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Attn: **Docket No. EPA-HQ-OLEM-2023-0451**

Comments in response to EPA's Notice of Availability- Waste Reduction Model version 16

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Carolyn Hoskinson, Director
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1200 Pennsylvania Avenue, NW (5306T)
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Attn: Docket No. EPA-HQ-OLEM-2023-0451

Re: Comments in response to EPA's Notice of Availability - Waste Reduction Model version 16

Dear Director Hoskinson:

Thank you for the opportunity to provide input on Version 16 of the Environmental Protection Agency's (EPA) Waste Reduction Model (WARM).

I commend the USEPA for its continuing efforts to update and expand the scope of the WARM model, which is a useful and easy-to-use tool for analyzing the potential lifecycle emission and energy savings of waste management practices, including source reduction, recycling, combustion, composting, anaerobic digestion, landfilling, and in this new version, edible food donation.

It is extremely valuable to have a tool that extends beyond the waste sector accounting[1] in the standard IPCC production-based greenhouse gas (GHG) accounting protocol, which only captures emissions from *product end-of-life* to *final disposition:* for example, the GHG impacts from shifting from incineration or landfill to composting or anaerobic digestion. For source reduction, reuse/recovery and recycling ("zero-waste") actions, focusing on this small portion of the product supply chain provides a very incomplete signal of GHG impacts. In setting priorities for investments in climate mitigation, zero waste actions are highly disadvantaged when the creators of the Climate Action Plans and other resource allocation plans rely on GHG inventory accounting to prioritize projects.

(1) WARM's inclusion of lifecycle GHG impacts of food waste actions is valuable for prioritizing climate resources, but should be augmented with missing agricultural land-use change GHG impacts.

Food waste is a high priority waste stream for source reduction, reuse/recovery and recycling. In the U.S., we waste an estimated 30%-40% of all food produced. Food residuals are typically the largest component of municipal waste streams; further, they have a very low recycling rate and represent the largest source of landfill methane emissions, in part because significant putrefaction occurs before cells and closed and gas collection systems are installed.[2]

Using a lifecycle framework, Project Drawdown ranks preventing food waste (i.e. source reduction) as either the #1 or #4 global mitigation strategy (depending upon choice of long-run

[1] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5: Waste. https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html

[2] US EPA. 2023. From Field to Bin: The Environmental Impacts of U.S. Food Waste Management Pathways. EPA/600/R-23/065.

mitigation scenario).[3] The lifecycle framework is essential to understanding the GHG mitigation potential of source reduction because, as the WARM model documentation states: "by one estimate, more than 85% of GHG emissions associated with food waste occurs upstream, before the food reaches the landfill (i.e., during production, processing and distribution.)"[4] The IPCC GHG Inventory accounting protocol also omits downstream carbon sequestration impacts from land applications of compost produced from recycling food scraps.

Strengths: The WARM coverage of lifecycle impacts from food waste management is valuable for including (1) avoided upstream GHG emissions from food waste source reduction and – new in v. 16 – edible food donation, and (2) downstream carbon sequestration gains from land application of recycling food scraps.

Recommendations: I recommend addressing two limitations, in order of priority.

a) The WARM source reduction algorithms do not include impacts from avoided agricultural land use (due either to reducing land moved into agriculture to support additional production or to allowing land currently in agricultural uses to convert to a more carbon-sequestering land use). This is a gaping omission, given that land use change is responsible for over half the GHG reductions in Project Drawdown algorithms.[5] In contrast, the source reduction and recycling algorithms *do* include forest carbon storage associated with the reduced tree harvest.

   USEPA could also include agricultural land use effects based on modeling with national and global agriculture sector or general equilibrium models, such as the ones featured at the Forestry and Agriculture Greenhouse Gas Modeling Forum sponsored by USEPA, USDA, Forestry Canada and partners or in the Agricultural Model Intercomparison and Improvement Project.[6] For example, in its new report, *Greenhouse Gas Mitigation Potential in the U.S. Forestry and Agriculture Sector*, the USEPA analyzed the impacts of alternative policies, including the land use change impacts, using three complementary models (Forestry and Agriculture Sector Optimization Model with Greenhouse Gases (FASOMGHG), Global Biosphere Management Model (GLOBIOM), and Global Timber Model (GTM)). [7]

   I recommend including estimated GHG changes due to induced agricultural land use change for the source reduction and donation pathways for food waste in WARM. The estimates should be based on results from an ensemble of models and can be reported separately from the GHG estimates for other changes along the supply chain, which are currently included in the WARM model.

b) The source reduction algorithms do not differentiate at what stage in the supply chain the food loss or waste is avoided. But the quantity of avoided emissions critically depends upon stage in the supply chain. Among its top 42 food scrap actions, ReFED has identified 31

[3] Project Drawdown's analysis uses consumption-based GHG accounting, looking at impacts all along the food supply chain. See the Project Drawdown Table of Solutions: https://drawdown.org/solutions/table-of-solutions

[4] USEPA. (2020). Documentation for greenhouse gas emission and energy factors used in the Waste Reduction Model (WARM): Organic materials chapters. https://www.epa.gov/sites/default/ files/2020-12/documents/warm_organic_materials_v15_10-29-2020.pdf.

[5] Project Drawdown. TECHNICAL SUMMARY: Reduced Food Waste: https://drawdown.org/solutions/reduced-food-waste/technical-summary. Last accessed Feb. 2, 2024.

[6] https://foragforum.org/Index.html; https://agmip.org/

[7] USEPA, Greenhouse Gas Mitigation Potential in the U.S. Forestry and Agriculture Sector, March 2024. https://www.epa.gov/system/files/documents/2024-03/epa-430-r-23-004-mitigation-report_full_report_v2.pdf

different prevention actions, which occur at all stages of the food supply chain from farm to final disposition.

I recommend differentiating GHG impacts from source reduction based on the stage in the supply chain where the food loss or waste is avoided.

(2) It is critical to managing waste investments to avoid climate tipping points that WARM model reporting provide information suited to managing over the next 25-50 years – not 100 years: reporting adjustments needed in WARM include using 20-year GWP along with 100-year GWP weights, and reporting intertemporal patterns of biogenic carbon dioxide emissions.

I highlight two issues: WARM reporting of emissions a) relies on 100-year GWP parameters to aggregate across GHGs and b) excludes biogenic carbon dioxide emissions.

In the WARM documentation, the rationale given for exclusion of biogenic carbon dioxide (CO_2) emissions is that they simply return to the atmosphere carbon that had previously been sequestered by photosynthesis and thus do not alter atmospheric CO_2 concentrations. The explanatory note in the WARM documentation acknowledges "this approach does not distinguish between the timing of CO_2 emissions, provided that they occur in a reasonably short time scale relative to the speed of the processes that affect global climate change. In other words, as long as the biogenic carbon would eventually be released as CO_2, whether it is released virtually instantaneously (e.g., from combustion) or over a period of a few decades (e.g., decomposition on the forest floor) is inconsequential." [8]

Several of EPA's peer reviewers observe that this treatment is not state of the art. In his peer review report, Dr. Matthew J. Realff highlights that we need to be managing for the next 25-50 years to avoid tipping points, and Dr. Brandon Kuczenski concurs that the position that temporal dynamics is inconsequential is not supportable. The 100-year timeframe has been used to justify ignoring biogenic CO_2 on the grounds that it has a cycling time of less than 100 years.[9] As Dr. Jeffrey Morris points out in his comment in this docket,[10] the exclusion of biogenic CO_2 subsidizes incineration over landfill, recycling, composting, anaerobic digestion, and waste prevention.

Methane's relatively short atmospheric lifetime and its strong warming potential means that -- *within the next few decades* -- actions to reduce methane emissions can slow the rate of warming and provide many other societal and environmental benefits. To understand the powerful short-term impacts of methane releases, it is critical to employ a 20-year GWP: On a 100-year timescale, methane has 27-30 times greater global warming potential than carbon dioxide and is 81-83 times more potent on a 20-year timescale. Using a 100-year GWP understates the short-term impacts of reducing landfill GHG emissions, for which methane represents a larger share than for other waste management options.

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[8] U.S. Environmental Protection Agency 2023. Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM) Background Chapters Page 1-2 (Note: the document identifies several different pages as "1-2".)

[9] Pp. 3-6. External Peer Review of EPA's Draft Waste Reduction Model (WARM) Methodology. Final Peer Review Report, December 2022. https://www.regulations.gov/document/EPA-HQ-OLEM-2023-0451-0028

[10] https://www.regulations.gov/comment/EPA-HQ-OLEM-2023-0451-0084

I note that the documentation also cites WARM's approach to biogenic carbon as consistent with IPCC inventory approaches, which focus on anthropogenic emissions. (This is a puzzling interpretation, since it is in fact anthropogenic decisions that determine how long biogenic carbon remains a sink versus being released to the atmosphere.) However, a major contribution of WARM is to go beyond the inventory approach to capture lifecycle emissions, so this does not seem relevant.

Recommendations:

- **I recommend** including accounting for fluxes of biogenic carbon dioxide along with fluxes of all other greenhouse gases.
- **I recommend** reporting emissions in CO_2-e using both 20-year and 100-year GWP weights; separate reporting of methane and CO_2 and N_2O emissions also would be valuable.

If you have any questions or comments, please contact me at email at jones@eli.org.

Respectfully submitted,

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