Landfill Airspace Efficiency

The Right Equipment And The Right Amount of Soil

Matt Kingsley, PE Frank Pugsley

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Agenda

- Airspace Measurement & Units
  - Airspace Utilization Density (AUD)
  - Landfilled Waste Density
  - Landfill Cover Soil Utilization
  - Cover Soil vs. Density
- Achievement of Airspace Goals
  - Post-Collection Safety
  - Personnel & Leadership
  - Equipment Selection
  - Equipment Maintenance

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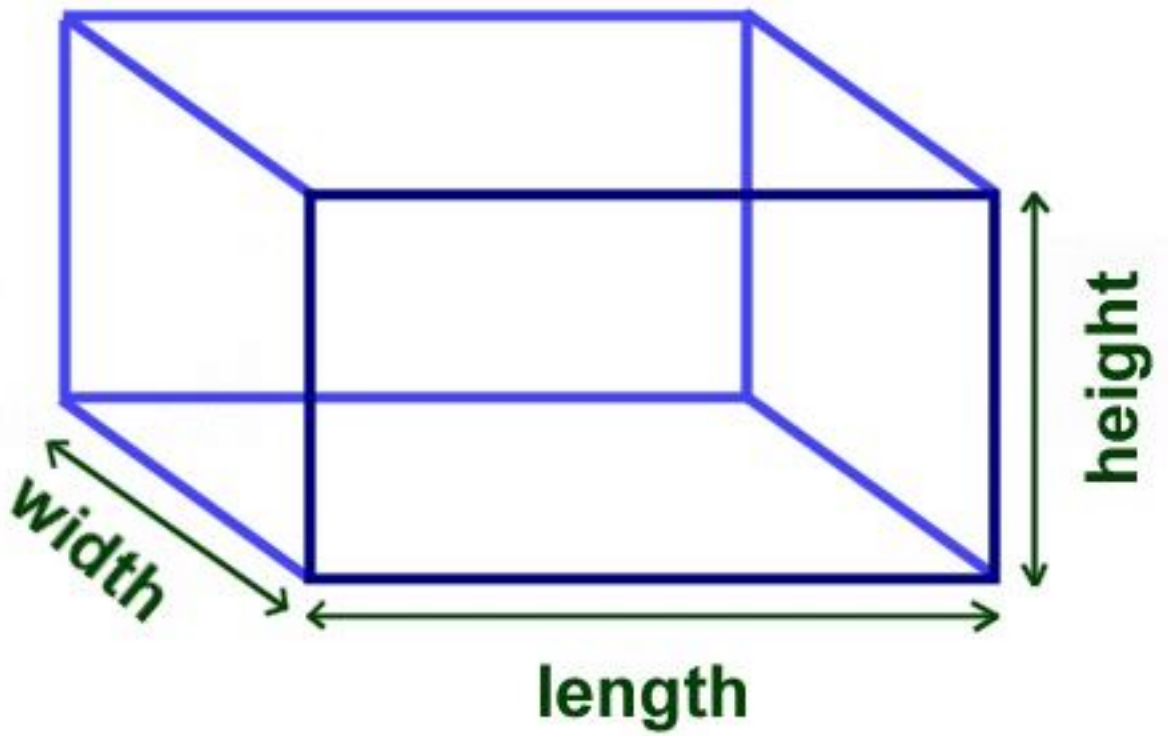
What Are We Measuring?

- Airspace – The volume of space which is permitted for disposal
  - Saleable commodity
  - Community Resource
- Bulk Density – Weight of a unit volume
  - Weight / Volume
  - Pounds per Cubic Yard



What Are We Measuring?

- Landfilled Waste Density
  - Compaction efficiency reporting parameter
- Airspace Utilization Density (AUD)
  - Primary landfill performance reporting parameter

Landfill Airspace Utilization

Landfilled Waste Density

$$\frac{\text{Weight (of waste)}}{\text{Volume (of waste)}}$$

Volume in this equation should not include soil

Landfill Airspace Utilization

Airspace Utilization Density

$$\frac{\text{Weight (of waste)}}{\text{Volume (of airspace)}}$$

Volume in this equation should include soil, material used in roads, etc.

Effect of Including or Excluding Cover Soil Volume on Density

- Weight of Waste – 1,000 pounds
  - Volume of compacted waste – 1 CY
- Waste-to-Soil Ratio – 4:1 (80% waste, 20% soil by volume)

LWD excluding soil – 1,000 lb/CY (1 CY of waste)

AUD including soil – 800 lb/CY (1.25 CY total volume consumed)

Note: To achieve 1,200 lb/CY excluding soil, waste must be compacted to half its volume out of the truck.

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Landfill Airspace Utilization

AUD has short-term and long-term values.

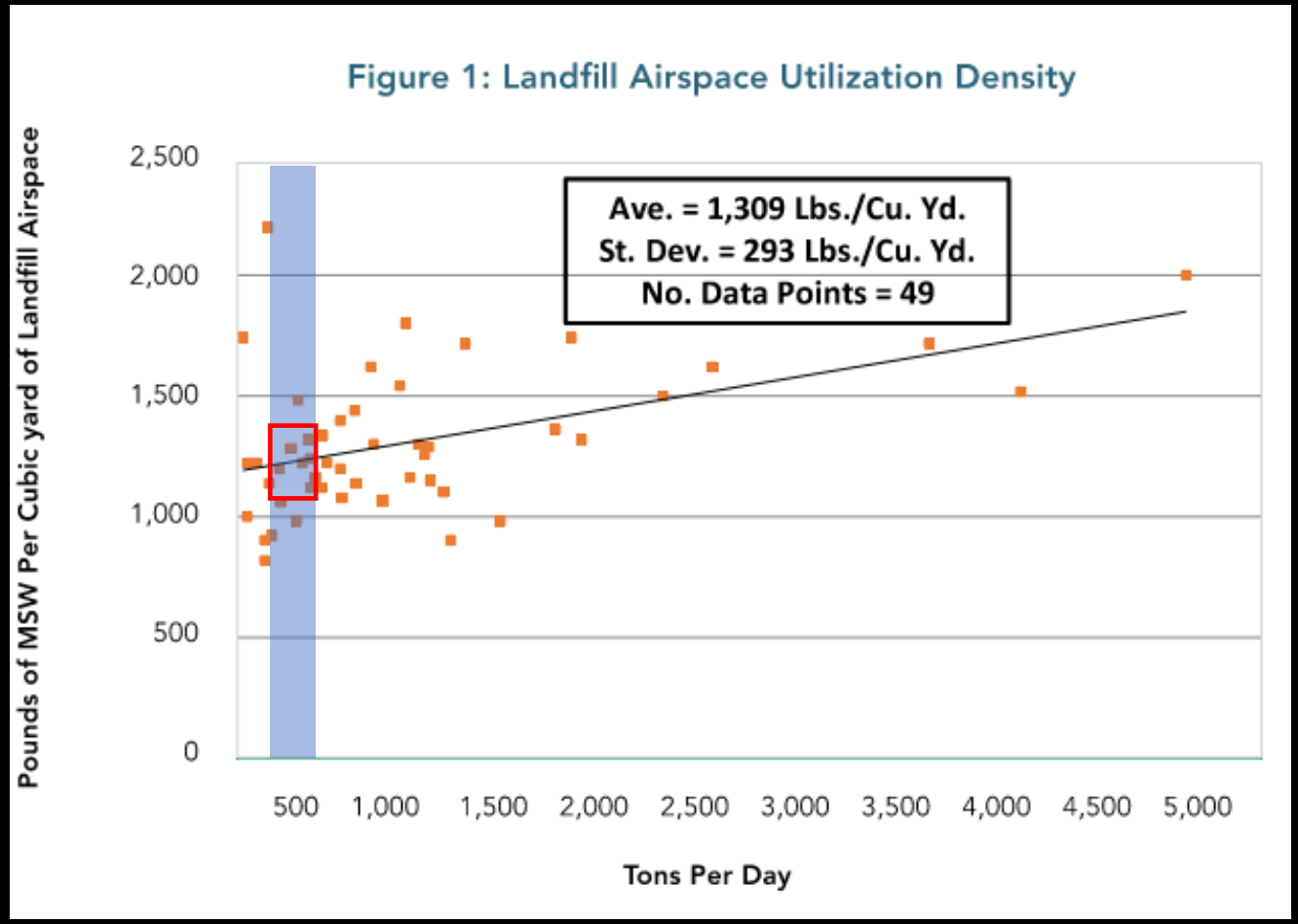
Short Term – Annual

Long Term – Lifetime

Increases over time due to decomposition and settlement

AUD Statistics

- 2018 study completed by the SWANA Applied Research Foundation
- 500 tpd landfill
  - Avg: 1,250 AUD
  - St. Dev.: 293 lb/CY
- Statistical Normal is: 1,100 to 1,400



Source: May 2018, Solid Waste Association of North America (SWANA) Applied Research Foundation; *Benchmarking The Performance and Costs of MSW Landfills*

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Landfill Cover Soil Utilization

Soil Usage Ratios

Many (most) sites use a waste-to-cover ratio as an operational performance indicator

Waste-to-Soil Ratio and Percent Volume of Cover Material Relationship	
Waste-to-Soil Ratio	**% Of Volume Consumed by Soil**
1:1	50%
2:1	33%
3:1	25%
4:1	20%
5:1	17%
6:1	14%
7:1	13%
8:1	11%
9:1	10%
10:1	9%

Landfill Cover Soil Utilization

Soil usage per ton of waste may be a better metric because it encourages increased waste compaction

A site achieving 800 lb/CY LWD and a 4:1 waste:soil ratio uses significantly more soil as a site achieving 1,200 lb/cy LWD and a 4:1 waste:soil ratio

Let's Dig Into Cover Soil Usage

- 500 tpd at 800 lb/CY LWD and 4:1 waste to soil ratio
  - Waste occupies 1,250 CY (500*2000/800)
  - Soil occupies 312 CY (0.62 CY/ton)
  - Total airspace used 1,562 CY
- 500 tpd at 1,200 lb/CY LWD and 4:1 waste to soil ratio
  - Waste occupies 833 CY
  - Soil occupies 208 CY (0.41 CY/ton)
  - Total airspace used 1,040 CY

BOTH sites achieve 4:1 ratios, but one uses 2/3 the soil.

Using the soil metric of CY soil per ton of waste allows you to identify and reward practices that minimize cover soil used.

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How Do We Get There?

1. Do we have the correct safety culture?
2. Do we have qualified & professional staff?
3. Do we have the right equipment?
4. Do we have the right maintenance culture?

SAFETY

What does a robust safety culture look like?

How much time do we spend reacting to safety incidents and injuries?

How much time do we spend training and mentoring?

DUKE Energy OSHA TCIR < 1.0!

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SAFETY

- Are all “accidents” preventable?
- Does Leadership prioritize, teach and mentor a world-class safety culture?
- Have we achieved the “Brother’s Keeper” status? (Brother’s/Sister’s)

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SAFETY

What's Wrong With This Picture?

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Personnel

What does our training program look like?

Safety:
Annual Training and OSHA?
Monthly, Weekly, Daily?

Equipment:
Peer Training?
Manufacturer Training?
Technology Updates and Refresher Training?
Equipment Certifications?

Operations:
Do we have a plan?
Bottlenecks & Gridlock?
Are we conducting a symphony?

SHARE THE WHY!

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Personnel

Leadership

Do we spend time daily in operations?
Do we see front-line employees daily?
Do we know everyone's name?
Are we pro-active or reactive?
Do we formally meet with all staff on a regular basis?
Do we keep up with operations technology?
Are we knowledgeable about our equipment?

If leadership cares, everyone cares.

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Equipment

- Do we have the proper amount of horsepower at the face?
- Low Horsepower can create employee stress and turnover, customer frustration
- High horsepower will cause excessive and unnecessary operating and maintenance costs.

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Equipment

Do we have the right support equipment?

LGP Dozer for slope maintenance and daily cover.

Water Trucks / Dust Control.

Road Maintenance / Motor Grader.

Proper support equipment improves facility safety, customer experience, employee engagement and operational efficiency.

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Maintenance

How can we have zero unplanned downtime?

Do we have an operator centric program?

Properly trained operators can:

- Detect machine issues in the moment.
- 360 Walkaround 3X per day.
- Sees and feels equipment every day.

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Maintenance

Do we invest in training for maintenance staff?
Do we have a goal for machine life?
Do we have a goal for G.E.T. life?

Do we clean undercarriages daily?

Do we have a schedule for wheels, undercarriage, and cutting edge replacements?

Do we track component life?

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QUESTIONS?

Matt Kingsley, PE
505-504-7758
mkingsley@parkhill.com

Frank Pugsley, PE
469-200-7384
fpugsley@parkhill.com

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