EQUIPMENT EMISSION REDUCTION

GOAL

Reduce air emissions from nonroad construction equipment.

CREDIT REQUIREMENTS

Use emission reduction exhaust retrofits and add-on fuel efficiency technologies that achieve the EPA Tier 4 emission standard for nonroad construction equipment. Points are awarded as follows:

1 point
At least 50% of the nonroad construction equipment fleet operating hours for the project are accomplished on equipment with installed emission reduction exhaust retrofits and add-on fuel efficiency technologies that achieve the EPA Tier 4 emission standard.

2 points
At least 75% of the nonroad construction equipment fleet operating hours for the project are accomplished on equipment with installed emission reduction exhaust retrofits and add-on fuel efficiency technologies that achieve the EPA Tier 4 emission standard.

Details

For this credit to be implemented successfully, workers may require additional training on how to keep track of equipment operating hours accurately. See also CA-2 Environmental Training.

DOCUMENTATION

Provide a list of all nonroad construction equipment used on the project that contains the following information for each piece of equipment:

1. Make and model of each piece of equipment.
2. Operating hours associated with the project.
3. For equipment achieving Tier 4 emissions standards, documented evidence that the equipment either (a) meets EPA Tier 4 emissions standards, or (b) has installed emission reduction exhaust retrofits and add-on fuel efficiency technologies that achieve the EPA Tier 4 standard.

CA-5

1-2 POINTS

RELATED CREDITS

- ✓ CA-2 Environmental Training
- ✓ CA-4 Fossil Fuel Reduction
- ✓ CA-6 Paving Emissions Reduction

SUSTAINABILITY COMPONENTS

- ✓ Ecology
- ✓ Equity

BENEFITS

- ✓ Reduces Air Emissions
- ✓ Reduces Greenhouse Gases
- ✓ Improves Human Health & Safety

APPROACHES & STRATEGIES

- Retrofit exhaust equipment on nonroad vehicles.
- Replace engines where this option is more cost-effective than retrofit.
- Switch to use ultra-low sulfur diesel (ULSD) in conjunction with the add-on fuel efficiency technologies installed in the equipment fleet.

Example: Scenarios

Some example scenarios are provided below based on a hypothetical nonroad fleet operating for a total of 1,000 equipment hours.

No points

- 400 of 1,000 total operating hours (40%) are associated with equipment that achieve the EPA Tier 4 emissions standard.

1 point

- 500 of 1,000 total operating hours (50%) are associated with equipment that achieve the EPA Tier 4 emissions standard.

2 points

- 800 of 1,000 total operating hours (80%) are associated with equipment that achieve the EPA Tier 4 emissions standard.

Example: Case Studies Documented by the U.S. EPA

The EPA describes several diesel engine emission reduction effort case studies at: http://www.epa.gov/diesel/construction/casestudies.htm

Example: Washington State Department of Ecology Strategy

One example of an overall statewide approach that this Voluntary Credit is consistent with is the Washington State Department of Ecology's "Diesel Particulate Emission Reduction Strategy." The goals expected under this approach are (Ecology, 2006):

1. Install emission reduction exhaust retrofits on fifty percent of the public legacy diesel fleet in four years.

2. Install emission reduction exhaust retrofits and add-on fuel efficiency technologies on fifty percent of the private legacy diesel fleet in eight years.

3. Evaluate, develop and implement an idle reduction program that addresses and remedies unnecessary idling through on-board retrofits, on-the-ground infrastructure and anti-idling regulations.

4. Replace twenty-five percent of older (pre-1996 for non-road) legacy vehicles in the private fleet in eight years.

POTENTIAL ISSUES

1. Retrofits and replacements of engines can represent a significant added cost to the contractor.

RESEARCH

Construction air emissions are largely from three main sources: (1) dust and particles from the construction activities, also called fugitive dust, (2) emissions from construction equipment exhausts, or (3) emissions from construction materials (such as fumes and vapors from hot asphalt). This Voluntary Credit addresses construction equipment emissions in general and specifically, diesel exhaust emissions from nonroad diesel equipment.

Nonroad Engine Defined

40 CFR Part 1068 (the General Compliance Provisions for Nonroad Programs) defines precisely what a nonroad diesel engine is and is not. In summary (40 CFR 1068 has exact definitions and exclusions), a nonroad engine is defined to be any internal combustion engine that is:

1. In or on a piece of equipment that is self-propelled or serves a dual purpose by both propelling itself and performing another function.
2. In or on a piece of equipment that is intended to be propelled while performing its function.
3. That, by itself or in or on a piece of equipment, is portable or transportable.

In general, diesel powered self-propelled and portable construction equipment with an internal combustion engine are considered to be nonroad engines.

Health Effects

Diesel engines emit a complex mixture of gaseous pollutants and fine particles and are a major source of air pollution. Particular emissions are nitrogen oxides (NOx), particulate matter (PM), sulfur oxide gases (SOx), and other toxic air pollutants which contribute to serious adverse health and environmental effects (EPA, 1995; ICF, 2005). Emissions from diesel engines have been found to include over forty cancer causing substances, and the U.S. Environmental Protection Agency (EPA) has concluded that diesel exhaust is likely to be carcinogenic to humans by inhalation at occupational and environmental levels of exposure (EPA, 2002). In Washington State, the Washington State Department of Ecology has identified diesel exhaust as the air pollutant most harmful to public health in Washington State. They found that 70% of the cancer risk from airborne pollutants is from diesel exhaust, mainly due to the PM 2.5 emissions (Washington State Department of Ecology, 2006). Until the mid-1990s, emissions from these engines were largely uncontrolled. In order to combat the health effects of diesel emissions, the EPA started a program in 2007 to reduce diesel engine emissions in the U.S. (EPA, 2004). The plan is estimated to reduce emissions by more than 90% by 2030.

Contribution of Nonroad Diesel Engines to Emissions Inventory

According to EPA's National Emission Inventory (2008 year data) (NEI, 2009), nonroad diesel engines (using the category of "off highway") are responsible for 26% of NOx emissions nationally (4,255,000 tons per year), and for 5.8% of fine particulate emissions (PM 2.5) (283,000 tons per year) nationally. These percentages can be considerably higher in some urban areas. In Washington State, the Department of Ecology states that construction activities are responsible for 18% of the State's PM 2.5 emissions (2002 data) (Figure CA-5.1).

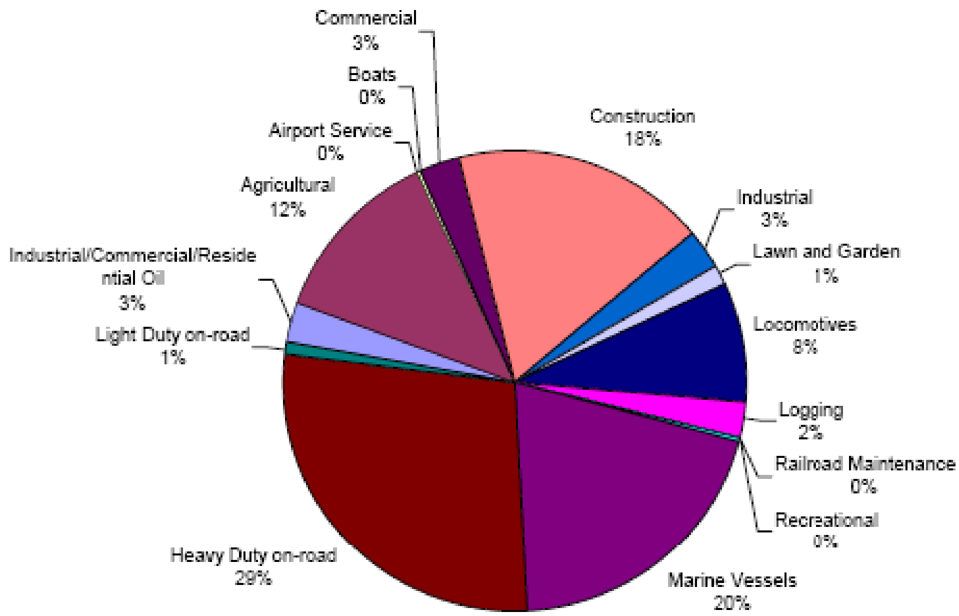

Figure CA-5.1:
(Washington State Department of Ecology, 2006).

1.

Improvement Efforts

Recognizing the large impact that diesel engine exhaust has on human health and the environment (e.g., CARB, n.d.), there are substantial efforts to reduce diesel exhaust emissions through burning cleaner diesel fuels (e.g., ultra low sulfur diesel or ULSD), installing exhaust retrofits to reduce emissions from existing engines and producing new diesel engines that emit less.

Pace of Change

Although efforts to reduce diesel emissions are underway, significant impacts may be years away. Nonroad diesel equipment can last 20 to 30 years and typical new emissions standards are not required to be met by existing equipment. Therefore, the impacts of such changes are likely to be felt as a majority of equipment fleets age and are replaced by equipment meeting newer, more stringent regulations. Furthermore, change and its pace will likely be controlled by the private sector as they own nearly 90 percent of diesel vehicles and diesel engines (Washington State Department of Ecology, 2006). Thus, efforts to incent the private sector to change ahead of natural equipment turnover rates may help make diesel emission reductions happen sooner.

Cost Considerations

A majority of construction companies are small firms. To retrofit or change their equipment requires large capital investments, which they may not be able to bear. For many private smaller construction companies, this cost is significant and interferes with the environmental benefits this would achieve. Also the cost of using alternative fuel or low-sulfur fuel is an issue.

The EPA estimates the incremental cost of producing 500 ppm fuel to be on average 2.5 cents per gallon, and 15 ppm around 5 cents per gallon. (This takes into account all the necessary changes in both refining and distribution practices, however this estimated costs vary widely for equipment of different sizes and for different applications) (EPA, 2003). For the vast majority of equipment, the cost of meeting emission standards will be roughly 1-2% compared with the typical retail price. As an example, EPA estimates that for a 175-hp bulldozer, it will cost an additional $2,600 to add the advanced emission control systems to the engine and to design the bulldozer to accommodate the modified engine. A new 175-hp bulldozer costs approximately $230,000 (EPA, 2003), so the increased costs are about 1 % of the total purchase price. Costs could be higher for some types of equipment. As a benefit, engines running on low-sulfur fuel will have reduced maintenance expenses (EPA, 2003). As incentive, there are several grant programs available at local and federal level for companies to retrofit or change part of their equipment fleet (Washington State Department of Ecology, 2006; EPA, 2009).

In the broader context, the benefits to society of reduced health costs resulting from fewer emissions are substantial. The EPA estimated the benefit-to-cost ratio (health benefits to compliance cost) of 30 (CARB, n.d.). In general, the California Air Resources Board (CARB) reports benefit-cost ratios in the literature from 2 to 8.

GLOSSARY

Tier 4 emission standard	EPA standards that require emissions to be reduced over current Tier 2 and 3 standards. Reductions of particulate matter (PM) for engines above 19kW and nitrous oxides (NOx) for engines larger than 56 kW are substantial. Hydrocarbon limits are also substantially reduced for engines larger than 56 kW. Such emission reductions can be achieved through the use of control technologies including advanced exhaust gas after treatment. Tier 4 standards are to be phased in over the period of 2008-2015.
Ultra low sulfur diesel (ULSD)	Standard term for diesel fuel having less than 15 ppm sulfur. As of 2009, most on-highway diesel fuel sold at retail locations is ULSD. The previous standard, low sulfur diesel (LSD), allowed 500 PPM sulfur.

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