



Challenges to Estimating Short- Lived Climate Pollutant Emissions from the Waste Sector

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Overview



- Background on short-lived climate pollutants (SLCPs) in the waste sector
- Challenges to estimating SLCPs from the waste sector, and potential climate mitigation benefits of reducing them
- Ongoing efforts to address challenges

Short-lived Climate Pollutants



- A subset of greenhouse gases and aerosols that:
 - Contribute to global warming and remain in the atmosphere for shorter time periods compared to other, long-lived greenhouse gases (e.g., CO₂)
 - Have detrimental impacts on human health, agriculture, ecosystems
- Examples:
 - Methane, black carbon, tropospheric ozone, hydrofluorocarbons

Short-lived Climate Pollutants



- Near-term mitigation of SLCPs could result in the following global benefits:
 - 0.5° C in avoided warming in 2050
 - 2.4 million avoided premature deaths from reduced pollution
 - 30 million metric tons of avoided annual staple crop losses
- Climate and Clean Air Coalition to Reduce Short-lived Climate Pollutants (CCAC)
 - Focuses on addressing SLCPs from several sectors
 - MSW Initiative focuses on reducing SLCPs through
 - Technical assistance (e.g., landfill gas assessments)
 - Capacity building (e.g., trainings)
 - Replication and networking



SLCPs from the Waste Sector



Methane

- Produced by anaerobic decomposition of organic material (e.g., in landfills)
- Key drivers:
 - Amount of organic waste deposited
 - Extent of anaerobic decomposition
 - Landfill cover properties
 - Methane oxidation rates
- Atmospheric lifetime: 12 years
- GWP_{100} : 28-36*
- Contributes to the formation of tropospheric ozone, an air pollutant



* IPCC. 2013. *Climate Change 2013: The Physical Science Basis*.

SLCPs from the Waste Sector



Black Carbon

- A component of particulate matter
 - An aerosol (not a GHG)
- Formed by the incomplete combustion of fossil fuels, biofuels, and biomass
- Emissions patterns vary significantly
- Atmospheric lifetime: As little as a few days to a week
- GWP_{100} : Variable (global avg ~910*)
- Contributes to all the same adverse health impacts that are associated with fine particulate matter



* Bond et al. 2013. *Bounding the Role of Black Carbon in the Climate System: A Scientific Assessment*



Methane

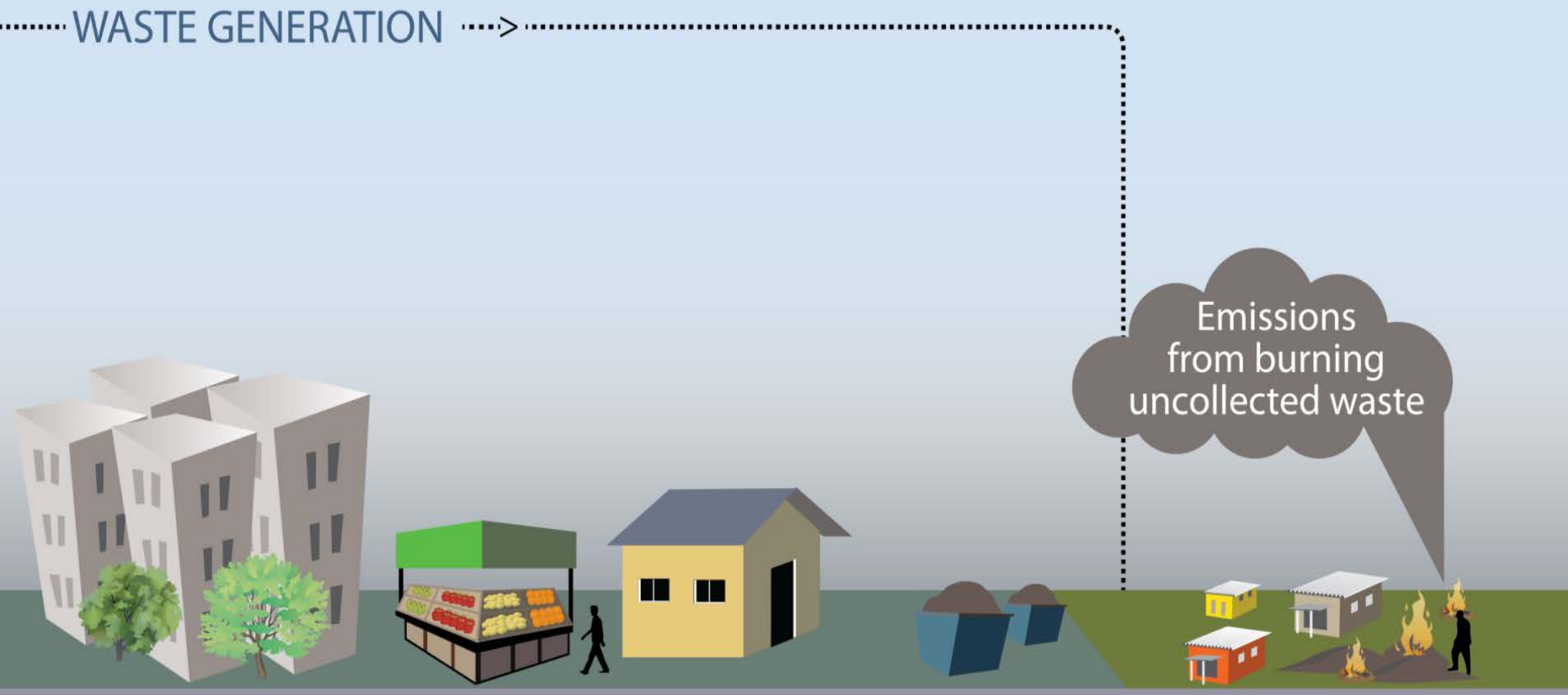


Black Carbon

METHANE AND BLACK CARBON EMISSIONS FROM THE WASTE SECTOR



WASTE GENERATION →



Emissions from burning uncollected waste

INNER CITY

PRODUCE MARKET

RESIDENTIAL AREA

TEMPORARY STORAGE LOCATION

INFORMAL AREA
(outside the formal waste collection, transportation, and disposal process)



Methane



Black Carbon

METHANE AND BLACK CARBON EMISSIONS FROM THE WASTE SECTOR



← WASTE COLLECTION AND TRANSPORTATION

Emissions from waste handling equipment

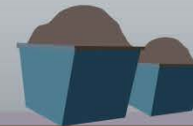


TRANSFER STATION

Emissions from trucks



SECONDARY COLLECTION



TEMPORARY STORAGE LOCATION



PRIMARY COLLECTION

METHANE AND BLACK CARBON EMISSIONS FROM THE WASTE SECTOR

WASTE DISPOSAL →



TRANSFER
STATION

TRANSPORT TO
LANDFILL

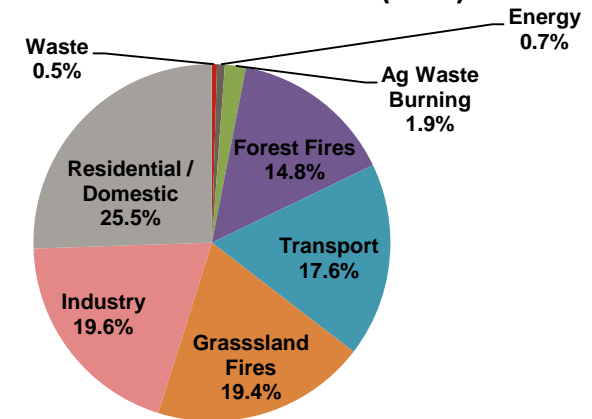
LANDFILL
OPERATIONS

Significance of SLCPs from the MSW Sector



- Black carbon
 - Unclear how much MSW sector contributes to total emissions
 - EPA estimates MSW sector accounts for 0.5% of global emissions (excludes transportation and other mobile sources)

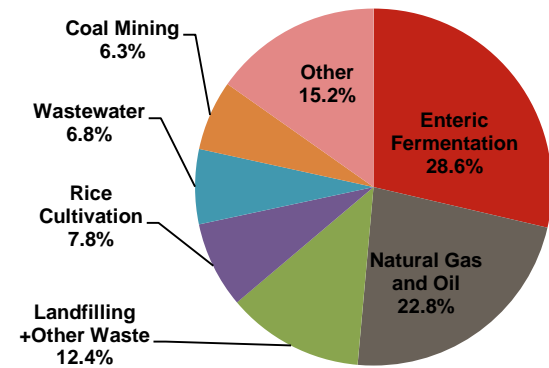
Global Black Carbon Emissions (2000)



Source: U.S. EPA. 2012. Report to Congress on Black Carbon.

- Methane
 - Contribution of the MSW sector is better understood
 - EPA estimates MSW sector accounts for 12% of global methane emissions (primarily landfills)

Global Methane Emissions (2000)



Source: U.S. EPA. 2012. Non-CO2 GHG Emissions Projections.

Mitigating SLCPs from the MSW Sector



- Cities have a range of options for mitigating SLCP emissions from the MSW sector
 - Methane
 - Capturing and using landfill gas
 - Diverting organic waste from landfills (e.g., to composting facilities or anaerobic digesters)
 - Black carbon
 - Preventing open-waste burning
 - Improving the efficiency of waste collection and handling practices
- However, cities often lack information on relative benefits of these measures (especially for climate and health)

Challenges to Estimating SLCPs from the MSW Sector



- Estimating emissions (and reductions) from the MSW sector is challenging (especially in developing countries)
 - Lack of data on MSW sector activities that contribute to SLCP emissions, such as
 - Waste generated and disposed or burned
 - Fuel consumed or miles driven by waste collection vehicles
 - Fuel consumed or hours of operation for waste handling equipment
 - Lack of SLCP- and activity-specific emissions factors for certain MSW sector sources
 - E.g., emissions factors for garbage burning depend on waste composition, atmospheric conditions, combustion characteristics, etc.

Challenges to Evaluating Climate Benefits of Mitigating SLCPs



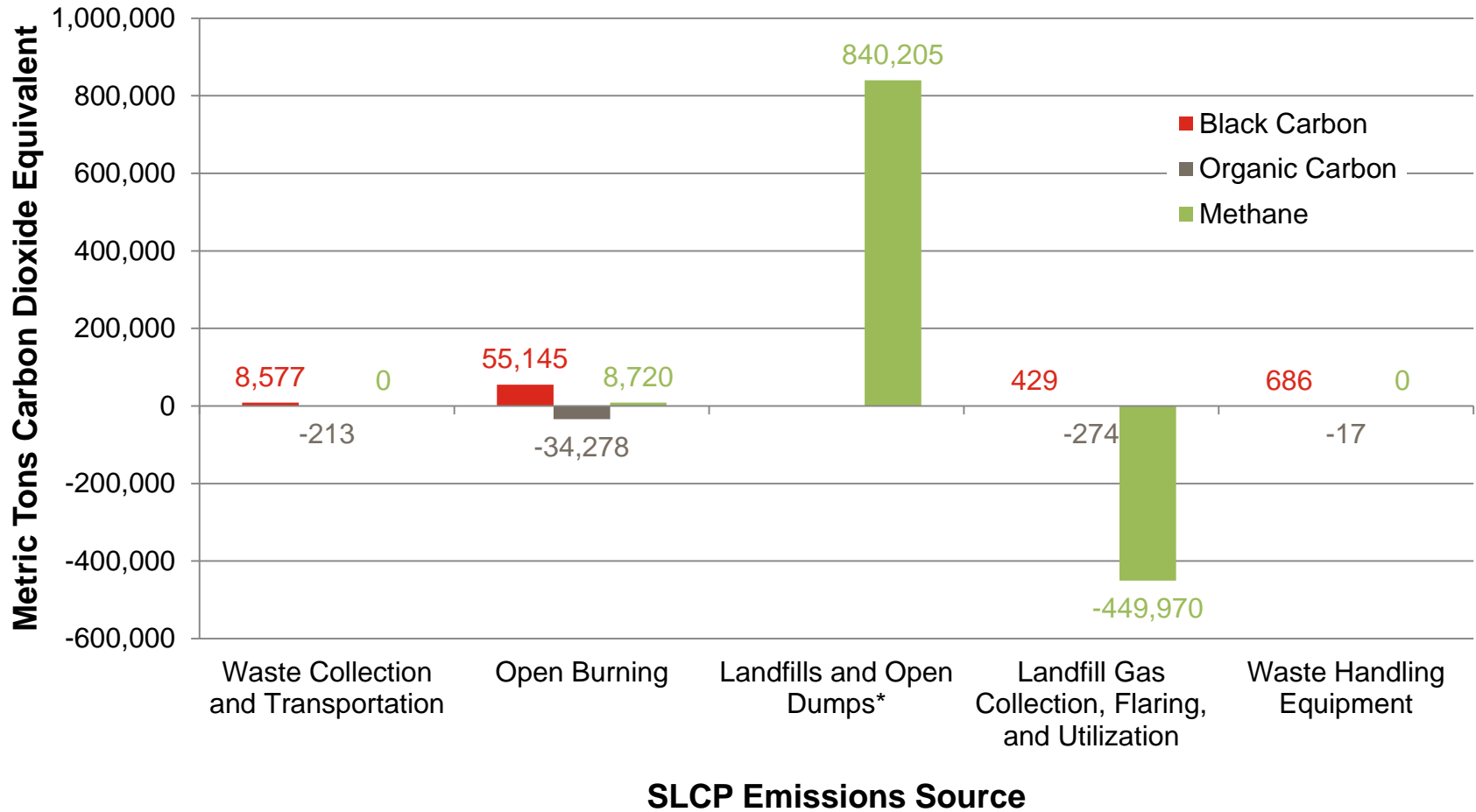
- Using an appropriate metric
 - Common metrics (e.g., GWP_{100}) used for long-lived GHGs (e.g., CO_2) are not appropriate for SLCPs
 - Black carbon is not well-mixed in the atmosphere; regionally variable climate effects (region-specific metrics)
- Accounting for the influence of co-emitted pollutants
 - Black carbon is co-emitted with other pollutants (e.g., organic carbon) that can have cooling effects on climate
 - Analyses of the benefits of emissions mitigation measures should consider the effects of all co-emitted pollutants

SLCP Baseline Emissions Estimation Tool (SLCP BEET)

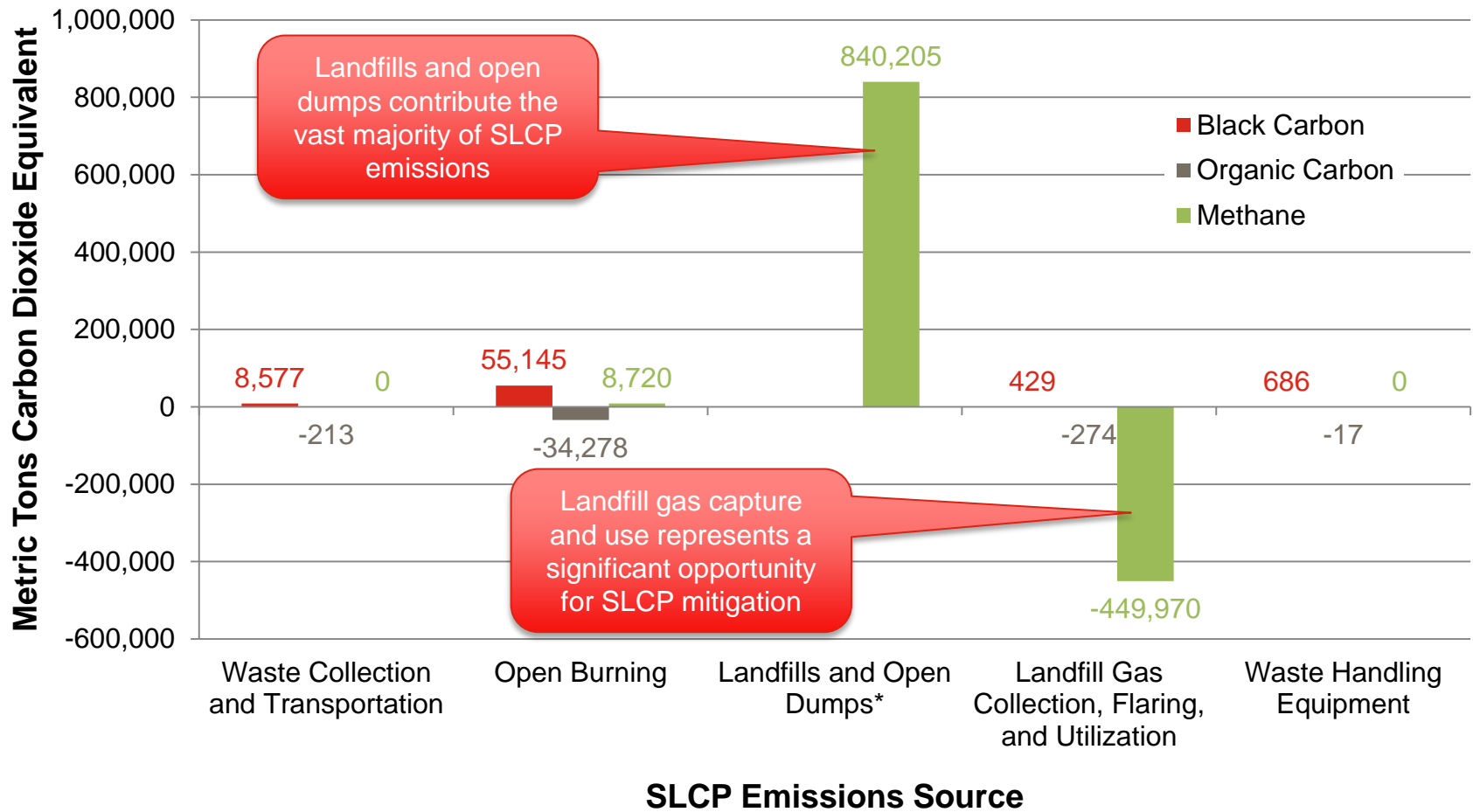


- Tool being developed by U.S. EPA, for use as part of CCAC MSW Initiative
 - Beta tested in several cities: Accra, Addis Ababa, Amman, Dhaka, Rio de Janeiro
 - Reviewed internally; still needs to be peer-reviewed
- Provides order-of-magnitude estimates of annual SLCP emissions to
 - Inform MSW management decision-making and priority setting
 - Benchmark and compare cities
- Highly automated to reduce user burden; only basic data about waste management is required
- Default values based on best-available data sources (e.g., U.S.-based emissions factors for waste collection vehicles)
- Several simplifying assumptions (e.g., globally averaged GWP_{100} of 910 for black carbon, from Bond et al., 2013)

SLCP Baseline – Amman, Jordan



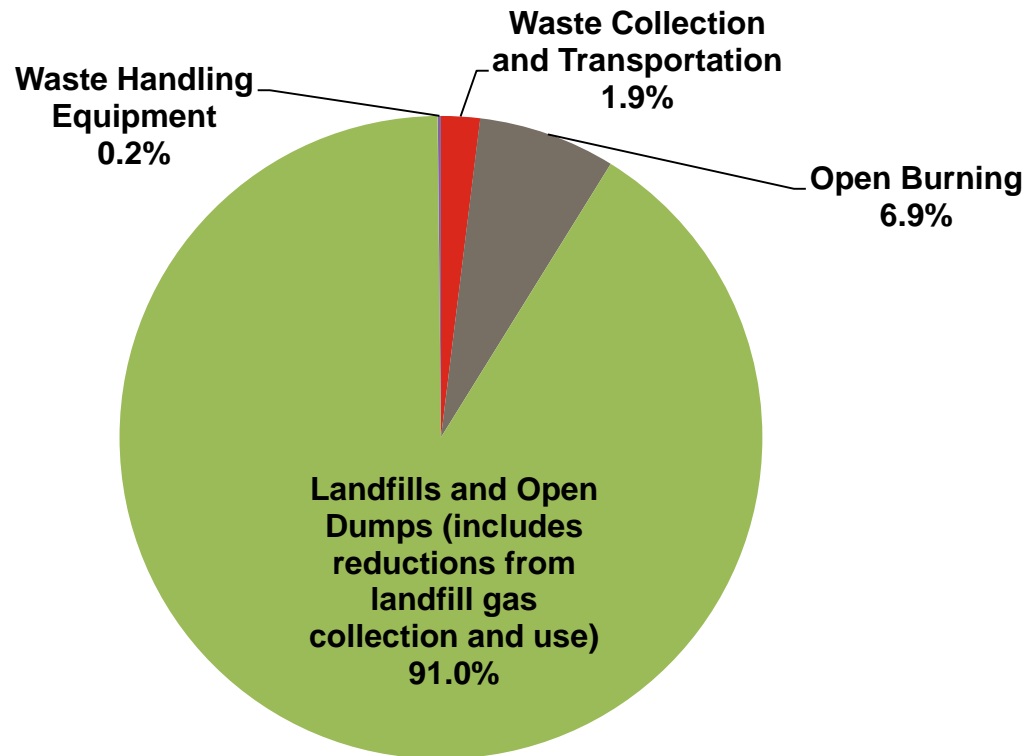
SLCP Baseline – Amman, Jordan



SLCP Baseline – Amman, Jordan



Total SLCP Emissions from MSW Sector (Metric Tons of Carbon Dioxide Equivalent)



Other CCAC SLCP-Related Tools



MSW SLCP Emissions Tool

- Being developed by the Institute for Global Environmental Studies (IGES)
- Provides order-of-magnitude estimates of SLCP emissions from MSW sector
- Evaluates alternative future scenarios
- Accounts for GHGs (CO₂, N₂O) in addition to SLCPs
- Uses different methodologies and assumptions from EPA's SLCP BEET

CCAC SLCP Toolkit

- Being developed by CCAC Secretariat
- Evaluates impacts of SLCP emissions at country-level
- Considers multiple sectors (not just MSW)
- Compares alternative emissions reduction scenarios
- Estimates cobenefits of mitigation scenarios
 - Health
 - Agricultural

Concluding Thoughts



- MSW sector is an important source of SLCP emissions (especially methane from landfills)
- Relative climate benefits of SLCP mitigation measures vary widely
- Tools can help prioritize potential SLCP mitigation measures
- Preliminary steps underway
 - Need for better data (e.g., emissions factors for representative countries)
 - Need to account for cobenefits in local-level analyses

Thank you!

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