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# Carbon Free Boston: Waste Technical Advisory Group, July 31, 2018

Table 1 -> Synthesis of main direct & indirect source types met in waste management activities

| Activity | Direct Emissions Sources | Indirect Emissions Sources | Avoided Emissions Sources | Biogenic $CO_2$ Emissions Sources |
|---|---|---|---|---|
| Collection & Transportation | -> $CO_2$ from fuel consumption<br>-> HFC from A/C leakages | -> $CO_2$ from electric vehicles<br>-> $CO_2$ from outsourced transport | N.A. | -> $CO_2$ from consumption of biomass energy (biofuels, bioliquids, solid biomass, biogases) |
| Transfer | -> $CO_2$ from fuel consumption | -> $CO_2$ from purchased electricity consumption | N.A. | -> $CO_2$ from consumption of biomass energy (biofuels, bioliquids, solid biomass, biogases) |
| Mechanical Pre-treatment (dismantling) | -> $CO_2$ from fuel consumption | -> $CO_2$ from purchased electricity consumption | N.A. | -> $CO_2$ from consumption of biomass energy (biofuels, bioliquids, solid biomass, biogases) |
| Sorting, Recycling & Recovering | -> $CO_2$ from fuel consumption<br>-> HFC emissions from WEEE dismantling | -> $CO_2$ from purchased electricity consumption | -> Potential avoided GHG emissions corresponding to the difference between virgin raw material production emissions and material recovery emissions<br>-> Potential avoided GHG emissions corresponding to the difference between burning fossil fuel and solid recovered fuels (SRF) | -> $CO_2$ from consumption of biomass energy (biofuels, bioliquids, solid biomass, biogases) |
| Physico-chemical waste treatment | -> $CO_2$ from fuel consumption | -> $CO_2$ from purchased electricity consumption | -> Potential avoided GHG emissions corresponding to the difference between burning fossil fuel and alternative fuels | -> $CO_2$ from consumption of biomass energy (biofuels, bioliquids, solid biomass, biogases) |
| Biological Treatment (composting) | -> $CO_2$ from fuel consumption<br>-> Process emissions ($CH_4$ and N2O) | -> $CO_2$ from purchased electricity consumption | -> Potential avoided GHG emissions corresponding to the difference between use of chemical fertilizer and compost spreading | -> $CO_2$ from consumption of biomass energy (biofuels, bioliquids, solid biomass, biogases)<br>-> $CO_2$ process emissions |

Table 1 (continued)

| Activity | Direct Emissions Sources | Indirect Emissions Sources | Avoided Emissions Sources | Biogenic $CO_2$ Emissions Sources |
|---|---|---|---|---|
| Biological Treatment (Anaerobic Digestion) | -> $CO_2$ from fuel consumption<br>-> Process emissions ($CH_4$ and N2O) | -> $CO_2$ from purchased electricity consumption | -> Potential avoided GHG emissions corresponding to the difference between biogas recovery emissions (as power, heat and/or fuel) and substituted energy production emissions | -> $CO_2$ from consumption of biomass energy (biofuels, bioliquids, solid biomass, biogases)<br>-> $CO_2$ process emissions<br>-> $CO_2$ from biogas combustion |
| Landfill | -> $CO_2$ from fuel consumption<br>-> Diffuse CH4 emissions<br>-> $CH_4$ from incomplete landfill gas combustion | -> $CO_2$ from purchased electricity consumption | -> Potential avoided GHG emissions corresponding to the difference between landfill gas recovery emissions (as power, heat and/or fuel) and substituted energy production emissions | -> $CO_2$ from consumption of biomass energy (biofuels, bioliquids, solid biomass, biogases)<br>-> Diffuse $CO_2$ & oxidised $CH_4$ emissions<br>-> CO2 from landfill gas combustion process |
| Thermal treatment | -> $CO_2$ from fuel consumption<br>-> N2O process emissions<br>-> $CO_2$ process emissions (only the fossil carbon share of the waste) | -> $CO_2$ from purchased electricity consumption | -> Potential avoided GHG emissions corresponding to the difference between energy from thermal treatment processes recovery (as power and/or heat) emissions and substituted energy production emissions.<br>-> Potential avoided GHG emissions corresponding to the difference between virgin raw material production emissions and material recovery emissions (e.g. slag, scrap, metals and bottom ashes) | -> $CO_2$ from consumption of biomass energy (biofuels, bioliquids, solid biomass, biogases)<br>-> $CO_2$ process emissions (the biogenic carbone share of the waste) |
| Mechanical Biological Treatment (MBT) | -> $CO_2$ from fuel consumption<br>-> Process emissions ($CH_4$, N2O) | -> $CO_2$ from purchased electricity consumption | -> Potential avoided GHG emissions corresponding to the difference between biogas recovery emissions (as power, heat and/or fuel) and substituted energy production emissions<br>-> Potential avoided GHG emissions corresponding to the difference between virgin raw material production emissions and material recovery emissions (compost production, alternative fuels, material recovery...) | -> $CO_2$ from consumption of biomass energy (biofuels, bioliquids, solid biomass, biogases)<br>-> $CO_2$ process emissions |