2025 Nebraska Statewide Material Characterization Study

WARM Analysis

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SCS acknowledges the support of the following sites and staff which have provided information and support for this Study:

- Bluff Road Solid Waste Management Facility
- Hastings Sanitary Landfill
- Lexington Area Solid Waste Agency Landfill
- Norfolk Transfer Station
- Pheasant Point Landfill – Waste Management
- Sidney Area Solid Waste Agency Landfill
- Solid Waste Agency of Northwest Nebraska Transfer Station
- Valentine Area Solid Waste Agency Landfill

1.0 EXECUTIVE SUMMARY

The Nebraska Department of Water, Energy, and Environment (DWEE) contracted with SCS Engineers (SCS) in September 2024 to conduct a 2025 Nebraska Statewide Material Characterization Study (Study) at eight landfills and transfer stations across the state over four seasons. The results from the Study informed an analysis on carbon dioxide equivalent emissions.

This report analyzed the following information for landfilled materials that could have been recovered for recycling, reuse, composting, and remanufacturing:

- **WARM Analysis –** An analysis of recyclable and compostable materials emissions reduction for carbon dioxide equivalents if diverted from landfill disposal using the United States Environmental Protection Agency's (EPA) WARM calculator model.

Table 1 (next page) shows the MSW emissions reduction for FY 2025 recyclable and compostable materials. The table lists the potential diversion of material components listed on the left and the estimated emission impacts on the right. The positive emission impact numbers indicate the metric tons of carbon dioxide equivalent emissions that could be reduced and the negative numbers indicate emissions that could be increased by the operation and activities associated with composting or recycling material.

Note: Due to rounding, aggregated data presented throughout this report may not equal exact totals or percentages.

Table 1. WARM Analysis – MSW Recyclable and Compostable Materials

WARM Material Components		2025 Analysis Tons Recycled/ Composted	2025 Analysis Emissions Reduced (MTCO2E)
Paper	Corrugated Containers	59,505	197,907
	Magazines/Third-class Mail	8,589	22,526
	Newspaper	2,963	5,520
	Office Paper	10,993	44,037
	Mixed Paper (General)	67,210	243,462
	Subtotal	**149,260**	**513,452**
Organics	Food Waste	238,413	139,281
	Yard Trimmings	89,417	-14,076
	Subtotal	**327,830**	**125,205**
Plastics	HDPE	9,309	7,249
	PET	19,078	20,146
	PP	8,599	6,999
	Subtotal	**36,985**	**34,394**
Electronics	Mixed Electronics	13,546	10,912
	Subtotal	**13,546**	**10,912**
Metal	Aluminum Cans	10,378	94,931
	Steel Cans	7,381	13,672
	Mixed Metals	16,819	74,198
	Subtotal	**34,578**	**182,801**
Glass	Glass	18,558	5,500
	Subtotal	**18,558**	**5,500**
	Overall Total	**580,758**	**872,264**

Table 2 below shows the MSW emissions reduction for FY 2025 potentially recoverable materials. The table lists the potential diversion of material components listed on the left and the estimated emission impacts on the right. The positive emission impact numbers indicate the metric tons of carbon dioxide equivalent emissions that could be reduced and the negative numbers indicate emissions that could be increased by the operation and activities associated with composting or recycling material.

Table 2. MSW Potentially Recoverable Materials WARM Analysis

WARM Material Components		2025 Analysis	
		Tons Recycled/ Composted	Emissions Reduced (MTCO2E)
Paper	Mixed Paper (General)	32,484	130,132
	Subtotal	**32,484**	**130,132**
Plastics	Mixed Plastics	75,666	71,563
	Subtotal	**75,666**	**71,563**
Construction Materials	Asphalt Shingles	6,087	670
	Concrete	5,268	158
	Dimensional Lumber	5,589	127,989
	Subtotal	**90,593**	**128,817**
	Overall Total	**198,743**	**330,513**

2.0 INTRODUCTION

This report provides the methods used to analyze the disposed of materials and the findings of the analyses utilizing data from the 2025 Nebraska Statewide Material Characterization Study (Study).

The report is organized in the following sections:

- Background
- Methodology
- Results
- Conclusion

3.0 BACKGROUND

In 2024, the Nebraska Department of Water, Energy, and Environment (DWEE) contracted with SCS Engineers (SCS) to perform an analysis on the results of the 2025 Nebraska Statewide Material Composition Study (2025 Study). The purpose of this report is to determine the emissions reduction for carbon dioxide equivalents of materials that were disposed of in Nebraska solid waste management facilities.

4.0 METHODOLOGY

This section provides the methodology of the emissions impact analysis.

4.1 WARM ANALYSIS

The Waste Reduction Model (WARM) is a tool produced by the EPA to provide comparisons of baseline and potential greenhouse gas emissions, economic impacts, and energy use. WARM Version 16 was used to generate the metric tons of carbon dioxide equivalent emissions (MTCO2E) for a baseline scenario and if materials were recycled or composted.

Once the material components from the Study were classified into recoverability terms, SCS combined various terms into two main categories: recyclable and potentially recoverable. The recyclable category includes compostable and recyclable classified material components. Both the recyclable and potential recoverable categories were used to generate the MTCO2E baselines and alternative scenario for MSW. The WARM tool provides material categories for the analysis, therefore SCS matched the material components of the Study to the tool. Appendix A lists the components utilized in the WARM analysis.

5.0 RESULTS

This section includes the methodology and results of the WARM analysis.

5.1 WARM ANALYSIS

SCS used the WARM tool from the EPA (described in Section 4.1) to perform an analysis on MSW materials that fall into the recoverability classifications of recyclable, compostable, and potentially recoverable.

SCS applied the material percentages identified in the MSW waste from the Study to reported disposed tonnages in FY 2025. It is important to note that this analysis captures emissions through the creation of material, transportation, gas collection, etc. all in relation to management of this material through recycling or composting. In some cases, there is a negative number of emissions, indicating the different management of this material has an increase of emissions as compared to the baseline.

5.1.1 MSW Material Analysis

Table 3 (next page) shows the tons that could have been recycled/composted and emissions reduced by metric tons of carbon dioxide equivalent emissions (MTCO2E) if diversion were to have occurred using FY 2025 waste disposal data. The recyclable and compostable materials account for approximately 580,000 tons annually, which represents 872,264 MTCO2E of emission reductions.

According to the EPA's Greenhouse Gas Equivalencies Calculator, this is equivalent to the energy usage of 117,142 households each year.

Table 3. MSW Recyclable/Compostable Materials WARM Analysis

WARM Material Components		2025 Analysis	
		Tons Recycled/ Composted	Emissions Reduced (MTCO2E)
Paper	Corrugated Containers	59,505	197,907
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Metal	Aluminum Cans	10,378	94,931
	Steel Cans	7,381	13,672
	Mixed Metals	16,819	74,198
	Subtotal	**34,578**	**182,801**
Glass	Glass	18,558	5,500
	Subtotal	**18,558**	**5,500**
	Overall Total	**580,758**	**872,264**

Table 4 on the following page displays the results for potentially recoverable materials in the MSW waste stream from FY 2025 that may have been diverted to reduce CO2 emissions. Potentially recoverable materials account for nearly 200,000 tons of MSW disposal annually. Had the potentially recoverable materials been recycled, a reduction of approximately 330,000 MTCO2E in

emissions may have been realized, which is equivalent to the energy usage of 44,318 households each year (EPA Greenhouse Gas Equivalencies Calculator).

Table 4. MSW Potentially Recoverable Materials WARM Analysis

WARM Material Components		2025 Analysis	
		Tons Recycled/ Composted	Emissions Reduced (MTCO2E)
Paper	Mixed Paper (General)	32,484	130,132
	Subtotal	**32,484**	**130,132**
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Construction Materials	Asphalt Shingles	6,087	670
	Concrete	5,268	158
	Dimensional Lumber	5,589	127,989
	Subtotal	**90,593**	**128,817**
	Overall Total	**198,743**	**330,513**

6.0 CONCLUSION

The WARM analysis determined that recycling, composting, or diverting of nearly 780,00 tons annually of FY 2025 MSW could lead to over 1,200,000 MTCO2E in emission reductions. This information encourages opportunities for diversion by providing evidence of materials available to expand and create recycling and composting programs. This increase in materials being processed would likely need to be supported by an increase in education, infrastructure, and labor.

The diversion of waste from disposal at landfills supports a circular system leading to a sustainable materials management (SMM) system. There are multiple benefits to recovering materials for recycling and reuse such as: increasing jobs for processing materials, adding revenue for the sale of recyclable materials, reducing metric tons of carbon dioxide equivalent emissions, and extending landfill life. Not only does this create a more sustainable system of materials management in Nebraska, but it also increases the general well-being of the public by protecting Nebraska's land, water, and air through reducing emissions.

Appendix A

MSW Material Components Used in WARM Analysis

2025 MSW Components - Compostable & Recyclable

Material	2025 Study Component(s)
Corrugated Containers	Corrugated Cardboard
Magazines/Third-class Mail	Magazines
Newspaper	Newsprint
Office Paper	Office Paper
Phonebooks	
Textbooks	
Mixed Paper (general)	Mixed Paper, Paperboard/Linerboard
Mixed Paper (primarily residential)	
Mixed Paper (primarily from offices)	
Food Waste	Food Waste - Unpkgd, Food Waste - Pkgd, Compostable Paper
Food Waste (non-meat)	
Food Waste (meat only)	
Beef	
Poultry	
Grains	
Bread	
Fruits and Vegetables	
Dairy Products	
Yard Trimmings	Yard Waste
Grass	
Leaves	
Branches	
HDPE	Natural HDPE #2, Colored HDPE #2
LDPE	
PET	PET #1, Plastic Single-Use Beverage Containers
LLDPE	
PP	PP #5
PS	
PVC	
Mixed Plastics	
PLA	
Desktop CPUs	
Portable Electronic Devices	
Flat-Panel Displays	
CRT Displays	
Electronic Peripherals	
Hard-Copy Devices	
Mixed Electronics	Electronic Waste
Aluminum Cans	Aluminum Cans, Metal Single-Use Beverage Containers
Aluminum Ingot	
Steel Cans	Steel/Tin Containers

2025 MSW Components - Compostable & Recyclable (cn.)

Material	2025 Study Component(s)
Copper Wire	
Mixed Metals	Other Ferrous Scrap, Other Non-Ferrous Scrap, Other Metals
Glass	Clear, Brown, Green, Blue, Glass Single-Use Beverage Containers
Asphalt Concrete	
Asphalt Shingles	
Carpet	
Clay Bricks	
Concrete	
Dimensional Lumber	
Drywall	
Fiberglass Insulation	
Fly Ash	
Medium-density Fiberboard	
Structural Steel	
Vinyl Flooring	
Wood Flooring	
Tires	
Mixed Recyclables	
Mixed Organics	
Mixed MSW	

2025 MSW Components - Potentially Recoverable

Material	2025 Study Component(s)
Corrugated Containers	
Magazines/Third-class Mail	
Newspaper	
Office Paper	
Phonebooks	
Textbooks	
Mixed Paper (general)	Other Paper/Non-Recyclable Paper
Mixed Paper (primarily residential)	
Mixed Paper (primarily from offices)	
Food Waste	
Food Waste (non-meat)	
Food Waste (meat only)	
Beef	
Poultry	
Grains	
Bread	
Fruits and Vegetables	
Dairy Products	
Yard Trimmings	
Grass	
Leaves	
Branches	
HDPE	
LDPE	
PET	
LLDPE	
PP	
PS	
PVC	
Mixed Plastics	Film and Bags, Retail Shopping Bags
PLA	
Desktop CPUs	
Portable Electronic Devices	
Flat-Panel Displays	
CRT Displays	
Electronic Peripherals	
Hard-Copy Devices	
Mixed Electronics	
Aluminum Cans	
Aluminum Ingot	
Steel Cans	

2025 MSW Components - Potentially Recoverable (cn.)

Material	2025 Study Component(s)
Copper Wire	
Mixed Metals	
Glass	
Asphalt Concrete	
Asphalt Shingles	Roofing Materials
Carpet	
Clay Bricks	
Concrete	Concrete
Dimensional Lumber	Untreated Wood, Treated Wood
Drywall	
Fiberglass Insulation	
Fly Ash	
Medium-density Fiberboard	
Structural Steel	
Vinyl Flooring	
Wood Flooring	
Tires	
Mixed Recyclables	
Mixed Organics	
Mixed MSW	