Natural Resources Defense Council

2016

Waste Audit Report for New York Headquarters

Facilities Department

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Waste Audit Report for Natural Resources Defense Council NYC Headquarters

[Executive Summary]

On April 28th, 2016 NRDC's Facilities team performed a waste audit of the New York Office to measure the effectiveness of recycling and composting practices by staff. Data on contamination (improperly sorted waste) by bin (landfill, plastic/metal/glass recycling, paper recycling, and compost) were collected by two Facilities team members and a group of staff volunteers. The waste audit indicates that composting, plastic/metal/glass (PMG) recycling, and paper recycling are largely effective (0.27%, 14.24%, 28.23% contamination respectively), while landfill waste management must be significantly improved (71.1% contamination). Our waste stream was 54.4% compostable, whereas only 42.1% of our stream was deliberately composted. By applying the observed contamination factors to historical data, Facilities estimated that *6.23 tons* $C0_2e$ were emitted in FY15 due to incorrect sorting of recyclables and compostables. Given the need for improvement, a set of waste management improvement strategies in areas of assessment, educational opportunities, and incentives are recommended.

Introduction

The NRDC NY Facilities team, along with two volunteers, performed an unannounced waste audit on April 28th, 2016 in order to better understand and improve the waste management and diversion process across the office. The audit was recommended given the office's participation in the Zero Waste Challenge, an initiative led by the NYC Mayor's Office of Sustainability to encourage commercial waste diversion. By performing the audit, Facilities was able to gauge the accuracy of waste-sorting by staff by measuring the amount of *contamination*, or improperly sorted waste, in each waste stream bin: landfill, plastic/metal/glass (PMG) recycling, paper recycling, and compost. The resulting data was analyzed to assess the effectiveness of our Zero Waste Challenge strategies, and to inform our future recommendations and improvement goals.

Audit Procedure

The waste audit was performed by a member of the NY Facilities team with assistance from a DC Facilities member with prior knowledge and experience in performing waste audits. The team had significant assistance from four additional NRDC employees, who, through the process, realized the necessity of obtaining accurate and thorough data.

Sample Interval

The team chose to perform the unannounced waste audit on a day where normal operations were taking place (i.e. meetings, substantial attendance). In order to avoid any potential selection bias, the waste audit was unannounced. All five floors were audited so that comparable data sets were collected. The waste audit was performed from 3pm-5pm to ensure that the sample collected was representative of a full day's waste output – about 7 hours' worth. The waste audit used all waste generated that was disposed of in the kitchens on each floor in the sample period.

Scope and Procedure

The project team measured the waste by weight, in pounds, using a mechanical vertical hanging scale. For each bin, i.e. landfill bin, the team hand-sorted the bag by type of waste: landfill, PMG recycling, paper recycling, and compost. Each constituent pile was then weighed separately. This process was repeated for each of the four waste streams.

Given the team's focus on staff sorting in kitchen areas, cardboard was deemed outside the scope of the audit. In general, corrugated cardboard and other packaging materials are dealt with on a case-by-case basis through Facilities or Building Management and stored in freight areas on each floor, resulting in a stream largely uncontaminated and removed from staff intervention.

Similarly, e-waste, while recycled at the NY Office, was not considered in this scope, as collection times are limited to two or three dates per year and managed by IT.

Results

Tables 1-6 represent the data that were collected from the waste audit. The original weights of each stream were measured in pounds. The total weight was calculated by summing the potential landfill, potential PMG recycling, potential paper recycling, and potential compost values for each waste category and location. The percentages were calculated by dividing the pound value of each waste category by the total pound value.

The formula for the percentages is as follows:

$$\frac{Weight\ of\ Individual\ Waste\ Category}{Total\ Weight\ of\ Potential\ Compost, PMG\ Recycling, Paper\ Recycling, Landfill} \times 100 = Percent\ of\ Waste\ Total\ for\ Individual\ Waste\ Category$$

In each column of tables 1-5 – results by floor – the emboldened number represents the weight (absolute and as a percentage) of appropriately sorted waste. A number close to 100% reflects low contamination, with contamination increasing as percentage falls. Table 6 sums data from all five floors, with an additional *Total Contamination* row indicating overall contamination of each waste stream for the NY office.

Floor: 8	**Landfill Bin (lb., % of total)**	**PMG Recycling Bin (lb., % of total)**	**Paper Recycling Bin (lb., % of total)**	**Compost Bin (lb., % of total)**
Potential Landfill	**1.0, 21%**	0.4, 7%	-	-
Potential PMG Recycling	0.7, 15%	**5.0, 83%**	-	-
Potential Paper Recycling	0.1, 2%	-	**0.9, 90%**	-
Potential Compost	2.9, 62%	0.6, 10%	0.1, 10%	**3.3, 100%**
Total	4.7, 100%	6.0, 100%	1.0, 100%	3.3, 100%

Table 1: *Waste Audit Results for Floor 8*

Floor: 9	**Landfill Bin (lb., % of total)**	**PMG Recycling Bin (lb., % of total)**	**Paper Recycling Bin (lb., % of total)**	**Compost Bin (lb., % of total)**
Potential Landfill	**0.9, 31%**	0.8, 7%	0.1, 17%	-
Potential PMG Recycling	0.5, 17%	**9.1, 83%**	-	-
Potential Paper Recycling	0.1, 4%	0.1, 1%	**0.4, 67%**	-
Potential Compost	1.4, 48%	1.0, 9%	0.1, 16%	**8.9, 100%**
Total	2.9, 100%	11.0, 100%	0.6, 100%	8.9, 100%

Table 2: *Waste Audit Results for Floor 9*

Floor: 10	**Landfill Bin (lb., % of total)**	**PMG Recycling Bin (lb., % of total)**	**Paper Recycling Bin (lb., % of total)**	**Compost Bin (lb., % of total)**
Potential Landfill	**0.8, 32%**	0.5, 8%	-	-
Potential PMG Recycling	0.5, 20%	**5.9, 91%**	-	
Potential Paper Recycling	0.1, 4%	-	**0.4, 100%**	-
Potential Compost	1.1, 44%	0.1, 1%		**9.6, 100%**
Total	2.5, 100%	6.5, 100%	0.4, 100%	9.6, 100%

Table 3: *Waste Audit Results for Floor 10*

Floor: 11	**Landfill Bin (lb., % of total)**	**PMG Recycling Bin (lb., % of total)**	**Paper Recycling Bin (lb., % of total)**	**Compost Bin (lb., % of total)**
Potential Landfill	**1.1, 29%**	0.4, 14%	0.5, 72%	0.1, 1%
Potential PMG Recycling	0.6, 16%	**2.1, 75%**	0.1, 14%	-
Potential Paper Recycling	0.1, 3%	0.1, 4%	**0.1, 14%**	-
Potential Compost	2.0, 52%	0.2, 7%	-	**10.2, 99%**
Total	3.8, 100%	2.8, 100%	0.7, 100%	10.3, 100%

Table 4: *Waste Audit Results for Floor 11*

Floor: 12	**Landfill Bin (lb., % of total)**	**PMG Recycling Bin (lb., % of total)**	**Paper Recycling Bin (lb., % of total)**	**Compost Bin (lb., % of total)**
Potential Landfill	**1.4, 34%**	-	-	-
Potential PMG Recycling	0.8, 20%	**3.2, 100%**	-	-
Potential Paper Recycling	0.6, 14%		**0.5, 100%**	
Potential Compost	1.3, 32%	-	-	**5.0, 100%**
Total	4.1, 100%	3.2, 100%	0.5, 100%	0.5, 100%

Table 5: *Waste Audit Results for Floor 12*

Overall	**Landfill Bin (lb., % of total)**	**PMG Recycling Bin (lb., % of total)**	**Paper Recycling Bin (lb., % of total)**	**Compost Bin (lb., % of total)**
Potential Landfill	**5.2, 28.9%**	2.1, 7.1%	0.6, 18.8%	0.1, 0.3%
Potential PMG Recycling	3.1, 17.2%	**25.3, 85.8%**	0.1, 3.1%	-
Potential Paper Recycling	1, 5.6%	0.2, 0.7%	**2.3, 71.9%**	-
Potential Compost	8.7, 48.3%	1.9, 6.4%	0.2, 6.3%	**37, 99.7%**
Total	18, 100%	29.5, 100%	3.2, 100%	37.1, 100%
Total Contamination[1]	**71.11%**	**14.24%**	**28.13%**	**0.27%**

Table 6: *Waste Audit Results for All Floors*

[1] Defined above as improperly sorted waste (e.g. compost in bins designated for landfill)

See graphs 1-5 for graphical breakdowns of waste composition and contamination results. Each bar represents a waste bin. Each color reflects a composite stream for each bin. The appropriately sorted portion (e.g. landfill in the landfill bin) is outlined in yellow.

Graph 6 represents total contamination across all bins. The waste audit indicates that composting, plastic/metal/glass (PMG) recycling, and paper recycling are largely effective (.27%, 14.24%, 28.23% contamination respectively), while landfill waste management must be significantly improved (71.1% contamination). Additionally, our waste stream was 54.4% compostable, whereas only 42.1% of our stream was deliberately composted.

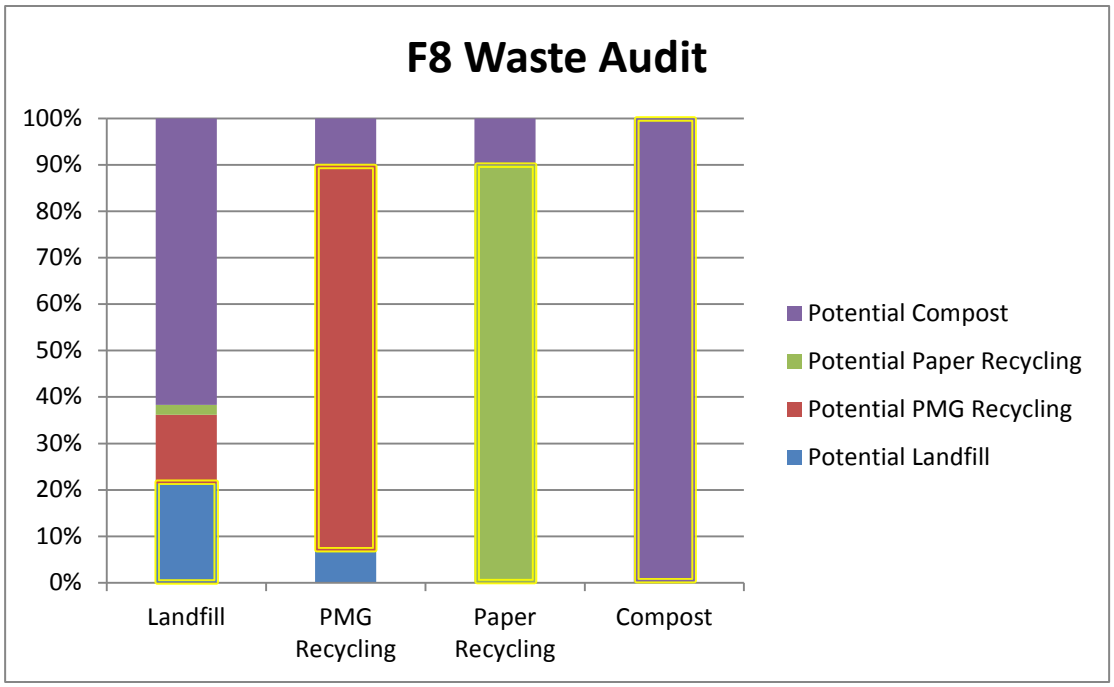

***Chart 1**: Floor 8 Waste Composition Breakdown.*

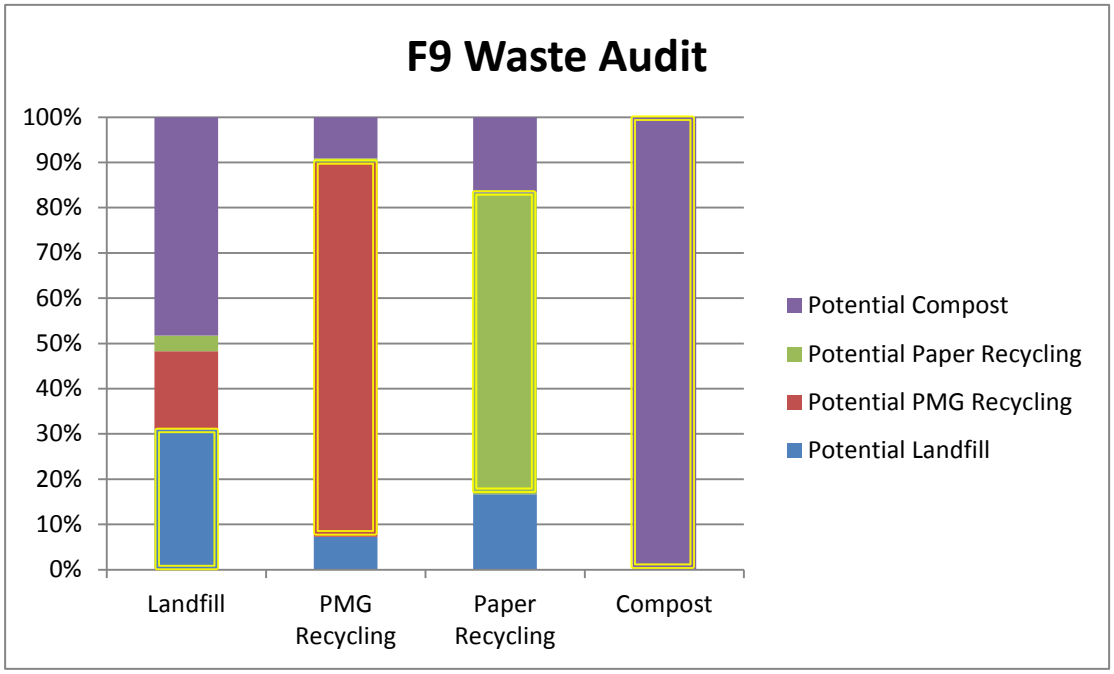

***Chart 2**: Floor 9 Waste Composition Breakdown*

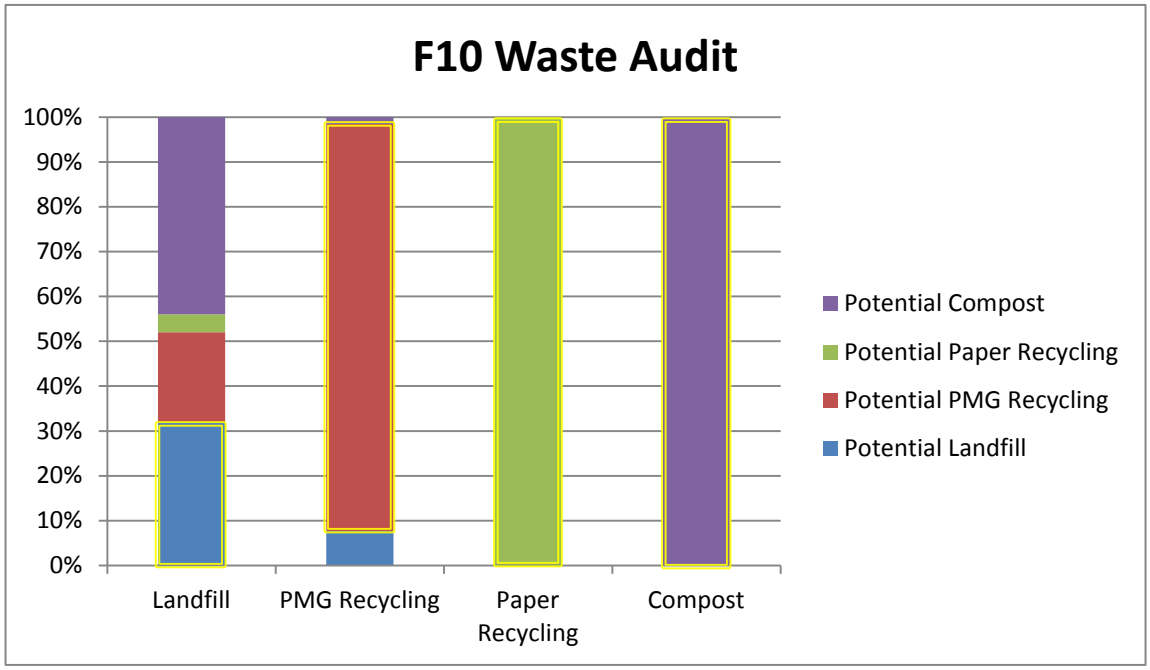

***Chart 3**: Floor 10 Waste Composition Breakdown*

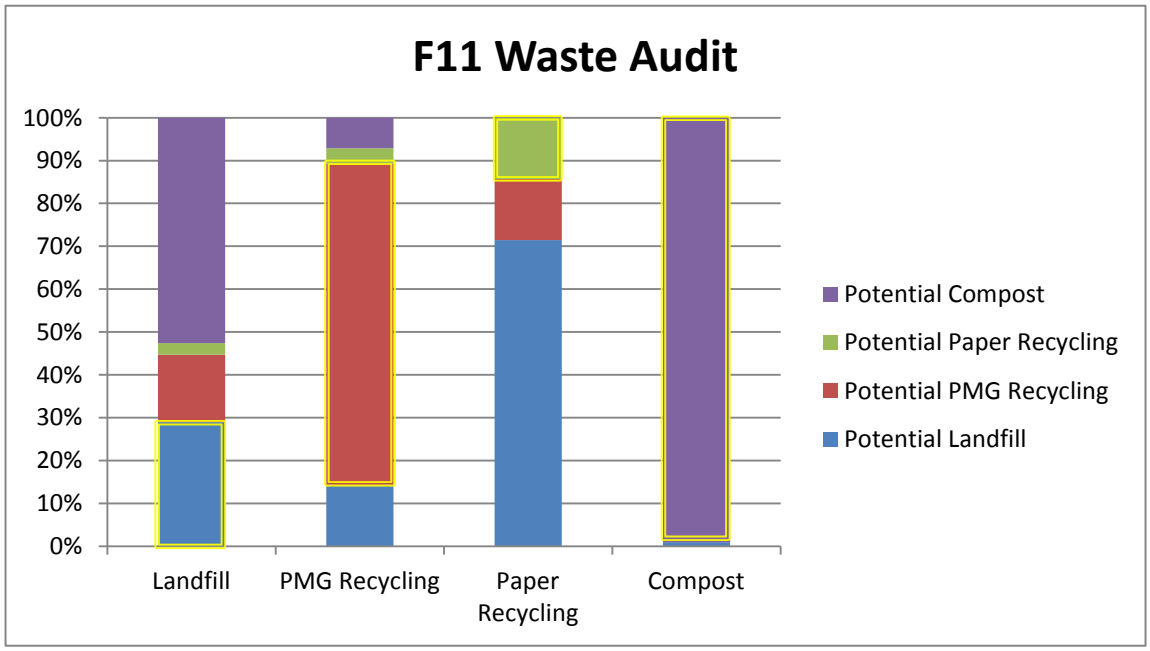

***Chart 4**: Floor 11 Waste Composition Breakdown*

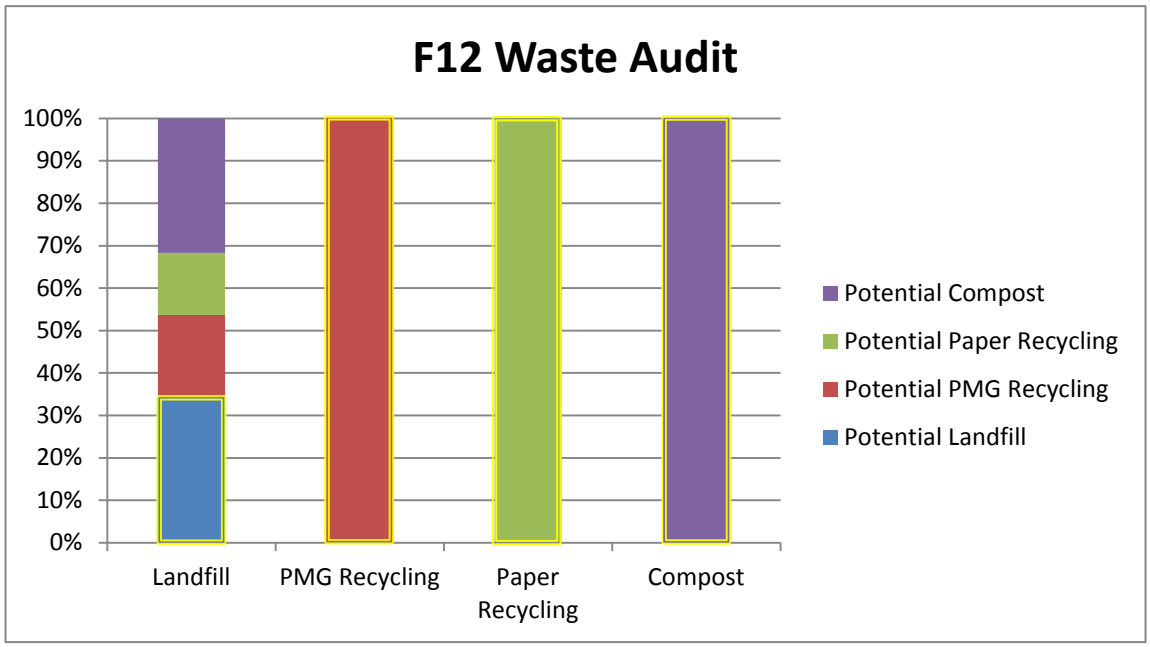

***Chart 5**: Floor 12 Waste Composition Breakdown*

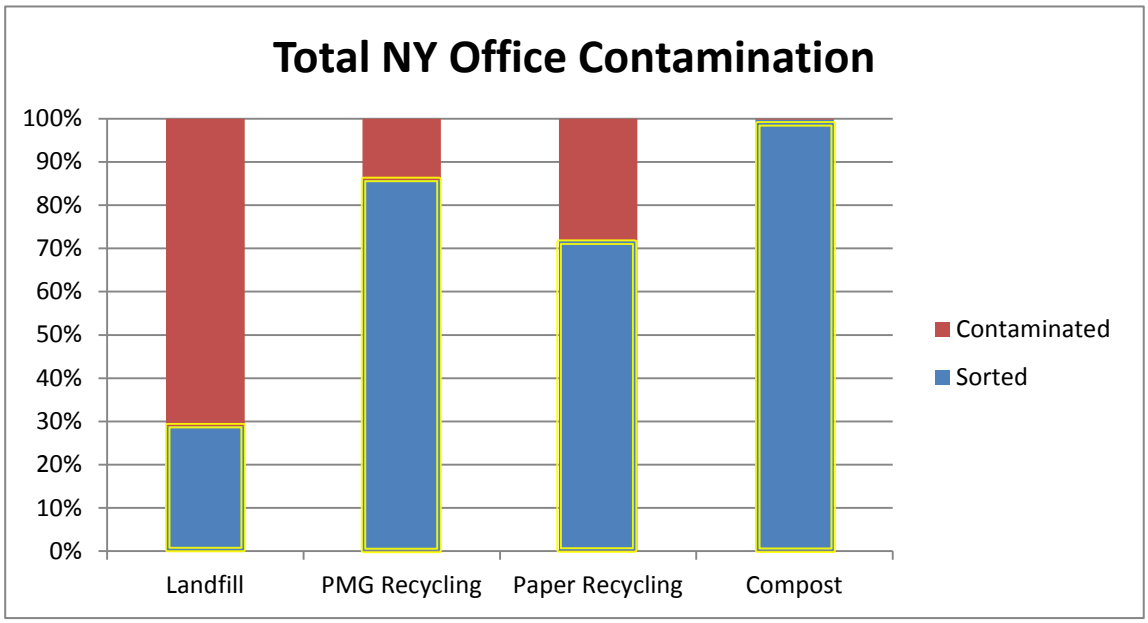

***Chart 6:** NY office Total Waste Stream Contamination*

Summary

The NRDC NY office waste audit indicates that composting and recycling are largely effective, while landfill waste management must be significantly improved. The following conclusions can be made based on the unannounced waste audit:

Composting

1. **Across all floors, compost had the least amount of contamination (<1% overall).**
    a. These findings were consistent with our expectations that those who were unsure of an item's 'compostability' erred on the side of caution. Composting occurred when staff was certain that the item was appropriate (i.e. fruits, vegetables, used coffee grounds).

Recycling

1. **Across all floors, PMG & paper recycling had low amounts of contamination (14.24%, 28.13% respectively).**
    a. Potential landfill contamination (7.1%) in PMG recycling stemmed mostly from plastic films (plastic wrap, bags), which are easily confused for recyclable rigid plastics. Unwashed containers also contributed to contamination (plastic lunch containers, ice coffee cups), as soiled recyclables will often be turned away from recycling facilities.
    b. Potential compost contamination (6.4%) was largely attributed to compostable silverware, much of which looks like recyclable plastic.
    c. Napkins and compostable containers made up a significant portion of all paper recycling contamination.
    d. Waxed paper was often discarded in paper recycling. Similarly, soiled paper (greasy) was discarded in paper recycling. In both instances, the paper is unable to be recycled because of its moisture resistance.

Landfill

1. **Across all floors, landfill was the most contaminated (71.1% overall). This represents a significant opportunity to improve landfill diversion practices.**
    a. Nearly half of all landfill (48.3%) should have been composted. Common items included napkins, leftovers, compostable bowls and takeout containers.
    b. Takeout packaging (from wrapped sandwiches, etc.) were often disposed of in landfill bins, instead of separated into appropriate recycling streams.
    c. Coffee cups were not properly sorted into paper and PMG recycling.

Moving Forward

Significant improvements can be made to enhance our current waste management practices. Facilities' goal is 5% contamination for landfill, PMG recycling, and paper recycling, and maintaining current composting practices at below 5% contamination. Opportunities for enhanced waste management practices can be separated into the three strategic classes below:

Assess

1. Perform additional unannounced waste audits to continue evaluation of management practices at regular intervals (bi-yearly). This provides insight into the NY office's progress and helps shape strategic planning for our future waste management systems.
2. Assess procurement options for Facilities and building management teams.
    a. A number of refrigerator water filters were found in our landfill stream. In this case, an opportunity exists to look into products that can be returned to their manufacturer at the end of their lifecycle.
3. Although outside the scope of this analysis, continue our daily weight audits to ensure for increased diversion *and* overall waste reduction.

Educate

1. Distribute the waste audit to staff in order to draw attention towards areas of concern regarding recycling and composting practices.
2. Send out a comprehensive email describing common misconceptions regarding certain items as observed during the waste audit alongside monthly Zero Waste Challenge updates.
    a. Plastic film vs rigid plastics, importance of washing recyclables, tin foil, compostable cutlery & containers, waxed and soiled paper
3. Place a new uniform set of signage throughout the office that clearly states the requirements for each waste category.
    a. Ensure signage reflects items found in bins that were not properly disposed of, i.e. napkins, compostable cutlery, cleaned containers.
4. Host an in-person training session or training video to distribute throughout the office on the subject of waste management practices.

Incentivize

1. Positive Incentives
    a. Given additional audits, provide rewards to floors who improve their waste sorting practices. Improvement can be assessed in a variety of ways (overall least contamination, most improved, etc.)
2. Negative Incentives
    a. Confront staff by displaying misplaced items above bins, in kitchen areas. This may leave a lasting impression on staff who otherwise would have not noticed the sorting error.

From A Carbon Savings Perspective

A carbon dioxide equivalent ($C0_2e$) emissions impact associated with contamination was calculated using NY office waste output data recorded for calendar year (CY) 2015. This estimation was derived using emissions factors from the Environmental Protection Agency's Waste Reduction Model (WARM), a model developed to help organizations and local governments report greenhouse gas emissions reductions and energy savings from several different waste management practices.[2]

To estimate the footprint, CY 2015 weights for each stream were broken down into constituent streams (Potential Landfill, PMG Recycling, Paper Recycling, and Compost) by applying overall percentage breakdowns observed in our audit (see table 6). After estimating contamination by weight, EPA $C0_2e$ factors were applied to each form of contamination to calculate the amount of associated $C0_2e$ emissions. In short, this carbon emissions estimate reflects the amount of $C0_2e$ that would be avoided if misplaced recyclables and compost were recycled in the appropriate stream, instead of diverted towards landfill.

The emissions factors vary by material and depend on (1) the quantity generated; (2) the differences in energy use for manufacturing a product from virgin versus recycled inputs; and (3) the potential contribution of materials to CH_4 generation in landfills.[3] Additional features, such as landfill gas (LFG) control system and transportation characteristics are internalized in these categories. The emissions factors applied in these calculations assume a LFG "national average," based on the proportions of landfills with LFG control in 2012. Likewise, average transportation estimates, varying by type of waste, were internalized.

Per EPA $C0_2e$ factor estimates, roughly **6.23 tons of $C0_2e$** would have been avoided over the course of CY 2015 by correctly sorting waste. This estimate is equivalent to the emissions associated with a year's worth of driving between one and two cars.[4] See Table 7 and 8 for further detail and supporting data.

For this estimate, it is assumed that contaminated waste is always diverted towards landfill in isolation. Under this assumption, compost contamination found in a paper recycling stream is ultimately sorted out and landfilled. While this may generally be the case (and a certainty for contaminated landfill streams), our emissions impact may be understated if contaminated recycling streams are landfilled in bulk rather than sorted through. Take a bin of soiled paper – instead of landfilling only the particularly greasy items, the whole bin may be turned away from the facility towards a landfill. In this case, a significantly greater opportunity arises from reducing waste stream contamination.

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[2] Environmental Protection Agency, March 2015. *Waste Reduction Model (WARM). https://www3.epa.gov/warm/Warm_Form.html (May 10 , 2016).*

[3] Environmental Protection Agency, March 2015. *Waste Reduction Model (WARM) Supporting Documentation.* https://www3.epa.gov/warm/pdfs/WARM_Documentation.pdf (May 10, 2016)

[4] Nunez and Pavely, 2007. *AB 32*. California Air Resources Board. www.arb.ca.gov (May 10, 2016).

Even in light of our assumptions, the magnitude of our estimated carbon impact associated with contamination is relatively small. However, significant value exists both in our ability to improve our waste management system internally, and to leverage NRDC's unique position as a leader in environmental stewardship. A far-reaching impact can arise given our management system's translatability across organizational boundaries. By sharing these experiences and strategies to businesses with more substantial waste footprints, we can make significant strides in reducing landfill waste and associated carbon emissions across NRDC, New York City, and beyond.

Estimated Breakdown of CY 2015 Waste Stream	**Landfill (lb.)**	**PMG Recycling (lb.)**	**Paper Recycling (lb.)**	**Compost (lb.)**
CY 2015 Recorded Weights	**9545.5**	**1312.1**	**11650.9**	**4888.4**
Potential Landfill *Estimate*	2757.6 (9545.5*.289)	93.40 (1312.1*.071)	2184.54 (11650.9*.188)	13.18 (4888.4*.003)
Potential PMG Recycling *Estimate*	1643.9 (9545.5*.172)	1125.29 (1312.1*.858)	364.09 (11650.9*.031)	-
Potential Paper Recycling *Estimate*	530.31 (9545.5*.056)	8.89 (1312.1*.007)	8374.08 (11650.9*.719)	-
Potential Compost *Estimate*	4613.7 (9545.5*.483)	84.51 (1312.1*.064)	728.18 (11650.9*.063)	4875.22 (4888.4*.997)

***Table 7**: Estimated Breakdown of CY 2015 Waste Stream by type and contamination. Calculations are provided for clarification underneath each estimate. For example, in CY 2015, 9545.5 lbs. of waste was recorded as generated towards landfill. Contamination factors, calculated in the waste audit, were applied to estimate contamination weights for CY 2015. For instance, 48.3% of all landfill waste should have been placed in compost. This 48.3% compost contamination factor was applied to overall CY 2015 output, resulting in an estimated 4613.7 lbs. of landfill waste that should have been diverted as compost.*

	Total Misplaced to Landfill (lb.)	**Total Misplaced to Landfill (ton)[5]**	**Emissions factor[6] (t C02e avoided / t waste diverted)**	**Potential t C02e savings**
PMG Recycling	2008.04	.911	*3.45*	3.14
Paper Recycling	539.20	.244	*3.78*	.924
Compost	5426.35	2.46	*.88*	2.17
			CY 2015 Estimate	**6.23 t C02e**

***Table 8**: Estimated t C02e Emissions Associated with Contamination CY2015*

[5] lb. to ton conversion = 0.00045359

[6] Environmental Protection Agency, March 2015. *Waste Reduction Model (WARM).* https://www3.epa.gov/warm/Warm_Form.html *(May 10, 2016).*