Replacement of a 1985 agricultural tractor

A farmer proposes to replace an uncontrolled 1985 175 hp agricultural tractor with a new 175 hp Tier 3 agricultural tractor. The new equipment will cost $100,000. This equipment operates 1000 hours per year, 100 percent of the time in California. A Level 3 diesel particulate filter has been verified for use on the engine and has a cost of $25,000. There are no available repowers for this specific equipment, so the applicant is eligible for up to 80 percent of the new equipment cost. This equipment is eligible for a project life of 5 years.

Baseline Technology Information:

- Engine (application): 1985 Model Year
- HP (application): 175
- Hours of operation (application): 1000
- Load factor (Table B-11): 0.70
- Emission factors (Table B-12): 10.23 g/bhp-hr NOx; 1.06 g/bhp-hr ROG; 0.396 g/bhp-hr PM10

Reduced Technology Information:

- Engine: Tier 3 (ARB executive order)
- HP (application): 175
- Hours of operation (application): 1000
- Cost of new engine (quote provided with application): $100,000
- Equipment replacement is eligible for up to 80 percent of the new equipment cost.
- Load factor (Table B-11): 0.70
- Emission factors (Table B-13): 2.32 g/bhp-hr NOx; 0.12 g/bhp-hr ROG; 0.112 g/bhp-hr PM10
- Percent operating in California (application): 100 percent
- Retrofit: Level 3 verified reductions: 85 percent PM10
- Retrofits are eligible for up to 100% of total cost.
- Cost of retrofit (quote provided with application): $25,000

Emission Reduction Calculations:

Formula C-4: Estimated Annual Emissions based on Hours of Operation (tons/yr)

1. Annual NOx baseline technology emissions
   10.23 g/bhp-hr *175 hp*0.70*1000 hr*(ton/907,200 g) = 1.38 tons/yr NOx
2. Annual NOx reduced technology emissions
   2.32 g/bhp-hr *175 hp*0.70*1000 hr*(ton/907,200 g) = 0.31 tons/yr NOx
3. Annual ROG baseline technology emissions
   1.06 g/bhp-hr *175 hp*0.70*1000 hr*(ton/907,200 g) = 0.14 tons/yr ROG
4. Annual ROG reduced technology emissions
   0.12 g/bhp-hr *175 hp*0.70*1000 hr*(ton/907,200 g) = 0.02 tons/yr ROG
5. Annual PM10 baseline technology emissions
   0.396 g/bhp-hr *175 hp*0.70*1000 hr*(ton/907,200 g) = 0.053 tons/yr PM10
6. Annual PM10 reduced technology emissions
   0.112 g/bhp-hr *175 hp*0.70*1000 hr*(ton/907,200 g) = 0.015 tons/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

- Emission benefits NOx = 1.38 tons/yr - 0.31 tons/yr = 1.07 tons/yr NOx
- Emission benefits ROG = 0.14 tons/yr - 0.02 tons/yr = 0.12 tons/yr ROG
- Emission benefits PM10 = 0.053 tons/yr - 0.015 tons/yr = 0.038 tons/yr PM10

Formula C-11: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Retrofits

0.015 tons/yr PM10 * 0.85 = 0.013 tons/yr PM10

Total PM10 Emission Benefits

0.038 tons/yr + 0.013 tons/yr = 0.051 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

1.07 tons/yr + 0.12 tons/yr + 20(0.051 tons/yr) = 2.21 weighted tons/yr

<u>Annualized Cost:</u>

Project Life: 5 years

CRF (Table B-1): = 0.225

Formula C-14: Incremental Cost

($100,000 * 80 percent) + ($25,000 * 100 percent) = $105,000

Formula C-12: Annualized Cost

0.225 * $105,000 = $23,625

<u>Cost-Effectiveness:</u>

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)

($23,625/yr)/(2.21 weighted tons/yr)

= $10,690/tons of weighted surplus emissions reduced

The cost-effectiveness for the example is less than $16,000 per ton of pollutants reduced. This project qualifies for up to $105,000 in grant funds requested.