



MEMO

To: Construction Subcommittee
From: Madeleine Weil, Environment Northeast
Date: November 3, 2005
Re: State-Funded Construction Vehicle Options Memo

Purpose

This memo outlines two potential policy options for reducing PM2.5 from state-funded construction equipment in Connecticut.

Summary

Option 1: Expand the scope of the CT Clean Air Construction Bid Specification to all state-funded construction projects and institute a formal and regular process for updating it over time.

1. Broaden the scope of state projects to which the CT Clean Air Construction Bid Specification applies.
Apply the bid specification to all state-funded construction;
 - a. By July 1, 2006, in accordance with P.A. 05-7, all state bid specifications on projects valued at \$5 million or more should require adherence to the requirements of the CT Clean Air Construction Bid Specification;
 - b. By January 1, 2007, the CT Clean Air Construction Bid Specification should apply to all state-funded projects of any value.
2. Establish a regular and formal mechanism for updating the bid specification over time to reflect evolving definition of “minimizing emissions.”
 - a. The DEP Commissioner should update the CT Clean Air Construction Bid Specification at least once per year;
 - b. Annual updates ensure that requirements keep pace with EPA/CARB’s verification list. Best available technology, verified by EPA/CARB for use on a particular engine, should be put to use on that engine;
 - c. The direct reference to the EPA/CARB verified list reduces uncertainty for contractors and reduces resources needs for DEP.
3. Recommended Funding Options:
 - Contract Specifications – Requirements are built into bid package so costs of compliance are built into overall project financing;
 - Contract Allowances – Competitive bid process excludes costs of compliance with emission control requirements. A clean air retrofit funding allowance is administered to the winning bidder.

Option 2: Adopt Best Available Control Technology (BACT) policy modeled after New York City Local Law 77 (2003). CT DEP could adopt by reference NY DEP’s list of “BACT” devices.

Background

Why focus on construction equipment?

Construction equipment engines in Connecticut were estimated to emit 694 tons of PM_{2.5} in 2002, the most recent year for which the state has data. This amount represents approximately 39% of total PM_{2.5} emissions from mobile source diesel engines (total = 1796 tons). Construction equipment PM_{2.5} emissions are significantly higher than emissions from on-road heavy-duty diesel vehicles (total = 563 tons), even though there are far fewer operating units in the state than on-road units.¹

Emissions per engine are significantly higher than on-road vehicles in part because EPA only began regulating emissions from off-road engines in 1996 and standards have continued to be considerably less stringent. Beginning with the Tier 4 emission standard, (to be phased-in on new engines starting 2011-2012), emissions from most new construction engines will have to be as clean as new on-road engines (meeting a PM standard of 0.01 g/bhp-hr).²

Because construction engines are concentrated at job sites, sometimes for long periods of time, they can create significant pollution hot-spots. The cumulative pollution burden from these engines is of particular concern for workers on the job site and in adjacent or down-wind areas, especially if the job-site is located in an area already overburdened by air pollution from other sources.

In sum, construction engines are particularly good targets for diesel emission clean-up efforts because:

1. They are much dirtier than on-road engines;
2. They typically last longer than on-road engines;
3. Federal standards requiring the cleanest available engine technology do not apply to non-road engines until 2011-2012;
4. They are concentrated at job-sites, often in overburdened areas, and create pollution hot spots;

Why start with state-funded equipment?

Connecticut has a responsibility to allocate its purchasing dollars in ways that protect the health and welfare of its residents. By demonstrating this leadership, the state can play a role in lowering the hurdles that prevent other public and private actors from doing the same. Also, state-funded construction constitutes a large portion of the very large construction contracts executed in the state, partly due to road and bridge projects. Finally, the state is typically the conduit for federal air pollution mitigation funds, such as CMAQ (Congestion Mitigation and Air Quality) funds, which can be used in some cases to defray the costs of diesel retrofits.

Connecticut Special Act 05-7: An Act Establishing a Connecticut Clean Diesel Plan

It was with these factors in mind that the CT General Assembly passed S.A. 05-7, directing the Connecticut DEP to develop:

(4) An implementation strategy, to be phased in not later than July 1, 2006, on projects valued at more than five million dollars, to maximize particulate matter emissions reductions from construction equipment servicing state construction projects, and an estimate regarding the cost and benefits to the state or municipalities of implementing such strategy;

¹ MANE-VU 2002 Connecticut Emission Inventory

² For engines smaller than 75HP, the Tier 4 PM standard is 0.02 g/bhp-hr.

In addition to an immediately implementable strategy for maximizing reductions from state projects over \$5 million, the legislature also directed DEP to develop a comprehensive plan for meeting the diesel particulate matter emission reduction targets outlined in the 2005 Climate Change Action Plan:

(b) The Connecticut diesel emission reduction strategy shall recommend programs, policies and legislation for achieving reductions of diesel particulate matter consistent with reduction targets for diesel particulate matter indicated in the Connecticut Climate Change Action Plan 2005.

The targets in this plan amount to approximately a 75% overall reduction in diesel particulate matter emissions by 2015. Achieving this goal in a ten-year timeline would significantly accelerate (by 10-15 years) the air quality benefits that would eventually occur through the implementation of federal new engine rules and business-as-usual fleet turnover. This acceleration would result in fewer diesel-related health impacts, including asthma and other respiratory impacts, cardio-vascular impacts, cancer and premature deaths.

Because construction-related emissions are such a large proportion of overall diesel PM emissions in Connecticut, emission reduction efforts from these engines must be a significant component of this comprehensive 10-year effort. Therefore, the DEP may wish to consider approaching the development of a construction policy from both a short and long-term perspective.

- An immediately implementable strategy for maximizing emission reductions on state-funded projects over \$5 million, and
- a 10-year plan to phase out all engines not meeting Tier 4 emission standards.

Connecticut's Construction Fleet

The State of Connecticut does not register non-road vehicles, and therefore does not have a central repository of information about construction vehicles. However, it is possible to construct an approximate picture of Connecticut's construction fleet using information submitted to DEP's Diesel Stakeholder Process.

Number of Engines:

- H.O. Penn Machinery estimates that the total equipment population in Connecticut equals approximately 10,000 units (3,500 units > 100 horsepower (HP) + 6,500 units < 100 HP).

Age of Engines:

- According to a survey by the Connecticut Construction Industry Association, the age-range of member-owned vehicles breaks down in the following way:
 - 25% - 20 years old or older
 - 25% between 15-20 years old
 - 17% between 10-15 years old
 - 21% between 5-10 years old
 - 12% newer than 5 years

Size of Engines:

- The EPA estimates that construction equipment in Connecticut breaks down by size according to the following proportions:
 - 2% larger than 600 HP
 - 5% between 300-600 HP
 - 9% between 175-300 HP
 - 19% between 100-175 HP
 - 25% between 75-100 HP

- 17% between 50-75 HP
- 23% smaller than 50 HP

Approximate Equipment Inventory:

- Based on the figures above, the following is an approximation of the total inventory of Connecticut construction equipment:

	>600	300-600	175-300	100-175	75-100	50-75	<50	Total
1985 or older	50	125	225	475	625	425	575	2500
1986-1990	50	125	225	475	625	425	575	2500
1991-1995	34	85	153	323	425	289	391	1700
1996-2000	42	105	189	399	525	357	483	2100
2001-2005	24	60	108	228	300	204	276	1200
	200	500	900	1900	2500	1700	2300	10,000

State Contracted Inventory

- The Construction Subcommittee in the CT DEP’s Connecticut Diesel Stakeholders Forum was unable to develop an estimate of the number and types of construction equipment contracted by the State of Connecticut for construction projects.

Existing Policy

Since 2001, the Connecticut Department of Transportation has had a Connecticut Clean Air Construction Bid Specification in place requiring contractors to reduce particulate matter emissions from construction equipment used on the I-95 Corridor Improvement Project through New Haven, “the Q-bridge Project.” With the amendments agreed upon at the June 8th, 2005 meeting of the South Central Regional Council of Governments, the bid specification should now contain the following baseline requirements:

- All equipment (including non-road) shall use on-road grade fuel, which switches to 15 PPM sulfur content in the second half of 2006;
- All equipment (non-road and on-road) 60 HP and larger shall reduce particulate matter emissions by at least 20% by installing emission control retrofits or using clean fuels;
- Reporting requirements and compliance provisions are included in the bid specification, as are certain exemptions.

Option 1 – Expand and enhance the CT Clean Air Construction Initiative

ConnDOT's four years of experience with the existing bid specification has provided a valuable base on which to build a comprehensive emission reduction policy for publicly-funded construction vehicles. However, so far the scope of this effort has been limited to the I-95 Corridor project through New Haven. Under Option 1, the state's next steps would be to:

1. **Broaden the scope** of state projects to which the CT Clean Air Construction Bid Specification applies. Apply the bid specification to all state-funded construction;
2. **Establish a formal mechanism for upgrading the bid specification** to require cleaner equipment over time, as Tier 3 and Tier 4 engines enter the market and high performance retrofit technology is verified for the off-road market. Through a process of regular review, and reference to certification systems from other states and federal agencies, assure that the bid specification requires equipment to conform to an evolving definition of "maximum emission reductions."
3. **Establish a record-keeping procedure** for maintaining up-to-date information regarding construction equipment used on state-funded projects

1) Broaden the Scope - include all state-funded construction projects

The CT DEP has indicated that the following state agencies are directly involved in contracting for or otherwise funding construction projects:

- Department of Public Works
- Department of Transportation
- Department of Environmental Protection
- University of Connecticut
- Department of Economic and Community Development

Source: Memo, CT DEP, "The Number of State Construction Projects Costing \$5 million or Greater," <http://www.dep.state.ct.us/air2/diesel/docs/fivemilcontracts.pdf>.

Under this option, a uniform CT Clean Air Construction Bid Specification would be adopted by the State of Connecticut for application in construction contracting by any state agency by certain deadlines. For example:

- By July 1, 2006, in accordance with P.A. 05-7, all state bid specifications on projects valued at \$5 million or more should require adherence to the requirements of the CT Clean Air Construction Bid Specification, (baseline requirements listed above under "Existing Policy");
- By January 1, 2007, the CT Clean Air Construction Bid Specification should apply to all state-funded projects of any value.

While the Department of Education doesn't directly contract with construction companies, DOE school construction grants to municipalities amounted to more than \$3.8 billion between 2000-2005. CT DOE's school construction program should likewise be subject to the CT Clean Air Construction Bid Specification.

2) Establish a regular and formal mechanism for updating the bid specification over time to reflect evolving definition of "maximum emission reductions"

In 2001, the diesel oxidation catalyst was selected as the technology of choice for this project because it was the most widely accepted and least expensive emission reduction option.³ After more than five years

³ Guido Shattaneck, Alex Kasprak, Donna Weaver, Coralie Cooper, *Implementation of Retrofit/Clean Fuel Programs for Diesel Equipment During the Construction Phase of Two Large Transportation Projects*, 2002, (12-13).

of successful implementation, and in order to bring emissions to their lowest possible level, the DEP can recommend evolving the specification beyond the diesel oxidation catalyst where technology permits.

The initial objective of the CT Clean Air Construction Initiative in 2001 was to ensure that “*every effort will be made to implement measures to minimize emissions during the construction period*”⁴ on the I-95 Corridor project through New Haven. This is a project that is scheduled to continue through the year 2014. To comply with the spirit of the Initiative, the state needs a periodic and formal mechanism to ensure that the contract specification continues to reflect the evolving state of technology and its effectiveness in “minimizing emissions.” This will be particularly important as Tier 3 and Tier 4 engines enter the Connecticut market and high performance emission control retrofits are verified for use in non-road applications. Implementation of a mechanism to update the standard could take the following shape;

- To keep pace with new verifications brought about by changes in technology, by December 1, 2006, and every December 1 thereafter, the DEP Commissioner publishes an updated version of the CT Clean Air Construction Bid Specification. Updates reflect emission control verifications added to CARB and EPA’s verified lists;
- The objective of annual updates is to ensure that the best available technology, verified by CARB or EPA for use on a particular engine, is put into use on that engine when used in the fulfillment of a contract with the state of Connecticut.
- By maintaining a direct reference to the CARB/EPA verified list, the bid specification reduces uncertainty for contractors and reduces the resources DEP allocates to updating the specification.

3) Establish a record-keeping procedure for maintaining historical and current information regarding construction equipment used on state-funded projects

- Inventory should include: number of engines, type of equipment, use of equipment, type and size of engine, engine model year, time spent on job.

Finance Options

Contract Specification

So far, the Connecticut Clean Air Construction Initiative has successfully used a contract specification to cover costs of emission control equipment. Contract specifications require that the contractor build the costs of meeting emission control requirements into the company’s bid package.⁵ The experience with the Boston Central Artery / Tunnel “Big Dig” project and the Connecticut Clean Air Construction Initiative showed that:

*“when implementing a retrofit program for offroad construction equipment, it is best to include the requirement for emission control equipment as of the contract’s bid package. By doing so, the cost of the retrofit equipment can be included as part of the overall contract cost, thus avoiding the use of economic incentives to bring contractors into the program.”*⁶

⁴ *Ibid*, (9).

⁵ ICF Consulting for U.S. EPA, *Emission Reduction Incentives for Off-Road Diesel Equipment Used in the Port and Construction Sectors*, 2005 (59).

⁶ Guido Shattaneck, Alex Kasprak, Donna Weaver, Coralie Cooper, *Implementation of Retrofit/Clean Fuel Programs for Diesel Equipment During the Construction Phase of Two Large Transportation Projects*, 2002, (15).

Since the costs of contract specifications appear in the bid package, the state pays these costs through the financing package of the overall construction project. ConnDOT has treated the costs of the Connecticut Clean Air Construction Initiative as “incidental” project costs.

Contract Allowance

Alternatively, funding for retrofits could be administered through a “Contract Allowance” which functions essentially as a grant to the winning bidder. This method levels the playing field for bidders and does not disadvantage smaller businesses that may have a harder time competing for contracts if retrofit specifications are built into the bid package.⁷

One promising source of outside funding for contract allowances is the Federal Highway Administration’s CMAQ (Congestion Mitigation and Air Quality) program. In the 2005 U.S. Transportation Bill, retrofits of diesel operated construction equipment were noted as priorities for receiving CMAQ funding.

Potential Costs and Benefits – Rough Estimate

The Construction Subcommittee was unable to estimate the number or types of construction equipment that is used on state funded construction jobs. In the absence of specific information, it is still possible to develop a rough estimate of costs and benefits.

The CT Department of Economic and Community Development estimated that in 2005, state construction authorizations amounted to \$911 million, or approximately 15% of the total value of construction output in Connecticut as measured by Gross State Product (\$5.9 billion).

Assume:

- State construction projects are responsible for 15% of total construction-related PM emissions: 15% of 694 tons = 104.1 tons per year
- State construction projects employ 15% of the Connecticut equipment inventory: 15% of 7,700 construction engines >50 HP = 1155 engines

Potential Cost Benefit Scenarios

	Low End	Middle	High End
Benefits	36.4 tons/yr	52 tons/yr	88.5 tons/yr
Cost	\$2.31 million	\$3.46 million	11.55 million

Low End assumptions: 35% PM reduction, DOC technology, \$2000 (ave) per engine
 Middle assumptions: 50% PM reduction, CWMF technology, \$3000 (ave) per engine
 High end assumptions: 85% PM reduction, DPF technology, \$10,000 (ave) per engine

Beyond State Projects

A contract specification can be utilized by any participant in the market for construction services, public or private. Municipalities and large private actors with public service missions (colleges and universities, for instance) may be willing to follow the state’s lead in adopting contract specifications that protect the

⁷ ICF Consulting for U.S. EPA, *Emission Reduction Incentives for Off-Road Diesel Equipment Used in the Port and Construction Sectors*, 2005 (59).

public health. The state could facilitate this by publicizing the benefits of the Connecticut Clean Air Construction Initiative and providing assistance to policy makers and procurement officers at the local level who are interested in adopting a similar specification. This outreach effort could multiply the total emission reduction benefits to be gained from the construction sector.

Option 2 – Adopt Best Available Control Technology requirement (NYC Local Law 77)

See the following documents:

- New York City Local Law 77 (12/22/03):
http://www.nycouncil.info/pdf_files/bills/law03077.pdf
- Notice of Promulgation of Chapter 14 of Title 15 of the Rules of the City of New York Rules Concerning the Use of Ultra-Low Sulfur Fuel and Emissions Control Technology in Nonroad Vehicles Used in City Construction (3/29/05):
<http://www.ci.nyc.ny.us/html/dep/html/news/notices.html>
- DDC Ultra Low Sulfur Diesel Manual:
<http://www.nyc.gov/html/ddc/html/ddcgreen/documents/lowsulfur.pdf>