

Methodology to Estimate Emissions from the Housing Rehabilitation, Reconstruction, Elevation, and Mitigation Associated With Hurricane Sandy—Use of Fuel for Residential Construction and Average Pollutant Emission Factors

Step 1: Obtain national data that relates residential housing spending to diesel fuel usage from Evaluation of Methodologies to Estimate Nonroad Mobile Source Usage, prepared by Sierra Research for the Office of Mobile Sources, U.S. Environmental Protection Agency (report number SR93-03-02, March 19, 1993, Table 7-4 on page 7-6). Based on the 1987 Census of Construction, \$1,200 of off-highway fuel is used for every million dollars of single family housing (SFH) construction. Also, \$880 of off-highway fuel is used for every million dollars of non-SFH residential construction. Assuming the Superstorm Sandy construction activities will be a mix of SFH and non-SFH residential construction, an average value of \$1,040 of off-highway fuel per million dollars of construction will be used.

Step 2: Convert the diesel fuel usage factor to gallons of fuel per million dollars (\$M) of current residential construction spending. An average 1987 diesel price of \$0.55 per gallon is from page 7-10 of the Sierra report. To convert the construction spending from 1987 dollars to current dollars, producer price indices (PPI) for finished goods less food and energy were obtained for 1987 (113.3) and 2012 (182.4) from <http://data.bls.gov/pdq/SurveyOutputServlet>. The diesel fuel usage factor is converted as follows:

$$\$1,040 \text{ fuel}/\$M1987\text{constn} \times 1 \text{ gal diesel}/\$0.55 \times 113.3/182.4 = 1,175 \text{ gal diesel}/\$M\text{constn}$$

Step 3: Obtain emission factors in terms of annual tons of pollutant per million gallons of nonroad diesel fuel to enable the estimation of pollutant emissions per million dollars of construction spending. The NJDEP ran the EPA NONROAD model to produce 2014 annual construction pollutant emissions and fuel usage for the nine New Jersey counties in which Superstorm Sandy recovery efforts will be concentrated. Details regarding the results of the NONROAD model runs are provided in the appendix. The NONROAD results were used to generate emission factors by considering the total annual construction pollutant emissions for the nine counties along with the total diesel fuel used by the construction equipment. This resulted in emission factors of: 6.90, 64.89, 5.51 and 0.13 pollutant tons per million gallons of diesel fuel for VOC, NO_x, PM_{2.5} and SO₂ respectively. Using the emission factors from the NONROAD model and 1,175 gal diesel/\$Mconstn from Step 2, the following emission factors are calculated: 0.00811, 0.0762, 0.00647 and 0.00015 annual tons of pollutant per million dollars of residential construction spending for VOC, NO_x, PM_{2.5} and SO₂ respectively.

Step 4: Apply the emission factors to the projected spending for the Superstorm Sandy rebuilding project. The spending for the project is estimated to be \$1.8 billion over a 24 month period beginning mid-2013 and ending mid-2015. The focus of this analysis will be the 2014 calendar year because project construction emissions are expected to be highest in that year (half of \$1.8 billion or \$900 million). General conformity emissions are estimated for each impacted nonattainment area. Of the nine counties in which HUD-funded Superstorm Sandy recovery projects will be concentrated, six are in the northern ozone nonattainment area and three are in the southern nonattainment area. However, the shoreline length is roughly equally split between the northern and southern ozone nonattainment areas. Six of the nine counties are in the northern

PM2.5 nonattainment area. Therefore, for the ozone precursor pollutants (VOC and NO_x), 2014 project construction spending is assumed to be \$450 million (half of \$900 million) for each nonattainment area and for PM2.5, 2014 project construction spending is assumed to be \$600 million (2/3 of \$900 million). Using these spending assumptions and the emission factors from Step 3, the following are the estimated 2014 emissions:

Table 1: Estimated VOC, NO_x and PM2.5 Emissions Associated with HUD-Funded Housing Projects

Nonattainment Area	VOC (tons/year)	NO_x (tons/year)	PM2.5 (tons/year)	SO₂ (tons/year)
Ozone Northern	4	34	NA	NA
Ozone Southern	4	34	NA	NA
PM2.5 Northern	NA	NA	4	0.09
General Conformity Limits	25	100	100	100

The methodology used to determine the emissions estimates in Table 1: Estimated VOC, NO_x and PM2.5 Emissions Associated with HUD-Funded Housing Projects is consistent with the damage reported by county and the method of distribution of funds included in the New Jersey Department of Community Affairs, Community Development Block Grant Disaster Recovery Action Plan (March 2013).¹

¹ <http://www.state.nj.us/dca/announcements/pdf/CDBG-DisasterRecoveryActionPlan.pdf> (pages 2-4 and 4-2)