MEMO

To: **On-road Fleets Subcommittee**
From: **Madeleine Weil, Environment Northeast**
Date: **November 10, 2005**
Re: **Waste Collection Vehicle Options Memo**

Purpose

This memo outlines potential policy options for cleaning up waste collection vehicles in Connecticut. Feedback from the group regarding policy mechanisms, estimated costs and benefits, and implementation avenues is welcome as it will help improve assessment.

Background

Waste collection vehicles have been targeted for priority clean-up efforts by other jurisdictions engaged in comprehensive diesel emission reduction programs.

These jurisdictions have prioritized waste collection vehicles because they:

- Travel at low speeds and idle frequently in neighborhoods and commercial centers where people are directly exposed to exhaust;
- Operate in significant numbers in urban areas where reductions in diesel emissions should be prioritized; and
- Are likely to be publicly-owned, or privately-owned but publicly-contracted**.**

Clean Up Option Summaries

- California model – BACT mandate applies to all public and private waste collection fleets (est. 12,000 vehicles). Costs will be passed on to customers (estimated $1 per household per year). Mandate phased in through 2010;
- NJ model – BART mandate applies to all publicly-owned or publicly-contracted fleets (state, county, municipal, est. 2180 vehicles). Costs will be reimbursed by state "Diesel Risk Mitigation Fund;"
- NYC model – ULSD and BACT is required in the fulfillment of solid waste contracts or recyclable materials contracts with a city agency (est. 2,500 vehicles). Costs will be built into City contracts, contractors must comply by March 1, 2006. Publicly-owned diesel vehicles (including solid waste vehicles) must phase-in BACT between 2007 and 2012;

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CT's Waste Collection Fleet

- For this options memo, it has been estimated that 1200 waste collection vehicles operate in Connecticut. This estimate is based on the DEP's observation that the California vehicle population can be used as a proxy, (the CT vehicle population is typically 1/10th the size of CA).[1]
- It is recommended that a complete inventory of waste collection vehicles in Connecticut be developed. This would include:
  - number of waste collection vehicles
  - engine vintage;
  - engine manufacturer;
  - ownership, (public/private);
  - location of fleet.

Priority Communities

Some communities in Connecticut are more at risk than others from elevated levels of PM2.5. These communities should be prioritized for expedited emission reductions if resources do not permit immediate statewide implementation.

[1] Paul Farrell, DEP, 9/8/05

Option 1 – High PM Reductions: "Best-Available Control Technology" requirement, maximizes emission reductions on ALL waste collection vehicles by 2010 (based on CARB's Waste Collection Vehicle Regulation), see *www.arb.ca.gov/msprog/SWCV/SWCV.htm*.

Application:

- The requirement would apply to owners of waste collection vehicles.
    - An "owner" can be a private company operating independently or under contract, or a city, state or federal agency;
    - "Waste collection vehicles" are diesel-fueled trucks over 14,000 pounds used to collect residential or commercial solid waste or recyclable materials;

Compliance:

- How would owners comply with the BACT requirement?
    - Purchasing an engine certified to the 2007 model year PM standard of 0.01 g/bhp-hr
    - Installing an EPA/CARB-verified retrofit device that reduces PM by the greatest amount possible for the particular engine and application (see BACT levels below):
        - The right BACT retrofit device depends on if:
            - The device is certified for the engine;
            - The duty cycle of the vehicle matches requirements;
            - The engine warranty can not be voided by using the device.
        - Engines too old to be retrofitted need to be repowered so that an emission control device can be installed;
    - Using an alternative fuel engine, alone or in combination with one of the options above, that reduces PM at least as much as a BACT retrofit device.

What would qualify as a BACT retrofit device:

- "BACT" is a technology or clean fuel verified by the EPA or CARB to reduce particulate matter (PM). To qualify as "BACT," a fuel or technology must reduce the engine's PM to the highest level possible. There are three levels of CARB-verified diesel emission control strategies:
    - **Level 1** reduces PM at least 25%
    - **Level 2** reduces PM at least 50%
    - **Level 3** reduces PM at least 85% or reduces PM emissions to at least 0.01 g/bhp-hr

Costs:

- Assume owners are most likely to retrofit 1991-2006 engines with a passive DPF or a DOC.
    - A DPF would cost approximately $5,000 - $8,000 (including installation and backpressure monitor);
    - A DOC would cost $3,000 - $4,000 (including installation, no backpressure monitor necessary).
- Older engines may need to be repowered before they can be retrofitted with a DPF or a DOC.
    - The average cost of a repower is $45,000, with a range of $21,000 - $90,000. Total average cost, with a filter installation, would be about $50,000.
    - Alternatively, older engines can be replaced with new 2007-compliant diesel vehicles or alternative fuel vehicles.

How would costs be covered:

- Since waste collection is a fee-based activity, CARB expects vehicle owners to raise fees to pay for the costs of compliance. CARB expects municipalities and service providers to work together to amend or renegotiate contracts as needed so that service fees reflect the service providers costs for compliance.
- CARB estimates that total costs of compliance will average out to about $1 per household, statewide.

Timeframe:

- Implementation requirements are phased in through 2010, based on engine model year, see schedule to the right, (http://www.arb.ca.gov/diesel/factsheets/trashtruck.pdf);
- Compliance extensions are given for early implementation, and for engines that have no verified control strategies.

IMPLEMENTATION BY ENGINE MODEL YEARS

Group 1 **	1988 - 2002	DEADLINE
	10 % BACT	December 31, 2004
	25 % BACT	December 31, 2005
	50 % BACT	December 31, 2006
	100 % BACT	December 31, 2007
Group 2a *	1960 -87	(Fleets of 15 or more vehicles)
	15 % BACT	December 31, 2005
	40 % BACT	December 31, 2006
	60 % BACT	December 31, 2007
	80 % BACT	December 31, 2008
	100 % BACT	December 31, 2009
Group 2b **	1960 - 87	(Fleets of 14 or fewer vehicles)
	25 % BACT	December 31, 2007
	50 % BACT	December 31, 2008
	75 % BACT	December 31, 2009
	100 % BACT	December 31, 2010
Group 3 **	2003 - 06	(includes dual & bi-fuel engines)
	50 % BACT	December 31, 2009
	100 % BACT	December 31, 2010

* GROUP 2a: level 1 technology may not be used as BACT

** Owners with total fleets of 1-3 vehicles may delay compliance until the final deadline for each group.

Enforcement:

- CARB will enforce the regulation through roadside inspections and visits to maintenance yards or terminals;
- Civil penalties will be assessed for non-compliance, and may range from $500 per day to $25,000 per day, depending on the violation.

Estimated Costs and Benefits in Connecticut:

Adopting a similar program in Connecticut would require BACT for an estimated 1200 waste haulers (the entire estimated population).

- Costs:
  - Assuming the highest level of BACT (a passive diesel particulate filter) is feasible for every truck, total estimated capital costs equal:
    - 1200 trucks * $7,500[2] = $9 million
  - Assuming that retrofits are phased in over four years between 2007, and 2010, the operating cost of cleaning filters equals:
    - 2008: 300 filters * $500[3] = $150,000
    - 2009: 600 filters * $500 = $300,000
    - 2010: 900 filters * $500 = $450,000
    - 2011: 1200 filters * $500 = $600,000
  - Cost Caveats:
    - For some engines, particularly pre-2002 Mack engines, the BACT will be a wire mesh filter (or high-performance DOC) rather than a DPF. These installations are much cheaper, (estimated $3,000 versus $7,500) and they do not require annual filter cleanings.

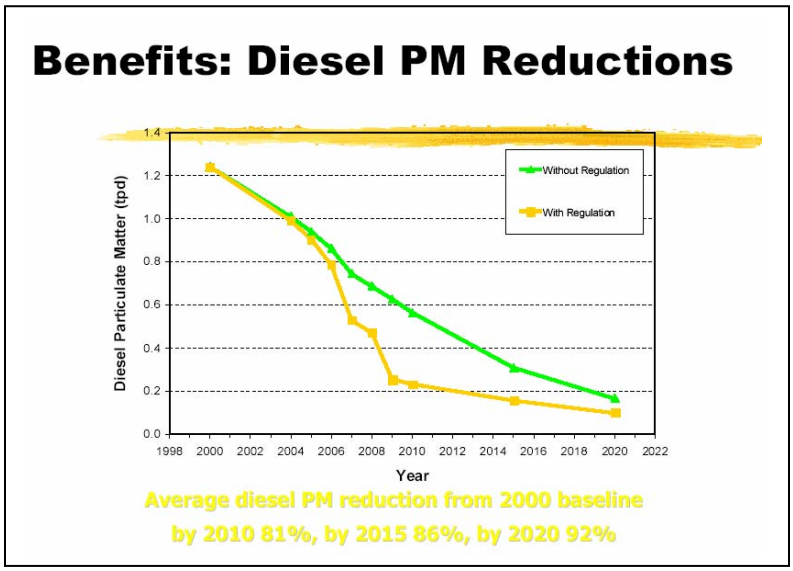
[2] Cost of diesel particulate filter, installation, and backpressure monitor used in calculations by the Transit Bus subcommittee, based on CT Transit experience.

[3] Cost of annual filter cleaning used in calculations by the Transit Bus subcommittee, based on CT Transit experience.

- Under this option, owners would be required to repower waste collection trucks older than 1991 (average cost $50,000 per truck) or replace engines with new 2007-compliant models. It is not known how many older, pre-1991 trucks operate in Connecticut.

- Benefits:
  - Connecticut benefits pro-rated from CARB's benefit assessment (see chart below):

Benefits of CARB Waste Collection Vehicle Regulation



Connecticut waste collection emissions (tons per day)

	2010	2015
Without regulation	0.058	0.03
With regulation	0.022	0.016

- Estimated annual benefits of regulation in 2010: 13.14 tons PM reduced
- Estimate cumulative benefits of regulation: 100 tons PM reduced

California Contact:

- Richard Varenchik, California Air Resources Board, 626-575-6730

California Progress To Date:

The California Air Resources Board is currently preparing a progress report on implementation by Group 1 fleets subject to the December 31, 2004 deadline (see implementation chart on previous page). So far, they have received reports covering 8400 Group 1 vehicles. 3040 of these vehicles have been brought into compliance by the following means:

- 194 LNG (liquefied natural gas) vehicles
- 552 CNG (compressed natural gas) vehicles
- 1619 DOC (diesel oxidation catalyst) retrofits
- 676 DPF (diesel particulate filter) retrofits

Staff Reports on Implementation - (Richard Varenchik)

- When the rule came into effect in early 2004, a DOC qualified as BACT for many sanitation trucks because few DPFs had been verified at that time. Fleet owners rushed to retrofit with

DOCs to avoid more costly DPFs. Now, DOCs would no longer be considered BACT for a large majority of sanitation trucks;

- The early compliance rule allows fleet owners to delay 100% implementation by two years (from 2007 to 2009) if they bring 50% of their fleet into compliance by July 2005. Several of the large fleet owners took this route by retrofitting 50% of their fleet with DOCs early in 2004 (before a variety of DPFs were verified);
- To staff's knowledge, no truck has been brought into compliance through a repower plus a retrofit. Instead, fleet owners are choosing to retire old trucks, or shift them to back-up duty. Trucks that are going to be retired in less than one year and back-up trucks are exempt under CARB's rule;
- Advice from Varenchik: Classifying the sanitation fleet into groups with separate implementation phase-in periods has made this rule difficult to administer. He recommends avoiding the group classifications by applying a standard phase-in schedule fleet-wide.

Option 2 – Medium PM Reductions: "Best-Available Retrofit Technology" requirement, maximizes emission reductions on waste collection vehicles that are publicly-owned or privately-owned but used in public contracts by 2010 (based on New Jersey's Waste Collection Vehicle Regulation), see *www.arb.ca.gov/msprog/SWCV/SWCV.htm*.

Application:
- The requirement would apply to any diesel solid waste vehicle registered in the State that is:
    - Owned by the State or any political subdivision thereof, or a county or municipality or any political subdivision thereof;
    - Owned by a person who has entered into a contract with the State or any political subdivision thereof, or a county or municipality or any political subdivision thereof, to provide solid waste services;

Compliance:
- Fleet owners would submit a "fleet retrofit plan" to the DEP that documents a BART determination for every regulated solid waste vehicle.
    - BART devices must be EPA/CARB verified, and reduce the engine's PM emissions by the highest feasible level (just like the CARB regulation above);
    - If BART is not feasible for a particular engine, an owner may negotiate an enforceable commitment to retire and replace the engine with a 2007-compliant vehicle, or an older vehicle with BART installed.
- More than one owner or a group of owners may submit a "combined-fleet retrofit plan."
- Any owner or group of owners of 75 or more regulate vehicles may submit to DEP a "fleet-averaging plan," as long as the net percentage reductions at least equal to the net reductions that would have been achieved through a fleet retrofit plan or a combined fleet retrofit plan.
- The DEP would be required to review, and approve or disapprove of fleet retrofit plans, and make determinations to fleet owners.

Costs and how they would be covered:
- Retrofit costs per vehicle are assumed to be the same as in California. However, New Jersey has explicitly said that no owner shall be required to repower or replace engines;
- Before retrofits installations are required, the NJ State Treasury must certify that money has been developed in the Diesel Risk Mitigation Fund and the DEP must certify that the money is sufficient to cover costs of the approved fleet retrofit plan;
- In New Jersey, the Diesel Risk Mitigation Fund is capitalized by a reallocation of a portion of the Corporate Business Tax currently dedicated to hazardous substance discharge remediation and underground storage tank upgrades.

Timeframe and Reporting:
- The legislation adopted this year in New Jersey gives the NJ DEP 270 days to adopt rules and regulations necessary for implementation;
- After these rules and regulations are adopted, owners of waste collection vehicles must submit an inventory and fleet retrofit plan to NJ DEP within 180 days;
- Each year, owners must submit a progress report and modifications to the fleet retrofit plan every year by the anniversary of the original submission.

Estimated Costs and Benefits in Connecticut:
Adopting a similar program in Connecticut would require BACT for an estimated 880 waste haulers (public and publicly-contracted vehicles, estimated number of vehicles pro-rated from New Jersey based on population).

- Costs:
  - Assuming the highest level of BACT (a passive diesel particulate filter) is feasible for every truck, total estimated capital costs equal:
    - 880 trucks * $7,500[4] = $6.6 million
  - Assuming that retrofits are phased in over four years between 2007 and 2010, the operating cost of cleaning filters equals:
    - 2008: 220 filters * $500[5] = $110,000
    - 2009: 440 filters * $500 = $220,000
    - 2010: 660 filters * $500 = $330,000
    - 2011: 880 filters * $500 = $440,000
  - Cost Caveats:
    - For some engines, particularly pre-2002 Mack engines, the BACT will be a wire mesh filter (or high-performance DOC) rather than a DPF. These installations are much cheaper, (estimated $3,000 versus $7,500) and they do not require annual filter cleanings.
    - Under this option, owners would not be required to repower, rebuild or replace engines, so no additional costs are expected for pre-1991 engines.
- Benefits:
  - Pro-rated from New Jersey DEP's benefit assessment (estimated annual benefit of 14 tons PM);
    - Estimated annual benefit of regulation in 2010: 5.6 tons PM reduced;
    - Estimate cumulative benefits of regulation: 42.9 tons PM reduced.

[4] Cost of diesel particulate filter, installation, and backpressure monitor used in calculations by the Transit Bus subcommittee, based on CT Transit experience.

[5] Cost of annual filter cleaning used in calculations by the Transit Bus subcommittee, based on CT Transit experience.

Option 3 – Lower PM Reductions: "Best-Available Retrofit Technology" requirement, maximizes emission reductions on waste collection vehicles that are owned by the state or used in state contracts by 2010 (based on New York City's waste collection vehicle policy, Local Laws 39 and 40), see:
http://www.nyccouncil.info/pdf_files/bills/law05039.pdf
http://www.nyccouncil.info/pdf_files/bills/law05040.pdf

Application:

- Would require the use of ultra-low sulfur diesel and best available retrofit technology in the fulfillment of solid waste contracts and recyclable materials contracts with any state agency;
    - State agency includes any subdivision of government for which expenses are paid in whole or in part from the state treasury;
- Would apply to contracts entered into or renewed after the policy becomes effective;
- Would require the use of ultra-low sulfur diesel and best available retrofit technology on all publicly-owned waste collection diesel vehicles.

Compliance:

- Any solid waste contract or recyclable materials contract let by any state agency would specify that all diesel fuel-powered vehicles used in the performance of the contract should utilize ULSD and BART – requirements would be noted in bid specification;
- Contractors would fulfill requirements by:
    - Utilizing vehicles with 2007-compliant engine models;
    - Installing BART, an EPA/CARB-verified emission control device that reduces the engine's PM emissions by the highest feasible level;
    - Using an alternative fuel engine, alone or in combination with one of the options above, that reduces PM at least as much as a BART retrofit device.
- No contractor would be required to replace BART for three years after the first installation;
- All contracts must permit independent monitoring of the contractor's compliance;

Reporting and Enforcement:

- Contractors must submit waste collection fleet retrofit reports to contracting agency and DEP;
- Because there is no good way to ensure that all contracted waste collection vehicles are regularly inspected, hefty penalty provisions could be used as a deterrent to non-compliance;
    - New York City's law specifies that in the event of a violation, a civil penalty of not less than $1000 and not more than $10,000 will be assessed, in addition to twice the amount of money saved by such contractor for failure to comply. If a contractor has been found to have made a false claim, New York City may assess an additional civil penalty of $20,000.

Timeframe:

- Because this policy option applies only to state-contracted waste haulers, it could take effect shortly after its enactment (4 months, suggested);

Limitations:

- This proposed state-owned vehicle and state contracting policy should be considered a first step toward a broadly applied waste collection vehicle policy. Ultimately, municipal vehicles, municipally-contracted vehicles, and private vehicles need to be cleaned up to maximize emission reductions from this category of diesels.

Estimated Costs and Benefits in Connecticut:
The costs and benefits of this policy are unknown at this point because the number of waste collection vehicles contracted to fulfill solid waste and recyclable materials contracts with the state of Connecticut is unknown.

New York Contact:
- Spiro Kattan, Department of Sanitation New York (DSNY), 718-334-9205

New York Progress to Date:
All DSNY vehicles are now subject to Local Law 39 requiring BART for all city-owned and city-contracted diesels. Prior to adoption of the local laws, DSNY introduced a number of pilot projects testing various types of diesel emission retrofits. The information below pertains to these pre-local law pilot demonstration projects. So far, a variety of emission control retrofit systems have been installed:
- Donaldson DOC + Crankcase systems - 100 installations on MACK LE sanitation trucks;
- Johnson Matthey Fleetguard CCRTs - 50 installations on MACK LE sanitation trucks;
- Johnson Matthey Fleetguard CRTs - 100 installations on Cummins M11 with crane carrier cab chassis;
- Environmental Solutions Worldwide CWMF (catalyzed wire mesh filter) – 50 installations on MACK LE sanitation trucks;
- Englehard DPX – 30 installations on MACK LE sanitation trucks.

Staff Reports on Implementation - (Spiro Kattan)
- Pilot demonstrations have been very successful. DSNY is happy with retrofits and expertise gained through experience with several technologies;
- All projects have benefited from close working relationship between DSNY and technology vendors;
- Installations began with custom-design prototypes that were adapted to the application. Based on this experience, vendors developed plug and play kits that can now be applied to all vehicles of a similar model/vintage;
- Cummins M11s with CRTs have since been rotated out of the fleet. Some CRTs were relinquished with the vehicles, others have been removed with the vehicle and returned to Cummins for re-use;
- CCRTs on MACK LE trucks will be scheduled for a regular cleaning once per year. Originally, CCRTs were cleaned with compressed air, but now will be sent out to get baked (service procured through competitive bid process). Baking (Level 2 cleaning) recovers DPFs to 95% their original condition;
- Training implemented for technicians in all districts by product vendors;
- DSNY is now assessing how to move forward with BART mandates for all vehicles (sanitation trucks and others). BART will mean different technologies for different vehicles and duty cycles – no one size fits all in a large, diversified fleet like DSNY's. DSNY expects to comply with Local Law 39 by implementing additional retrofits and modernizing the fleet with MY2007 and newer trucks.