is: what does that mean in the context of the current ARB regulations that would, in essence, retire much of California's current sweeper fleet because of the engines they use to operate?

To show why it seems clear that continued use of current street sweepers should be grandfathered in by CARB, let me provide an illustration of the expected PM-10 removal efficiencies of the street sweepers with the worst pickup efficiencies, mechanical broom sweepers, as compared to their estimated output of pollutants while operating.

In collaboration with Roger Sutherland, we estimate that the pickup and containment of PM-10 material even by relatively inefficient broom sweepers, depending upon native soil type and other factors, might approach 2% and 4% of total material removed. However, use of even a more conservative 1% will underscore the value of continued operation of current sweepers. For purposes of this analysis, the assumption will be that only 1% of the material picked up by a typical mechanical broom sweeper is sized at 10-microns or less.

To aid in developing this analysis, I requested that a California street sweeping contractor provide me with the company's total sweeper hourmeter hours, fuel usage (in gallons), and total pounds of debris collected/disposed of for the year

2007. It is assumed that the following will be roughly replicable using data from other contractors or municipalities in the region.

In rounded figures, the contractor used a total of 36,000 gallons of diesel (or 255,600 lbs. at 7.1 lbs./gallon) to collect 1.6 million pounds (amount delivered to landfill) of street debris. Combined hourmeter results of all sweepers used showed that approximately 12,000 hours of sweeper operation were needed in order to pick up this volume.

The average total brake horsepower of the sweeper engine(s) is considered to be about 200, a value that appears to err on the high side. The multiplication of 12,000 (hours) times 200 horsepower results in a total of 2,400,000 brake horsepower hours used to pick up all debris cited above.

Note: There is little difference in total brake horsepower whether the sweeper is a single-engine or a dual-engine machine. In the former case, the relatively larger chassis engine's output will approach 200-brake hp, since it is operating both the sweeper and the chassis portion of the machine. In the case of a dual-engine sweeper, the chassis engine is operating at a low rpm to propel the sweeper at or near 5 mph, while the engine used to operate the sweeper, approximately 80 to 100 hp in size, will be operating at an average of about half capacity.

Although I could not locate emissions' figures for the Tier Zero engine model used by the sweepers the contractor operates, an Internet search showed output for a (much larger) diesel locomotive engine to be .6 grams of pollution emissions output per brake horsepower per hour of operation. Multiplying .6 times 2,400,000 results in a total of 1,440,000 grams of pollutants, or approximately 3,214 lbs of total pollutants being emitted as a result of operating all the street sweepers in the company's fleet. Because low sulfur fuel is being used, emissions are reduced by approximately 10%, resulting in a total emissions output from the engine(s) for the year of just under 3,000 lbs.

So, even utilizing worst-case assumptions:
- Only 1% of total picked up by the sweepers to be PM-10 material or smaller,
- A higher horsepower output during operation than is probably occurring, and
- Average emissions' figures for what is probably a 'dirtier' engine,

an objective analysis shows that the sweepers in use by this particular contractor will have picked up approximately 16,000 lbs of small-micron material while emitting less than 3,000 lbs. of small-material as engine exhaust.

Although this analysis is of just a single contractor, there is no apparent reason why similar results would not be obtained when using figures supplied by other contractors and/or municipal sweeping agencies.

These particular results show that operation of current sweepers with Tier Zero engines will result in a net reduction of pavement-based material available to

become fugitive dust in excess of 500%. For that reason it seems apparent that power sweepers should be provided with a 'grandfather status' that allows them to continue operating at current levels.

In addition to the information quantified above, any removal of sweepers will be subject to a basic economic concept called 'elasticity of demand.' In short, this is a calculation of how the number of units of anything purchased changes due to increases/decreases with changes in the price of the item. If something has an inelastic demand curve, it means the same number of units would be purchased at any price.

By far more 'real world' is that demand changes significantly with price, increasing with a lower cost and decreasing with a higher cost. Although we might quibble about the amount of change that would occur in this instance, most or all would agree that the demand for sweeping services, given budgetary and other constraints, is far from inelastic. (For more information on the concept of elasticity, go to: http://www.netmba.com/econ/micro/demand/elasticity/price/).

Common sense dictates that, for any increase in the price per hour of operating a sweeper, the number of hours of sweeping that will be purchased will drop by some commensurate amount. The cost of new, street-class sweepers today approaches $200,000 per machine. If California cities and contractors are forced to upgrade their fleets, especially with short notice, the amortized cost per hour to operate sweepers will rise significantly, affecting all users.

Additional costs would also be borne through re-training of mechanics, an inability to service some newer technology components in-house, higher cost of parts where an aftermarket infrastructure has not been established, etc.

Since demand for sweeping is not inelastic by any means, the net result will be fewer sweepers re-purchased. Then, each of those will be used, on average, for fewer hours each (given their new, higher equilibrium price per hour). It is clear that this scenario *will not* provide the overall improvement in air quality being sought by CARB and the State of California.

The above is only an outline of the dilemma facing CARB in regard to its proposed inclusion of sweepers when outlawing use of previous technology engines. Because most individuals outside of the sweeping industry do not understand the net environmental value of sweeping, I am submitting this analysis in an attempt to further CARB management's understanding of the most likely outcome of legislating the removal of current sweepers from use.

Each sweeper retired from the state's fleet because they cannot meet one or more of the various CARB regulations—even those with the dirtiest, Tier Zero engines—actually increases the very particulate matter CARB is striving to reduce.

It seems clear that exempting power sweepers as a class, and thus allowing normal fleet turnover that will result in newer, cleaner vehicles over the next few years, will better serve to optimize the number of sweepers available. At the same time, the net ability of power sweepers to assist the State of California in meeting its clean water and clean air mandates will be maximized.

Given the intent to improve the air quality of California, it seems clear that power sweepers should be classified as exempt from any regulations mandating removal of current machines now in widespread usage. Analysis clearly appears to show that doing otherwise can only increase the pressure on CARB to make up the difference in other ways.

Please feel free to contact my office with your comments, or for further information, explanation, or analysis regarding this white paper.

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