

CITY OF ATLANTA Watershed Management

CDFA: 66.046

CLIMATE POLLUTION REDUCTION GRANTS PROGRAM: IMPLEMENTATION GRANTS GENERAL COMPETITION

EPA-R-OAR-CPRGI-23-07

Technical Appendix

Waste Reduction Model v16 Food Waste Landfill Degradation Emissions Factor

Greenhouse gas (GHG) at landfill avoidance is based on all wastes processed are destined for beneficial reuse and under the project agreement (PA) a penalty will be assessed for any reuse materials that go to a landfill. The EPA's Waste Reduction Model v16 reports standard waste degradation emissions for a variety of waste management methods. For our purposes of calculating the avoided emissions from landfill waste diversion of food waste, the value of 1.45 MT CO_{2e}/year per ton of food waste was used which is shown in **Figure A-1** below.

There is no factor for biosolids and thus a conservative factor of 60% of the food waste was selected. This is based on the lower volatile solids content of processed biosolids as opposed to food waste. Food waste typically has a range of volatile solids content from 80% to 97%. Processed (digested) biosolids is expected to have a 50% to 55% volatile solids content. The ratio of the averages of these ranges is 59.3. 60% is used in the evaluation.

Waste Reduction Model (WARM) -- Results

Total GHG Emissions from Baseline MSW Generation and Management (MTCO ₂ E):	1.45
Total GHG Emissions from Alternative MSW Generation and Management (MTCO ₂ E):	(3.66)
Incremental GHG Emissions (MTCO ₂ E):	(5.11)

MTCO₂E = metric tons of carbon dioxide equivalent

Per Ton Estimates of GHG Emissions for Baseline and Alternative Management Scenarios

Material	GHG Emissions per Ton of Material Produced (MTCO ₂ E)	GHG Emissions per Ton of Material Source Reduced (MTCO ₂ E)	GHG Emissions per Ton of Material Recycled (MTCO ₂ E)	GHG Emissions per Ton of Material Landfilled (MTCO ₂ E)	GHG Emissions per Ton of Material Combusted (MTCO ₂ E)	GHG Emissions per Ton of Material Composted (MTCO ₂ E)	GHG Emission per Ton of Material Anaerobically Digested (MTCO ₂ E)
Corrugated Containers	5.58	(5.58)	(3.14)	1.66	(0.48)	NA	NA
Magazines/third-class mail	8.57	(8.57)	(3.07)	0.25	(0.34)	NA	NA
Newspaper	4.68	(4.68)	(2.71)	(0.23)	(0.54)	NA	NA
Office Paper	7.95	(7.95)	(2.87)	3.39	(0.46)	NA	NA
Phonebooks	6.17	(6.17)	(2.63)	(0.23)	(0.54)	NA	NA
Textbooks	9.02	(9.02)	(3.11)	3.39	(0.46)	NA	NA
Mixed Paper (general)	6.07	(6.07)	(3.55)	1.44	(0.48)	NA	NA
Mixed Paper (primarily residential)	6.00	(6.00)	(3.55)	1.33	(0.47)	NA	NA
Mixed Paper (primarily from offices)	7.37	(7.37)	(3.58)	1.41	(0.44)	NA	NA
Food Waste	3.66	(3.66)	NA	1.45	(0.13)	(0.16)	(0.06)

Figure A-1 EPA Waste Reduction Model v16 Standard Waste Degradation Emission Factors

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BEAM 2022 Biosolids Land Application Emissions

Emissions from land application of biosolids in 2030 (ATL 2030) and 2050 (ATL 2050) were calculated using the “Land Application” tab within the Biosolids Emissions Assessment Model (BEAM) v2022 (North East Biosolids and Residuals Association (NEBRA), Northern Tilth LLC, and Northwest Biosolids, 2022).

Biosolids quantities and solids content were sourced from the values presented in **Table 2** and **Table 4** of the application narrative. The biosolids will be digested prior to finishing. It is assumed that the biosolids will not be lime-stabilized which is indicated in the BEAM model. It is assumed that biosolids will be stored an average of 2 weeks (14 days) prior to land application. The Atlanta area receives on average < 40 inches of precipitation annually, so it is considered to have a “Humid” climate based on BEAM’s definitions within the tool. BEAM defaults were then used for the remaining fields. See **Figure A-2** below for a screen shot of the BEAM model inputs and outputs.



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Land Application	Scenario 1		Scenario 2	
	ATL 2030		ATL 2050	
	Inputs & Daily Emissions	Default Input (Optional)	Inputs & Daily Emissions	Default Input (Optional)
Biomass characteristics				
Processing prior to land application	Thermal Drying		Thermal Drying	
Quantity of treated biosolids going to land application (Mg/day-wet)	122		147	
Solids content of treated biosolids going to land application (%)	83.0%		83.0%	
Quantity going to land application (Mg/day-dry)	101.0		121.7	
Density of treated biosolids (kg/m ³)	950	950	950	950
Type of biosolids to be land applied	digested		digested	
Total nitrogen (%-dry weight)	5.0%	5.0%	5.0%	5.0%
Total phosphorus (%-dry weight)	1.9%	1.9%	1.9%	1.9%
Total volatile solids (TVS) (%-dry weight)	65.0%	65.0%	65.0%	65.0%
Organic carbon (%-dry weight)	36%	36.4%	36%	36.4%
CaCO ₃ equivalence (%-dry weight)	0.0%	0.0%	0.0%	0.0%
Average number of days biosolids are stored prior to land application	14		14	
Climate at land application sites	Humid		Humid	
Is lime in biosolids derived from a waste product? (e.g. cement kiln dust)	no	no	no	no
Will the lime in biosolids replace purchased lime where it is applied?	no	yes	no	yes
Soil Texture at land application sites (total)				
Fine-textured (% of land application area)	50%	50%	50%	50%
Coarse-textured (% of land application area)	50%		50%	
Fuel Use				
Applying biomass to land (L-diesel fuel/day)	82	82	99	99
CO ₂ emissions from diesel used (Mg/day)	0.22		0.27	
Methane Emissions				
CH ₄ emitted from storage of biomass prior to land application (Mg/day)	0.0000		0.0000	
CO ₂ Emissions equivalents from released CH ₄ (Mg/day)	0.00		0.00	
Nitrous Oxide Emissions				
N ₂ O emitted from land application - fine-textured soils (Mg/day)	0.1091		0.1315	
N ₂ O emission adjustment for dry biomass on fine-textured soil (Mg/day)	-0.109		-0.131	
N ₂ O emitted from storage of biomass prior to land application (Mg/day)	0.0000		0.0000	
CO ₂ emissions equivalents from released N ₂ O (Mg/day)	0.00		0.00	
Carbon Sequestration				
Carbon sequestration as result of land application (Mg CO ₂ /dry Mg biosolids)	Current Default	Current Default	Current Default	Current Default
From biosolids applied to soil (Mg CO ₂ /day)	-15.15		-18.26	
Fertilizer Off-set Credits				
From nitrogen applied to soil (Mg CO ₂ /day)	-20.20		-24.34	
From phosphorus applied to soil (Mg CO ₂ /day)	-3.84		-4.62	
Calcium Carbonate Debit				
From CaCO ₃ applied to soil (Mg CO ₂ /day)	0.00		0.00	
CO₂ equivalents (Mg/year)				
Scope 1	-5,449		-6,566	
Scope 2	0		0	
Scopes 1 & 2	-5,449		-6,566	
Scope 3	-8,774		-10,572	
Biomass combustion	-		-	

Figure A-2 BEAM v2022 Biosolids Land Application Calculations for 2030 and 2050