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Survey Results for Ammonia in Leachate / Technologies / Costs

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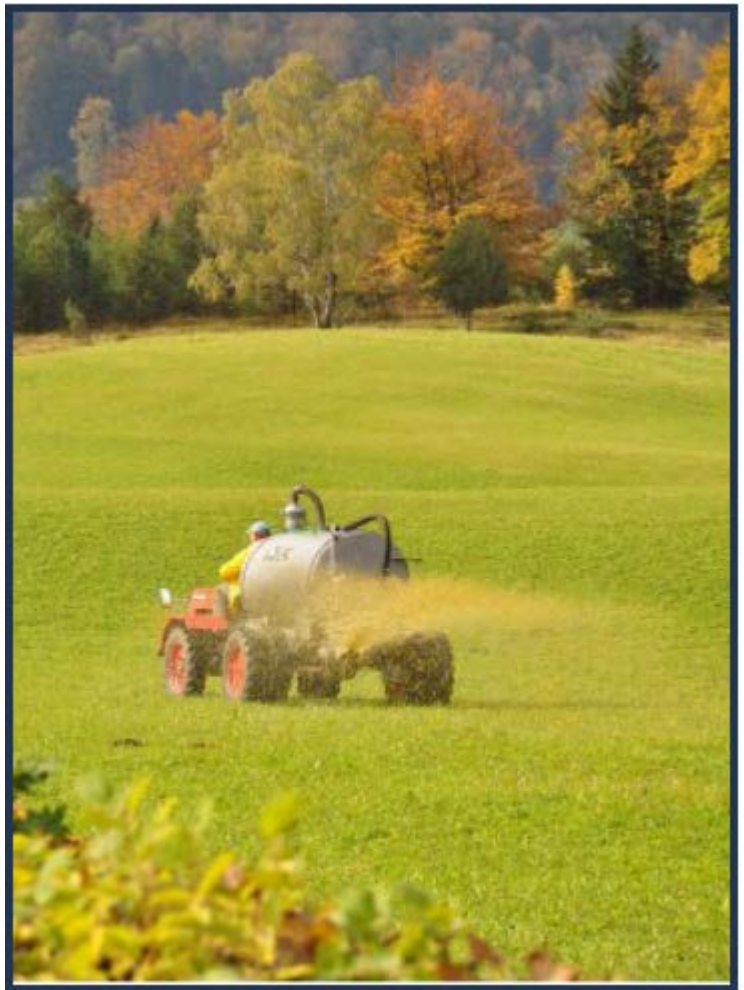
NEW YORK FEDERATION

BOLTON LANDING, NY

MAY 20-23, 2018

Agenda

- **SWANA Leachate Survey**
- **Plants with Ammonia Limitations**
- **In Depth Regional Comparisons**
- **Treatment Technology Costs**



Many fertilizers include ammonia.

Q1: How is leachate presently managed at your landfill?

- **Answered: 184 Skipped: 0**

Answer Choices	Responses	
Other	0.00%	0
a. Discharged to POTW	47.28%	87
b. Pretreated and discharged to POTW	12.50%	23
c. Treated entirely on site	17.93%	33
d. Other	22.28%	41
Total		**184**

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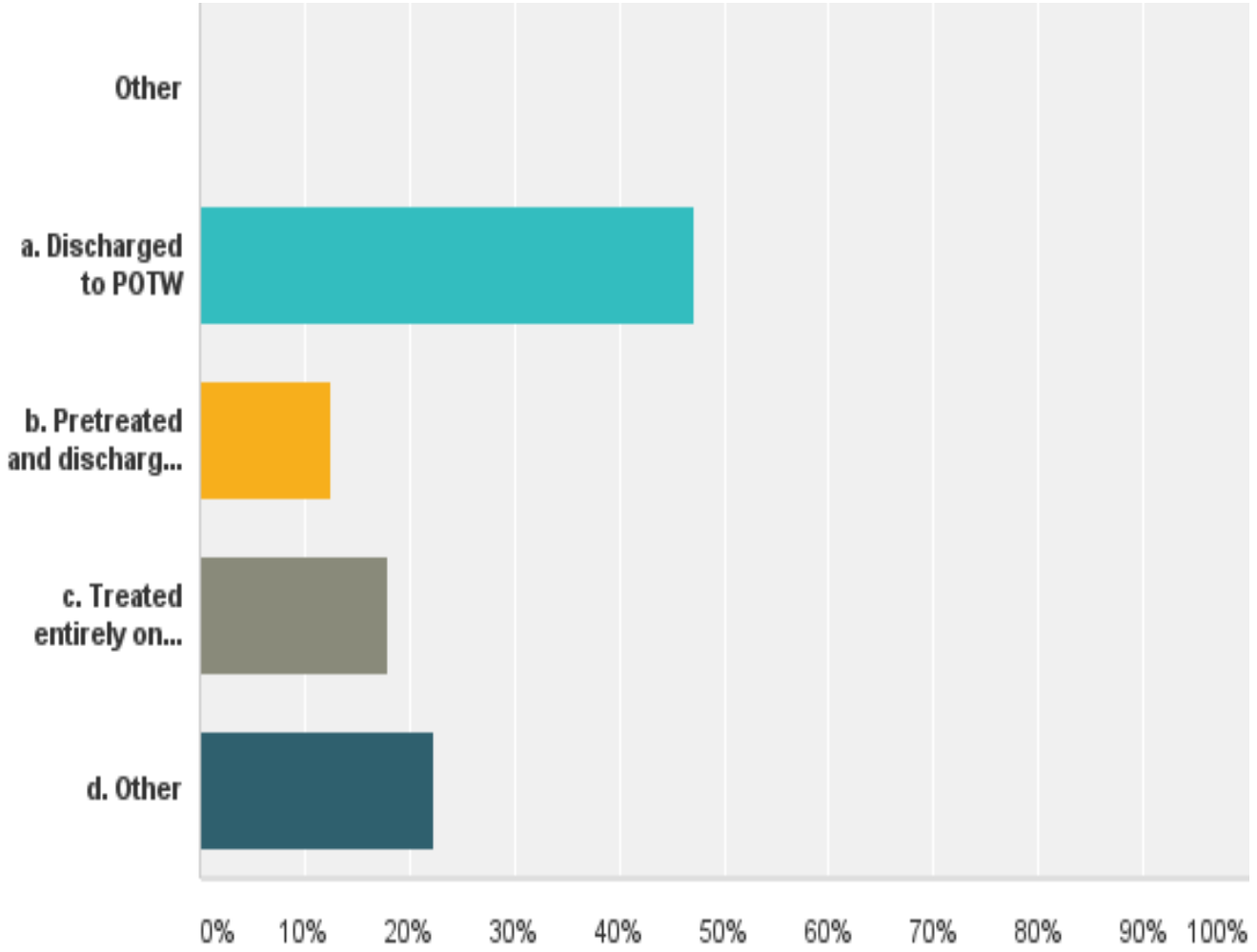
Q1: How is leachate presently managed at your landfill?

- **Answered: 184 Skipped: 0**



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Q2: If discharged to POTW, how is it conveyed?

- **Answered: 117 Skipped: 67**

Answer Choices	Responses	
a. Truck	46.15%	54
b. Gravity flow to sewer	15.38%	18
c. Force main to sewer	38.46%	45
Total		**117**

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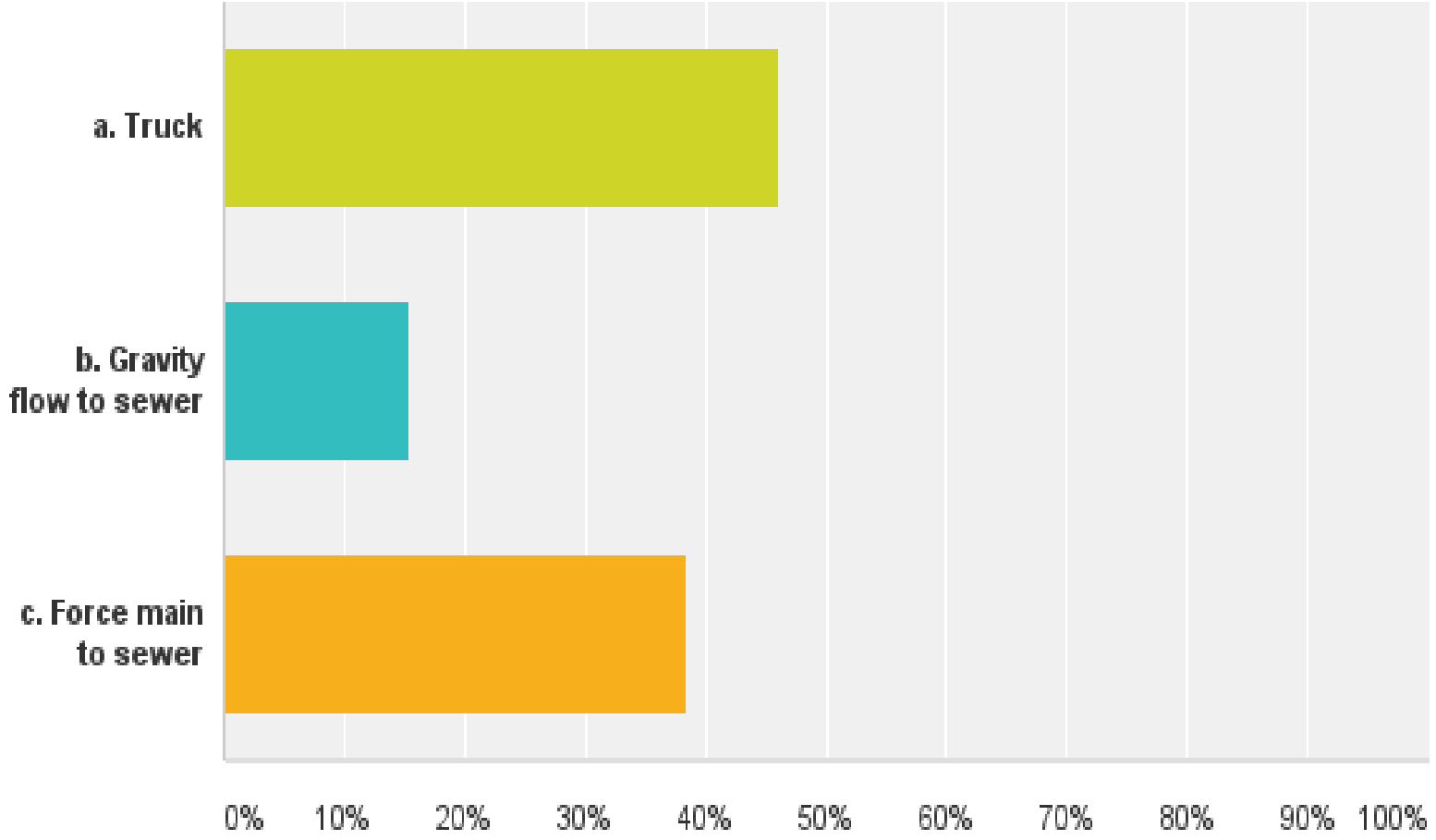
Q2: If discharged to POTW, how is it conveyed?

- **Answered: 117 Skipped: 67**



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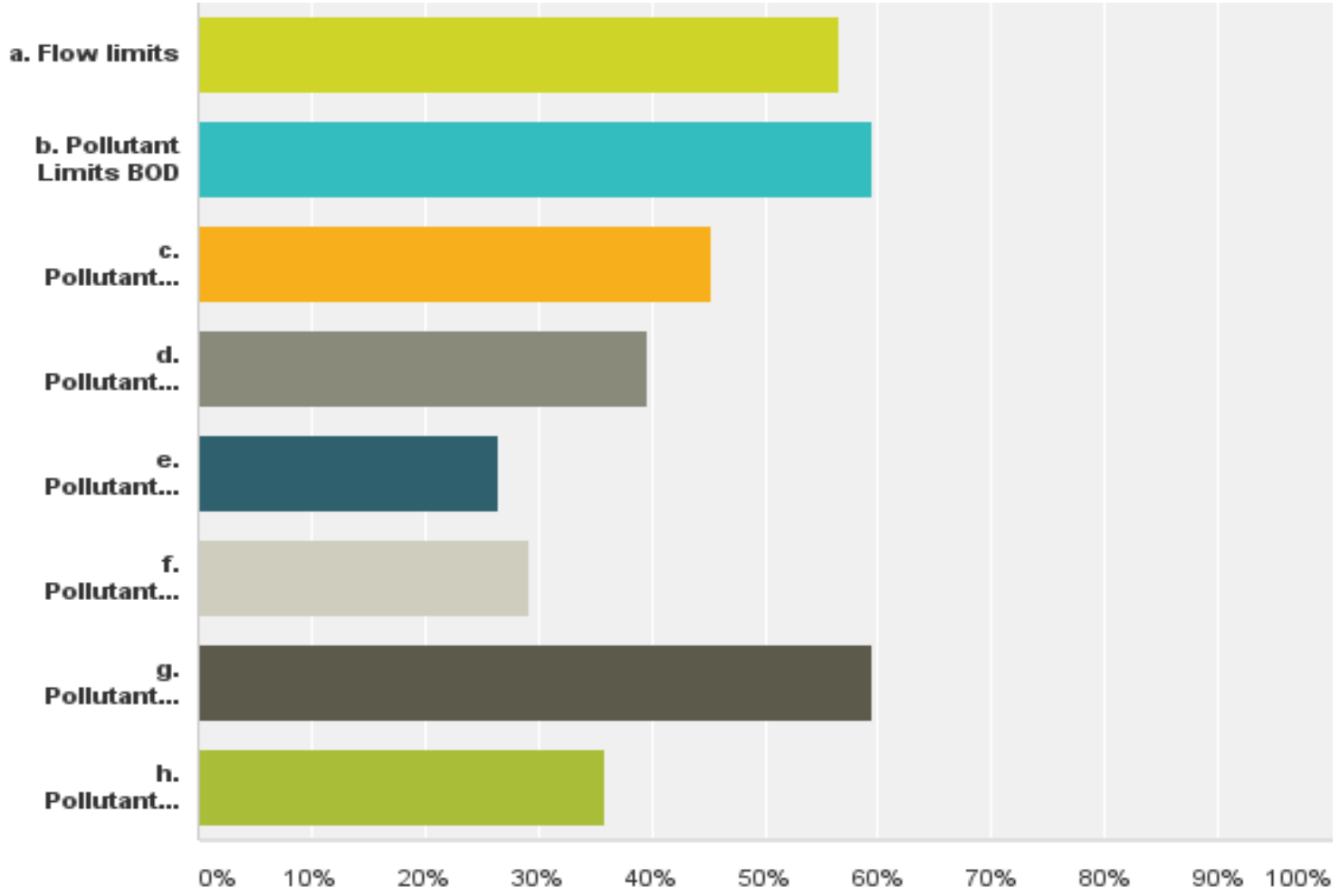
Q3: If discharged to POTW, what discharge limits must the leachate meet?

- **Answered: 106 Skipped: 78**

Answer Choices	Responses	
a. Flow limits	**56.60%**	60
b. Pollutant Limits BOD	**59.43%**	63
c. Pollutant Limits COD	**45.28%**	48
d. Pollutant Limits NH3-N	**39.62%**	42
e. Pollutant Limits TKN	**26.42%**	28
f. Pollutant Limits Total Nitrogen	**29.25%**	31
g. Pollutant Limits pH	**59.43%**	63
h. Pollutant Limits Other	**35.85%**	38
Total Respondents: 106		

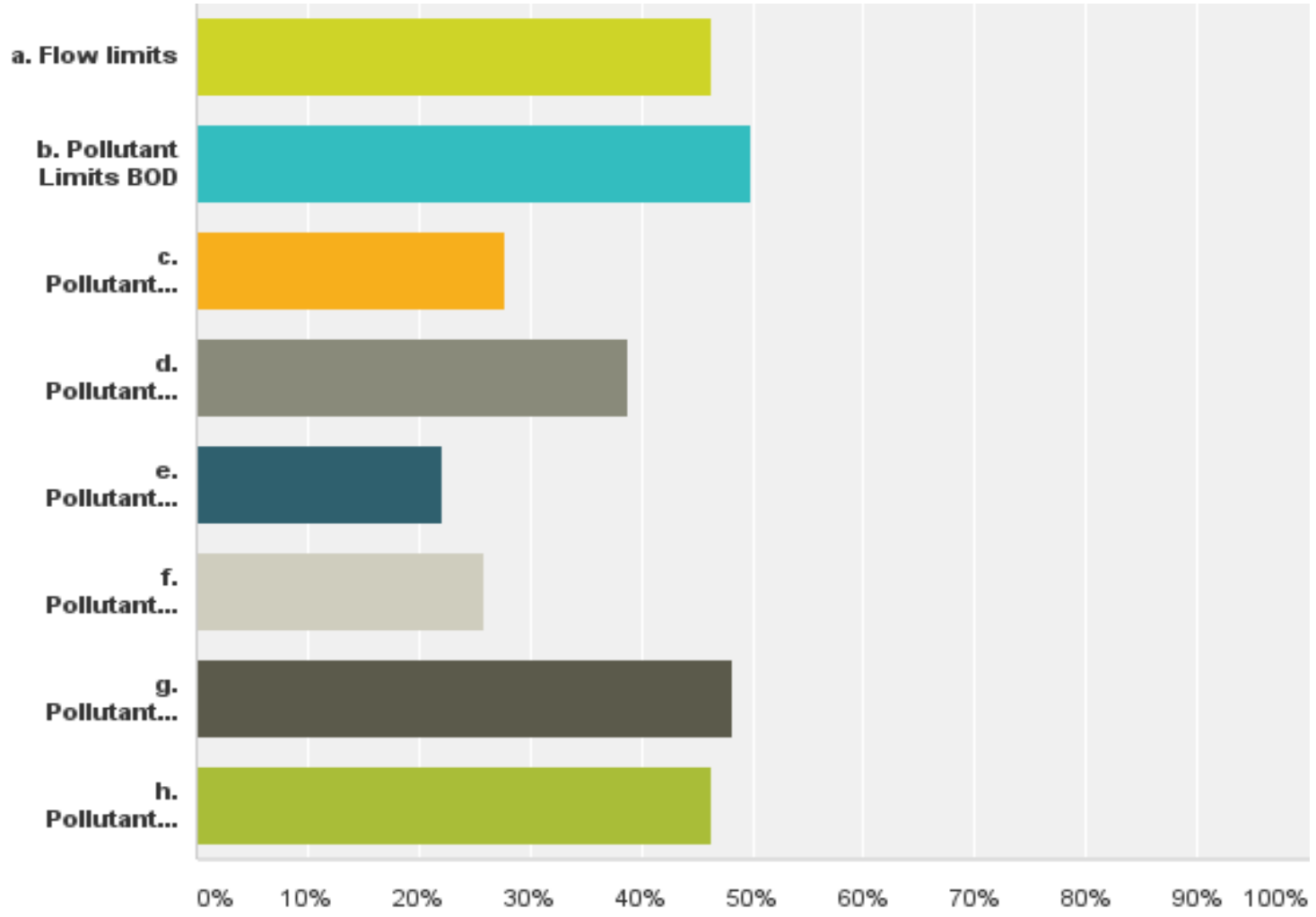
Q3: If discharged to POTW, what discharge limits must the leachate meet?

- **Answered: 106 Skipped: 78**



Q4: If pre-treated or treated on site, what discharge limits must the leachate meet?

- **Answered: 54 Skipped: 130**



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Breakdown of Regions and States

Northeast:

Connecticut, Delaware, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, and Pennsylvania

Midwest:

Illinois, Indiana, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota

Southeast:

Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, District of Columbia, Arkansas, Louisiana, Alabama, Kentucky, Mississippi, Tennessee and West Virginia

Southwest:

Arizona, New Mexico, Oklahoma, and Texas

West:

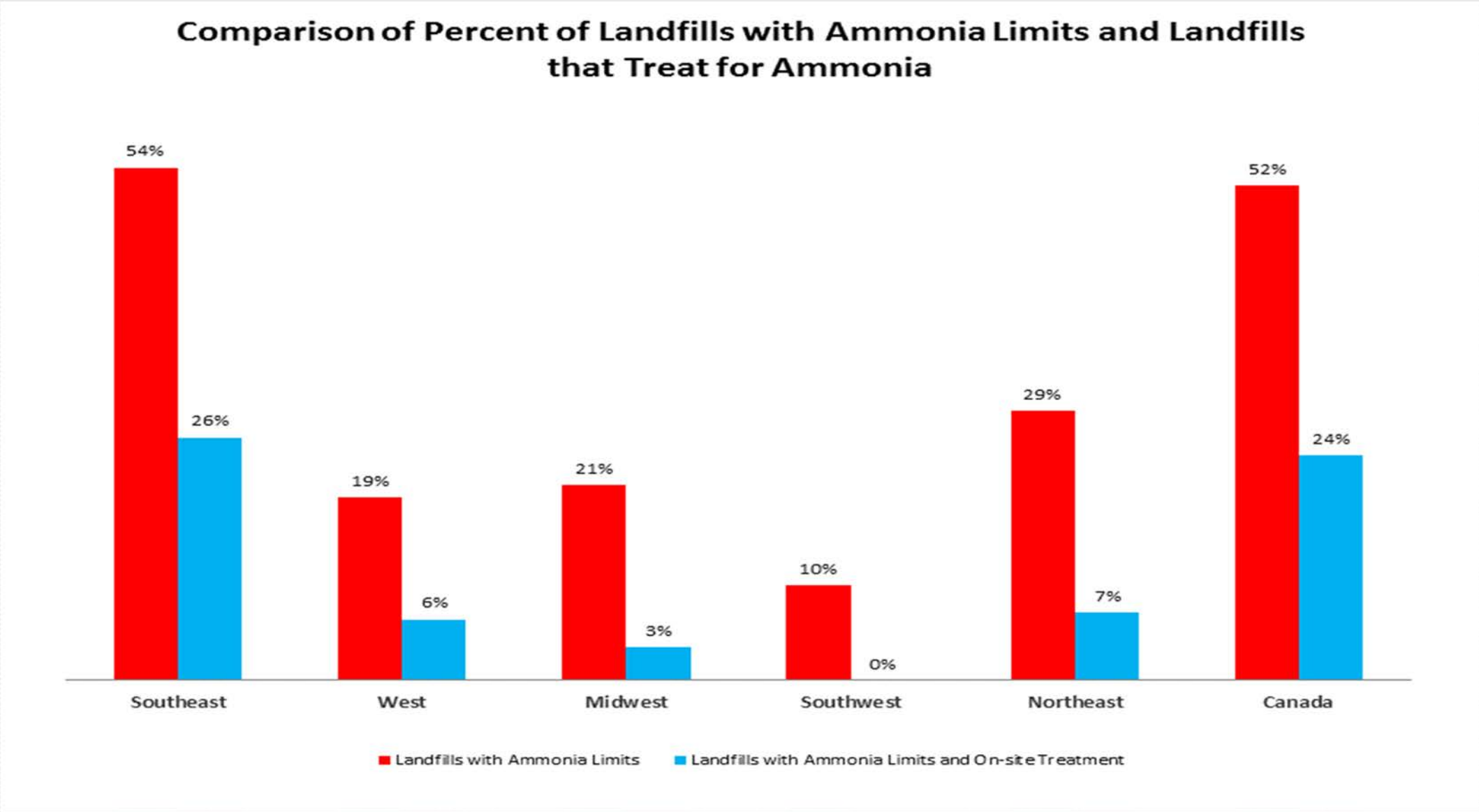
Alaska, California, Colorado, Hawaii, Oregon, Idaho, Montana, Nevada, Utah, Wyoming and Washington

Canada:

Limited information for was provided from Canadian provinces (4 sites)

We used a verification check against the active list of municipal solid waste (MSW), industrial and ash landfills from North Carolina, New Jersey, Arizona, Oregon, Florida, and New York obtained from each state's Department of Solid Waste

Comparison of Percent of Landfills with Ammonia Limits and Landfills that Treat for Ammonia



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Nationwide Comparison Leachate Treatment

Region	Actual From US EPA[2]	Landfills with Ammonia Limits	Landfills with On-site Treatment	Landfills with Ammonia Limits and On-site Treatment	Landfills with Ammonia Limits and Without On-site Treatment
Southeast	529	286	212	134	151
West	729	97	245	32	65
Midwest	381	100	133	17	83
Southwest	151	16	49	0	16
Northeast	166	67	48	17	50
	1956	566	687	200	365

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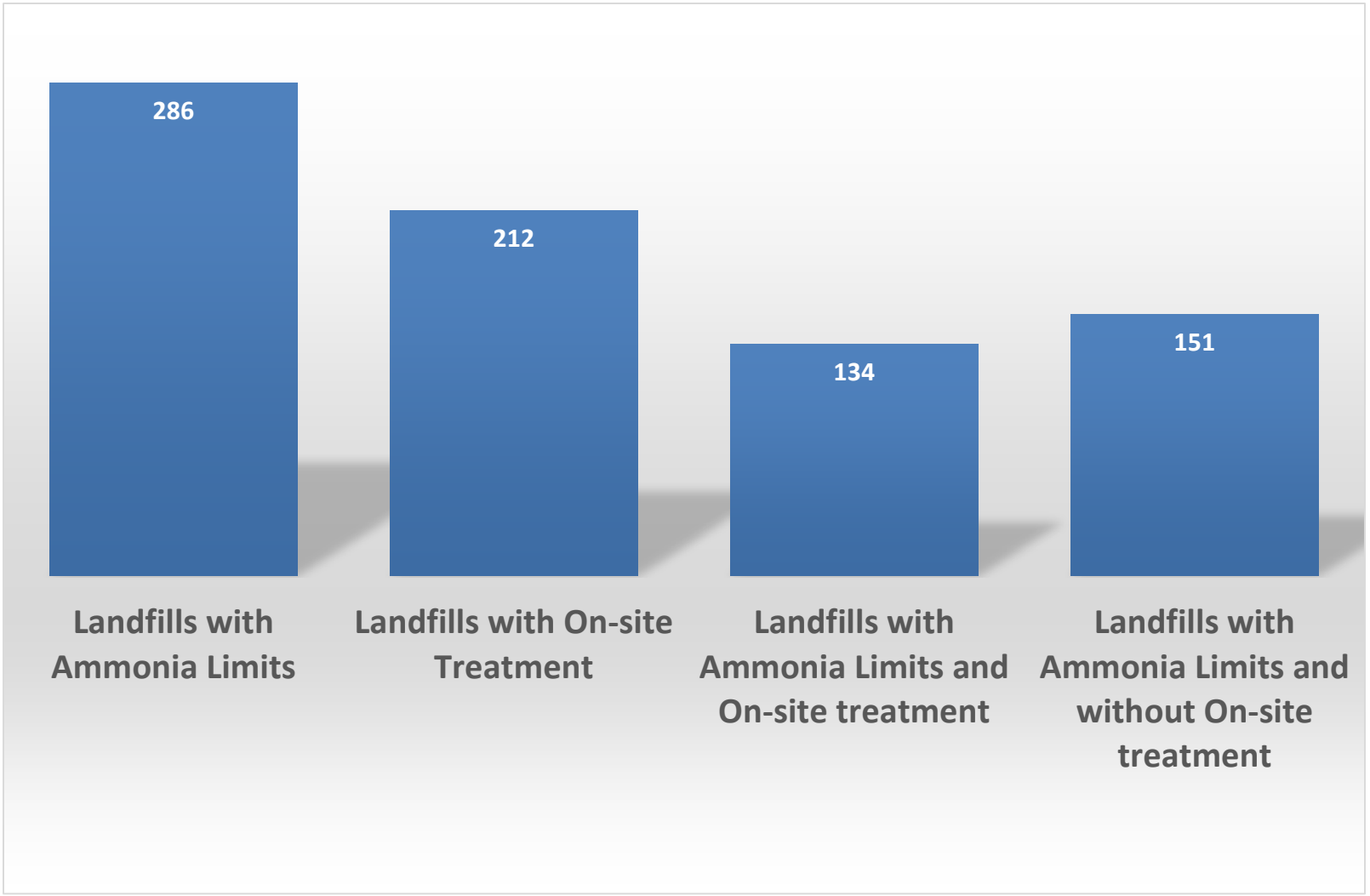
Projected Number of Landfills Showing Treatment Characteristics in the Southeast



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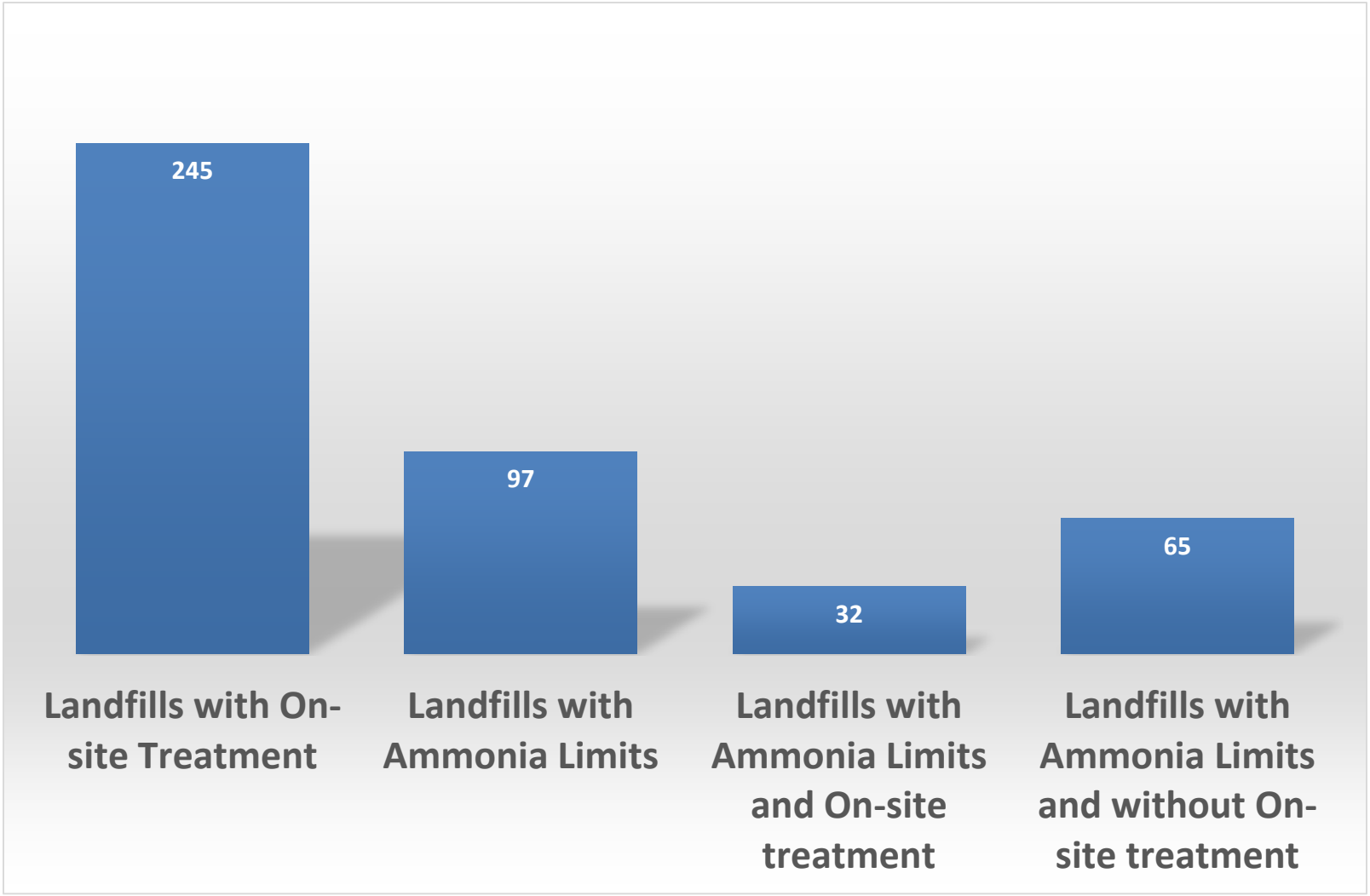
Projected Number of Landfills Showing Treatment Characteristics in the West



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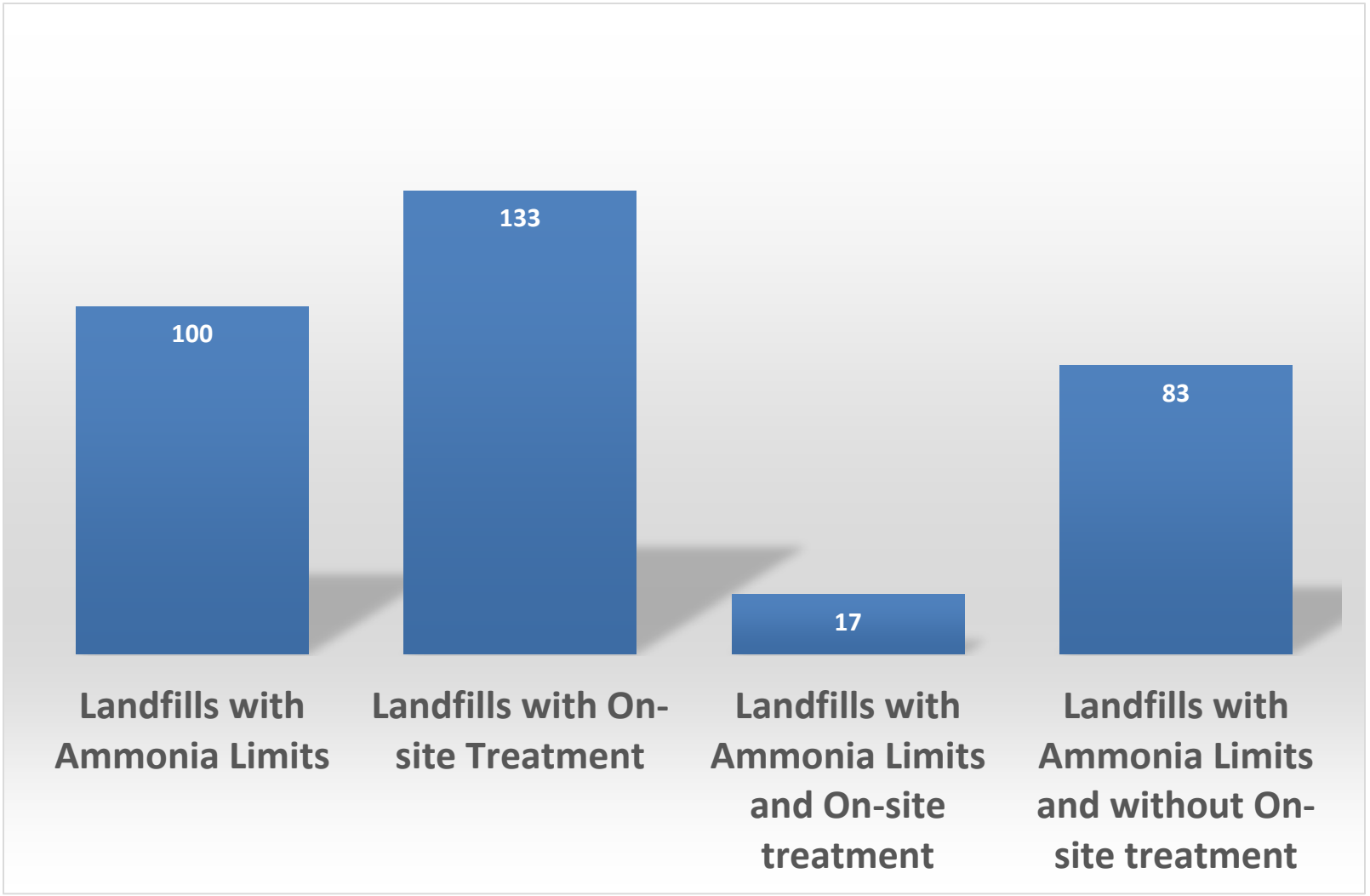
Projected Number of Landfills Showing Treatment Characteristics in the Midwest



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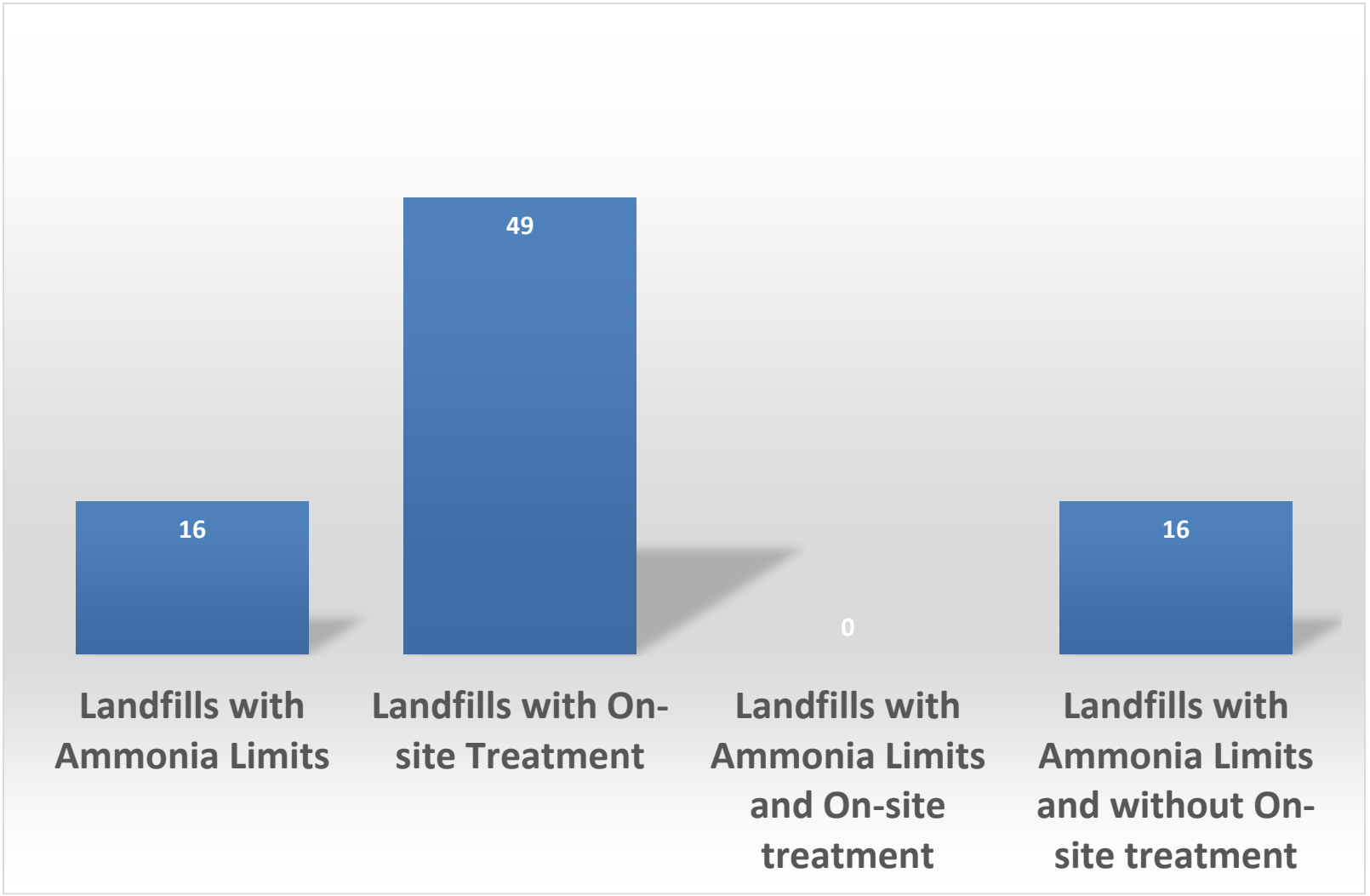
Projected Number of Landfills Showing Treatment Characteristics in the Southwest



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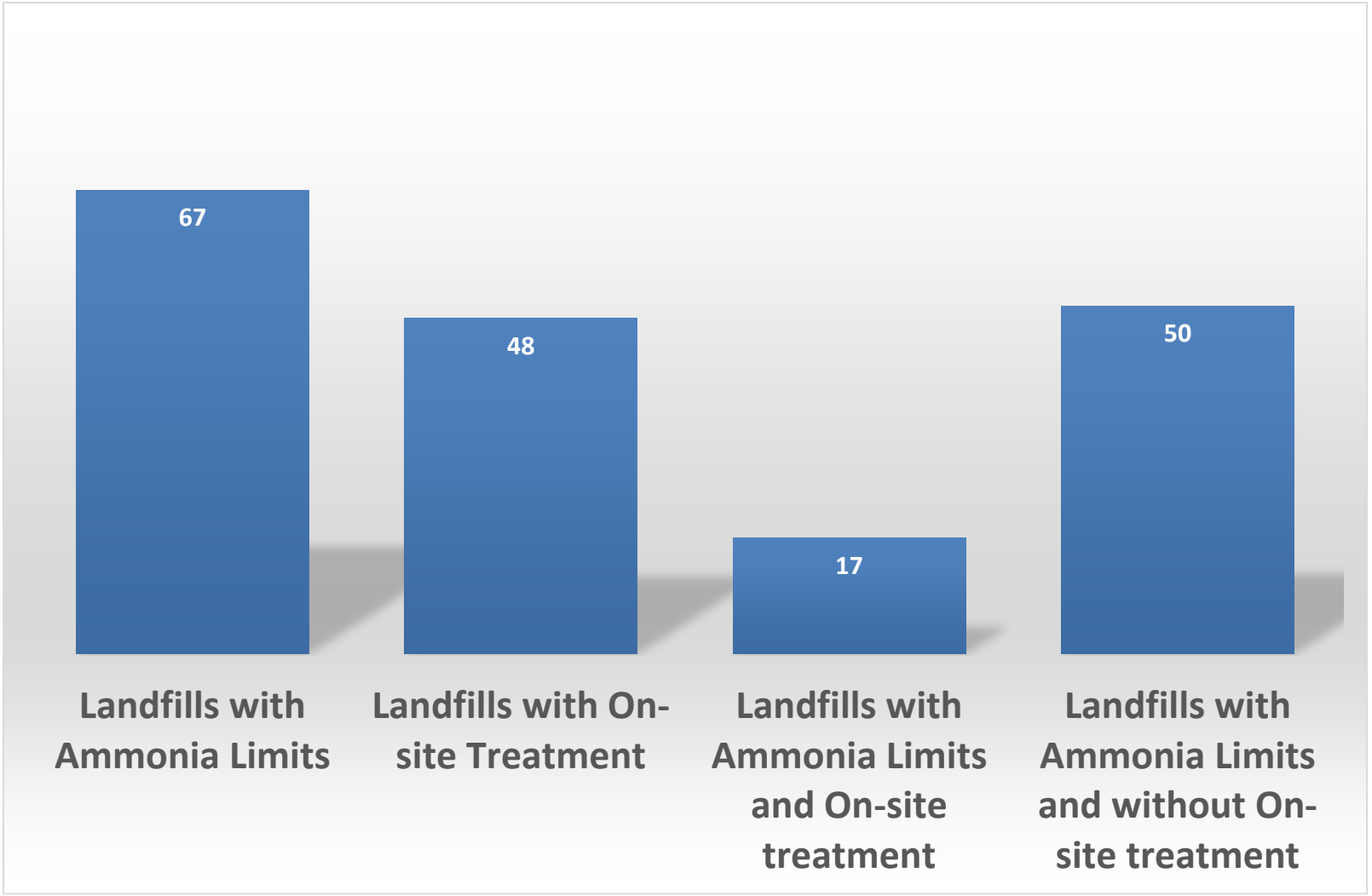
Projected Number of Landfills Showing Treatment Characteristics in the Northeast



Simulated On-Site Leachate Pretreatment System Parameters

The criteria used in this alternative technology evaluation include the following:

- **Flow 50,000 gallons per day;**
- **Ammonia 800 mg/l;**
- **COD 5,000 to 15,000 mg/l;**
- **TDS > 5,000 mg/L;**
- **Discharge is to a pretreatment plant, not direct discharge;**
- **Metals are not a regulatory or inhibitory issue;**
- **Temperature is ambient (not a reaction landfill);**
- **No other extenuating constituents (no phenols or other TTO);**
- **Power cost at $0.10 per gallon (USD);**
- **Phosphorous deficient;**
- **Neutral pH in the raw leachate;**
- **Locations in the eastern US (East of the Mississippi River - related to precipitation/temperature); and**
- **No specific space or other location restrictions.**

CAPEX Considerations for Simulation

- **Construction Cost** — **Major equipment and structures (Costworks and Bids)**
- **Overhead & Profit** — **25% of labor & material**
- **Undefined Scope** — **30% of labor, material, overhead & profit**
- **Engineering and Project Administration** — **20% of construction cost**
- **Opinion of Probable Project Cost (OPCC)** — **Sum of above**
- **Life Cycle Cost Analysis** — **5 year payback on CAPEX, O&M Annual Costs**
- **O&M Annualization of Present Worth** — **20 years**
- **Interest Rate** — **6%**
- **Present Worth Factor** — **11.47**

OPEX Considerations for Simulated Pretreatment

Chemical	Purpose	Units	Specific Gravity	Units	Unit Price
Magnesium Hydroxide	pH/alkalinity control	lb/hr	1.54	lb	$0.24
Sodium Hydroxide	pH control/membrane cleaning	lb/yr	1.52	lb	$0.12
Sulfuric Acid	pH Control	lb/yr	1.84	lb	$0.28
Defoamer	Foam control	lb/yr	1	lb	$5.50
Coagulant	Coagulation enhancement	gph	1.35	lb	$0.90
Polymer Anionic	Solids/liquid separation	lb/yr	0.02	lb	$5.25
Polymer Cationic	Solids/liquid separation	lb/yr	1.02	lb	$6.25
Sodium Hypochlorite	Membrane cleaning	gal/hr	1.2	gal	$1.60
Phosphoric Acid	Nutrient supplement	lb/Hr	1.78	lb	$0.85
Citric Acid	Membrane cleaning/ heat exchanger cleaning	lb/Hr	1.665	lb	$0.30
Anti-Scaling Agent	Prevent scaling in system	lb/yr	1	lb	$2.50

CAPEX, OPEX, Life Cycle Cost, and Cost per Gallon of Various Ammonia Treatment Alternatives (50,000 gpd)

	Low CAPEX Less 30%	CAPEX	High CAPEX Plus 50%	OPEX	Life Cycle Cost - Present Worth	Cost/Gallon	Pass Fatal Flaw Test
Technology							
Air Stripping	$1,992,000	$2,845,000	$4,268,000	$632,000	$10,090,000	$0.066	Yes
Breakpoint Chlorination	$810,000	$1,157,000	$1,736,000	$1,282,000	$15,865,000	$0.083	Yes
Selective Ion Exchange	$1,156,000	$1,652,000	$2,478,000	$372,000	$5,923,000	$0.039	No
Xogen Electro-Oxidation	$888,000	$1,268,000	$1,902,000	$542,000	$7,484,000	$0.044	Yes
Membrane Bioreactor	$4,043,000	$5,776,000	$8,664,000	$503,000	$11,540,000	$0.091	Yes
Moving Bed Biofilm Reactor	$3,746,000	$5,352,000	$8,028,000	$383,000	$9,749,000	$0.080	Yes
Sequencing Batch Reactor	$2,627,000	$3,753,000	$5,630,000	$252,000	$6,647,000	$0.055	Yes
Anammox Process	$2,977,000	$4,253,000	$6,380,000	$292,000	$7,106,000	$0.057	Possibly?

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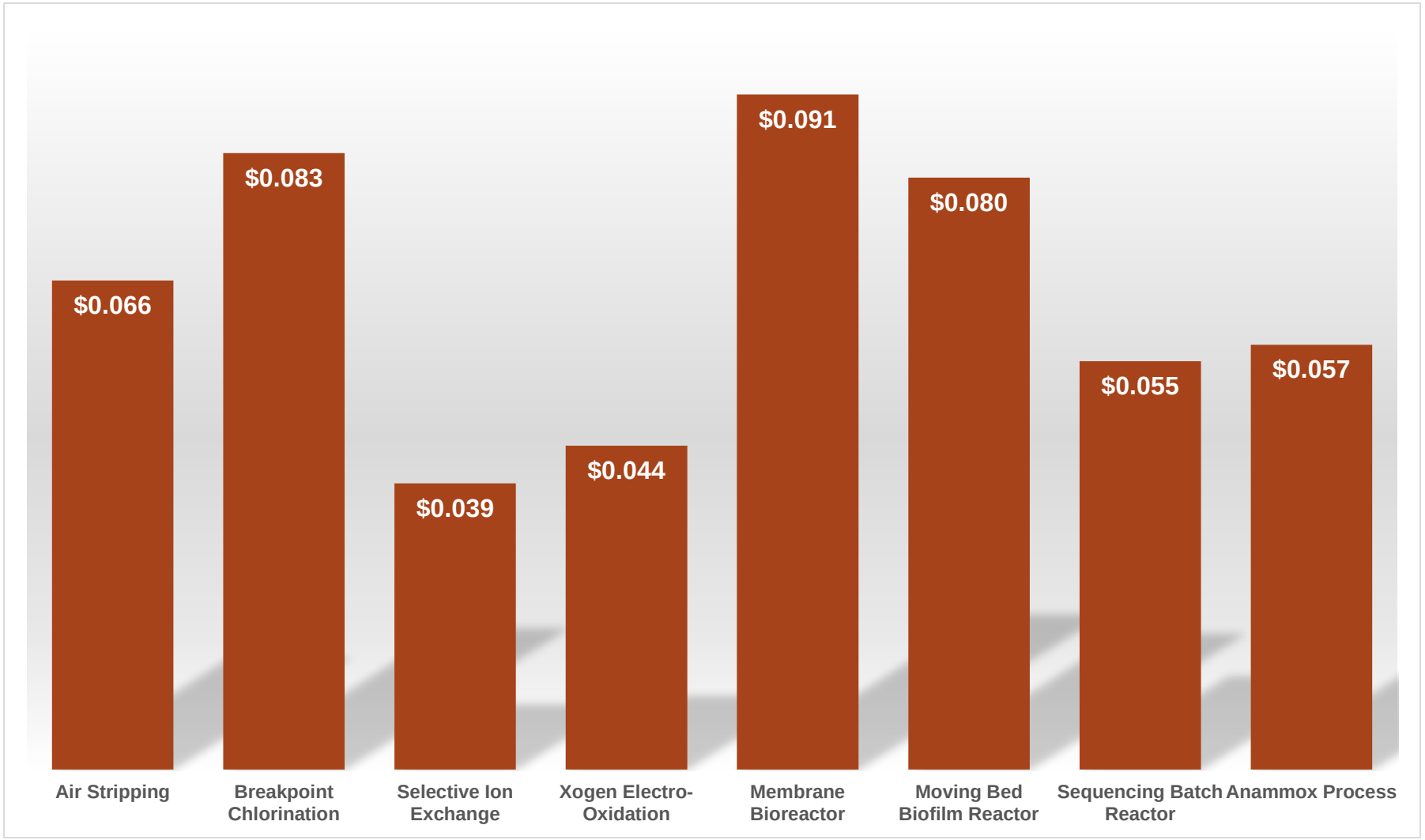
Comparative Annualized CAPEX and OPEX Cost per Gallon for Various Alternatives



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Questions?

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