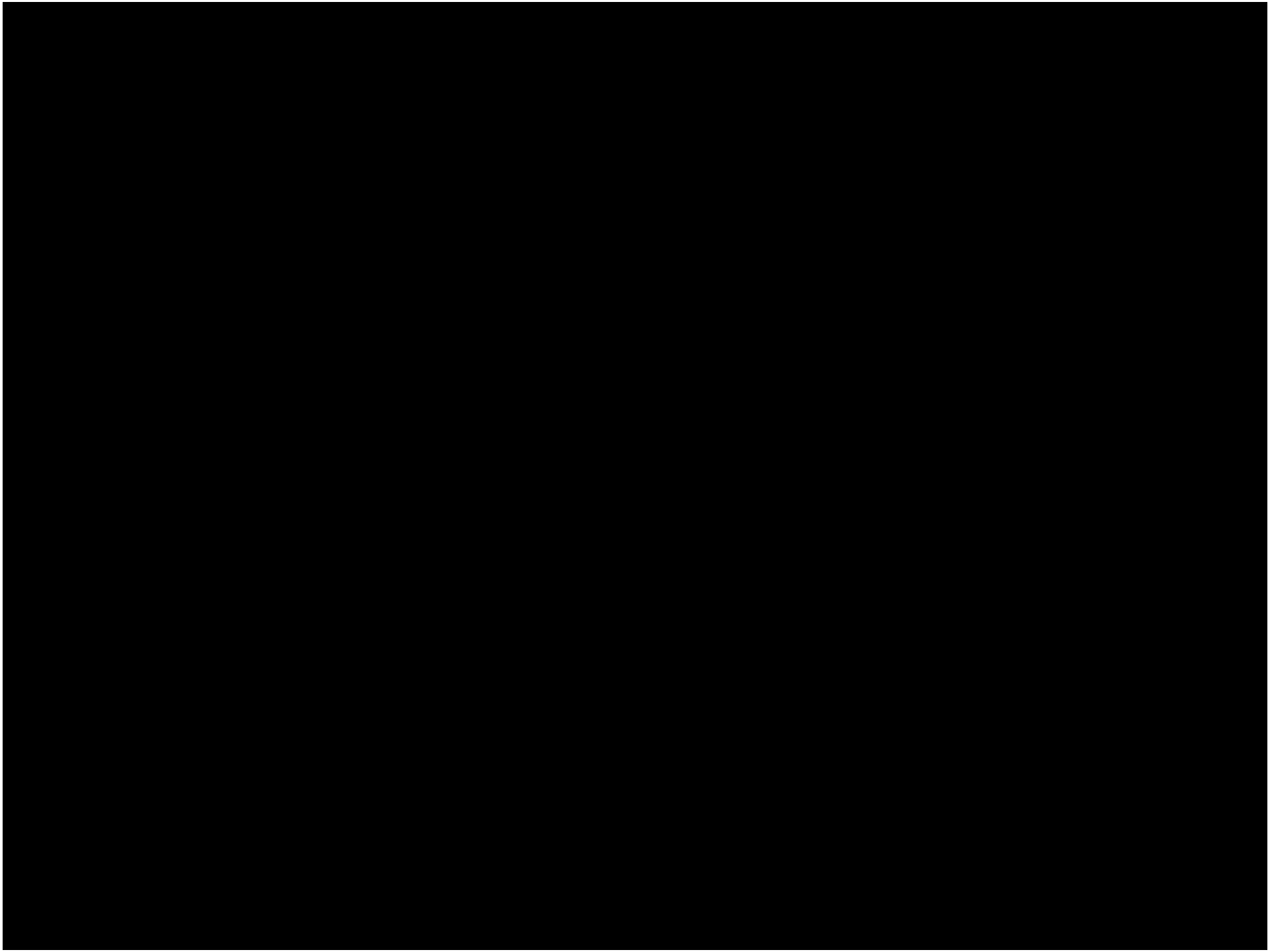

Refining Commercial Lawn and Garden Equipment Population and Emission Estimates

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May 16th, 2007

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Commercial Lawn & Garden Equipment

- In the San Antonio region, NONROAD model default values for lawn and garden emission are inappropriate due to varying usage rates and the wide variety of businesses and agencies using lawn and garden equipment
- Accuracy of lawn and garden equipment population and usage rates can be increased with surveys.
- Commercial lawn and Garden Equipment was surveyed to determine:
  - hours usage,
  - horsepower, and
  - weekday/weekend adjustment

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Commercial Lawn & Garden Survey

Categories for Lawn and Garden Equipment

1. Commercial Lawn and Garden Companies (both for residential properties and commercial properties),
2. Golf Courses (47 courses),
3. Public Schools (608 schools),
4. Universities/Colleges (13 facilities),
5. Non-Military Government Facilities (including Hospitals, Municipality offices, Parks, National Wildlife Areas (NWA), Utilities, Transportation departments, etc.),
6. Other Commercial Companies (companies that do not use lawn and garden equipment as their main business),
7. Cemeteries,
8. Private Airports (21 airports),
9. Commercial Airports, and
10. Military Facilities (6 Army and Air Force Bases).

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Survey Results

- The NONROAD model over predicted the number of lawn and garden equipment in the San Antonio region.
- The survey results indicate that local commercial lawn and garden equipment population was only 79 percent of the NONROAD defaults.
- There were more rear-engine mowers, front-engine mowers, and chainsaws in the AACOG survey than indicated by the NONROAD model.
- At the same time, the NONROAD model over predicted the number of tillers, gasoline mowers, and turf equipment.
- For some categories, surveyed horsepower (HP) was less then NONROAD defaults

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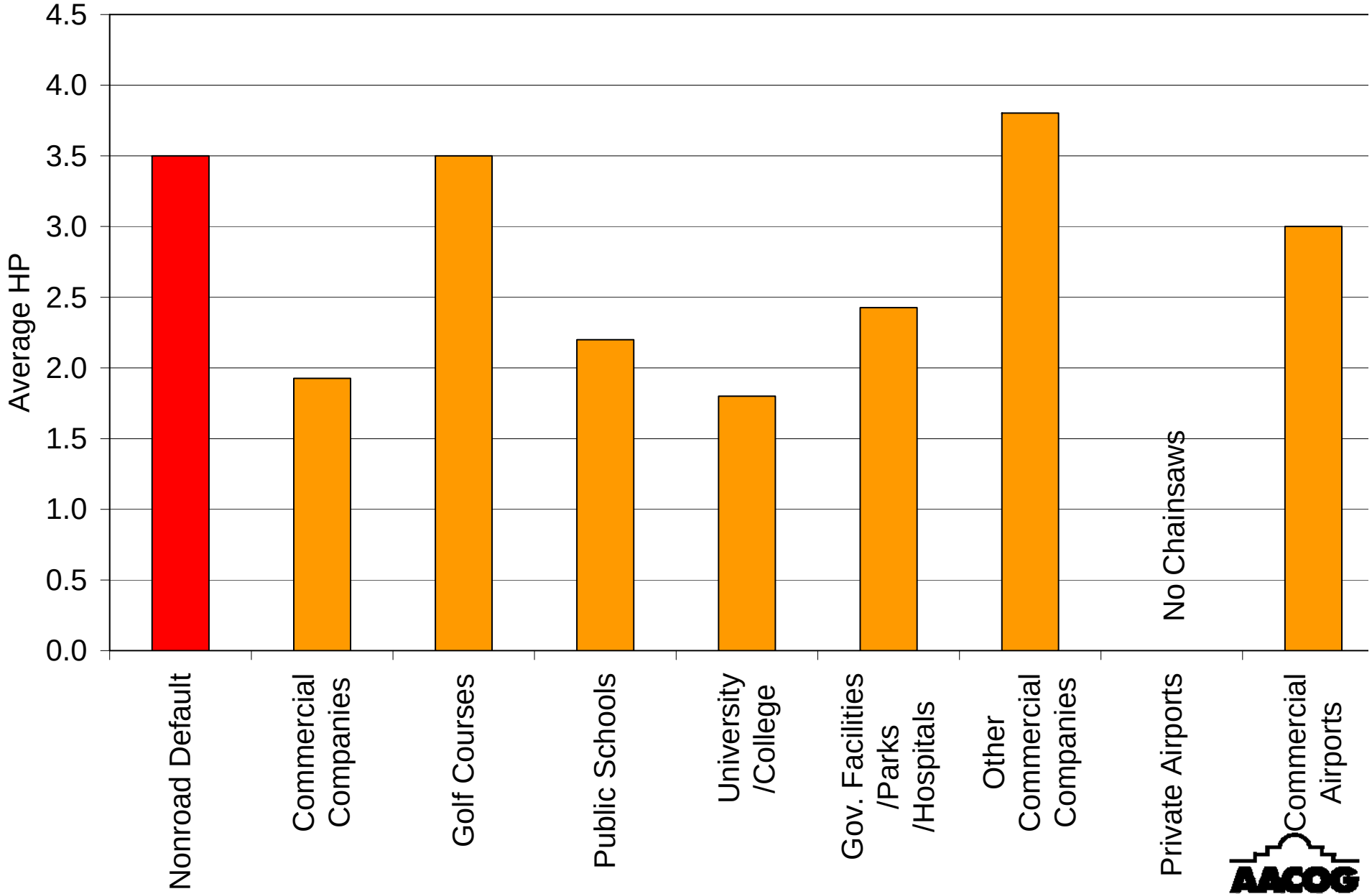
Average HP of Commercial Chainsaws in the San Antonio region, 2005



Does not include military bases Lawn and Garden Equipment

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Comparison between EPA Non-ROAD MODEL and Survey Reponses for Lawn and Garden, 2005**

Equipment Type	2004 EPA NONROAD Model Default	Com. Companies	Univer. / Colleges	Public Schools	Golf Courses	Gov. Facilities / Parks / Hospitals*	Other Companies	Com. / Private Airports	Percent of NONROAD Model Population
Lawn Mowers	11,020	3,131	20	475	44	175	34	12	35%
Tillers	4,054	113	3	5	4	7	0	2	3%
Chainsaws	5,258	5,517	26	50	9	551	9	3	117%
Trimmers	13,402	5,876	320	4,060	321	2,294	70	132	98%
Blowers	7,636	4,443	82	379	253	524	15	26	75%
Rear Mower	339	774	77	139	582	154	1	10	513%
Front Mower	2,764	4,548	61	232	1,795	225	3	16	249%
Shredder	2,127	2,403	31	202	0	16	9	7	125%
Tractor	2,719	111	8	416	113	83	3	10	27%
Chippers	682	470	0	7	4	49	0	0	78%
Turf	6,827	78	1	14	360	29	0	22	7%
Other	5,084	3,904	5	0	0	60	43	0	79%
Total	58,051	31,367	634	5,979	3,485	4,167	188	239	79%

*This category includes Municipality offices, Parks, National Wildlife Areas (NWA), Utilities, Transportation departments, etc.
**Adjusted based on NONROAD 2004 default hours per equipment
Does not include military bases Lawn and Garden Equipment

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Weekday/Weekend Adjustment

- On average, 96.7 percent of the equipment hours of operation are during weekdays and 3.3 percent of the equipment hours of operation occur during the weekend.
- The weekday survey results are much higher than the NONROAD default of 80% usage on weekdays.
- Many commercial lawn and garden equipment companies in San Antonio do not operate on the weekends.
- The exceptions are golf courses and private airports that had lower usage of lawn and garden equipment on weekdays compared to NONROAD default values.

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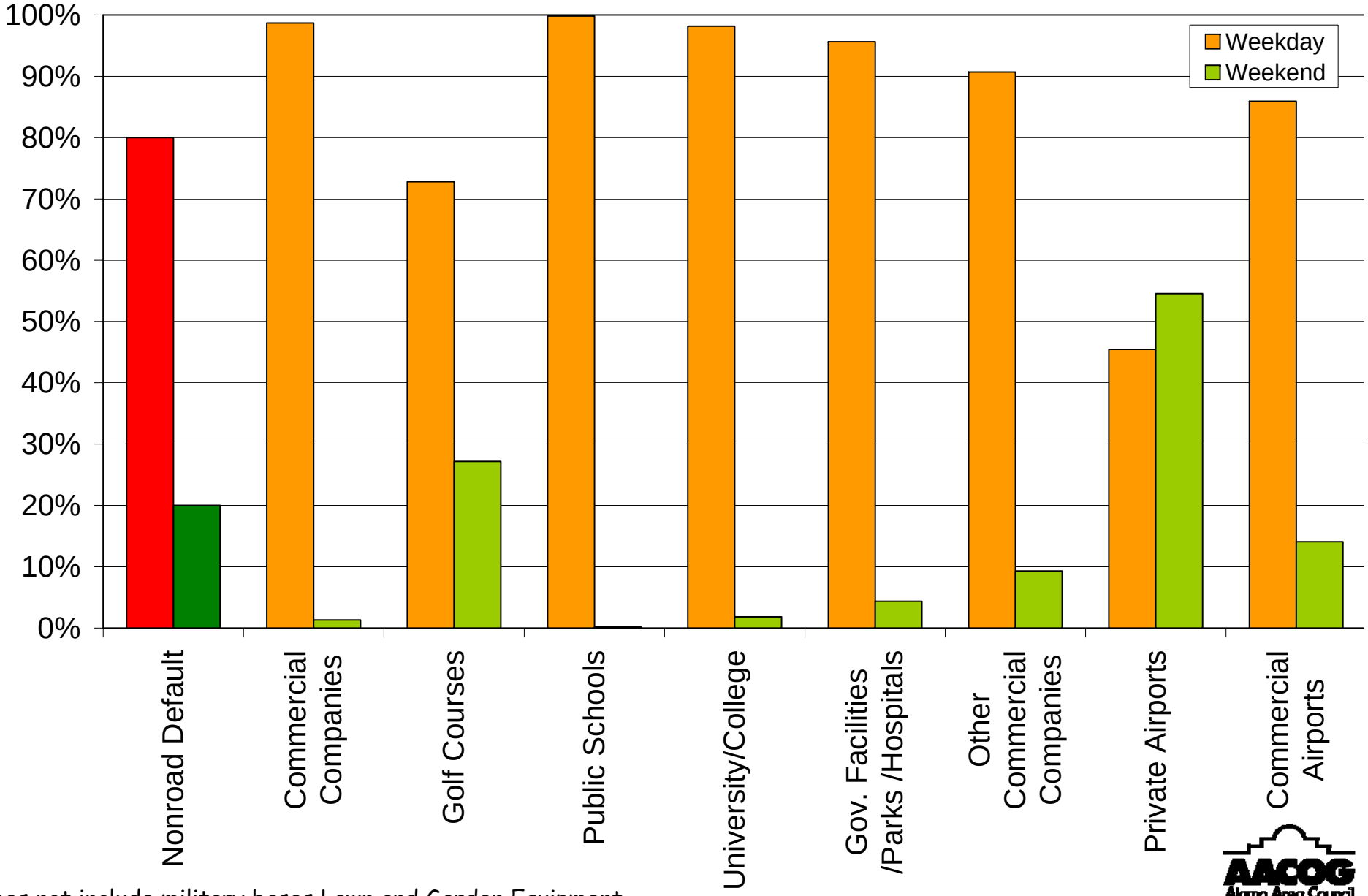
Ozone Season Weekday/weekend allocation of commercial lawn and garden equipment hours in the San Antonio region, 2005



Does not include military bases Lawn and Garden Equipment

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Emissions Calculations

- Once county level equipment populations were determined, emissions of VOC, NOx, and CO were calculated using NONROAD Model 2004.
- Local Data was used to update:
  - Population,
  - Season, and
  - Allocation files.

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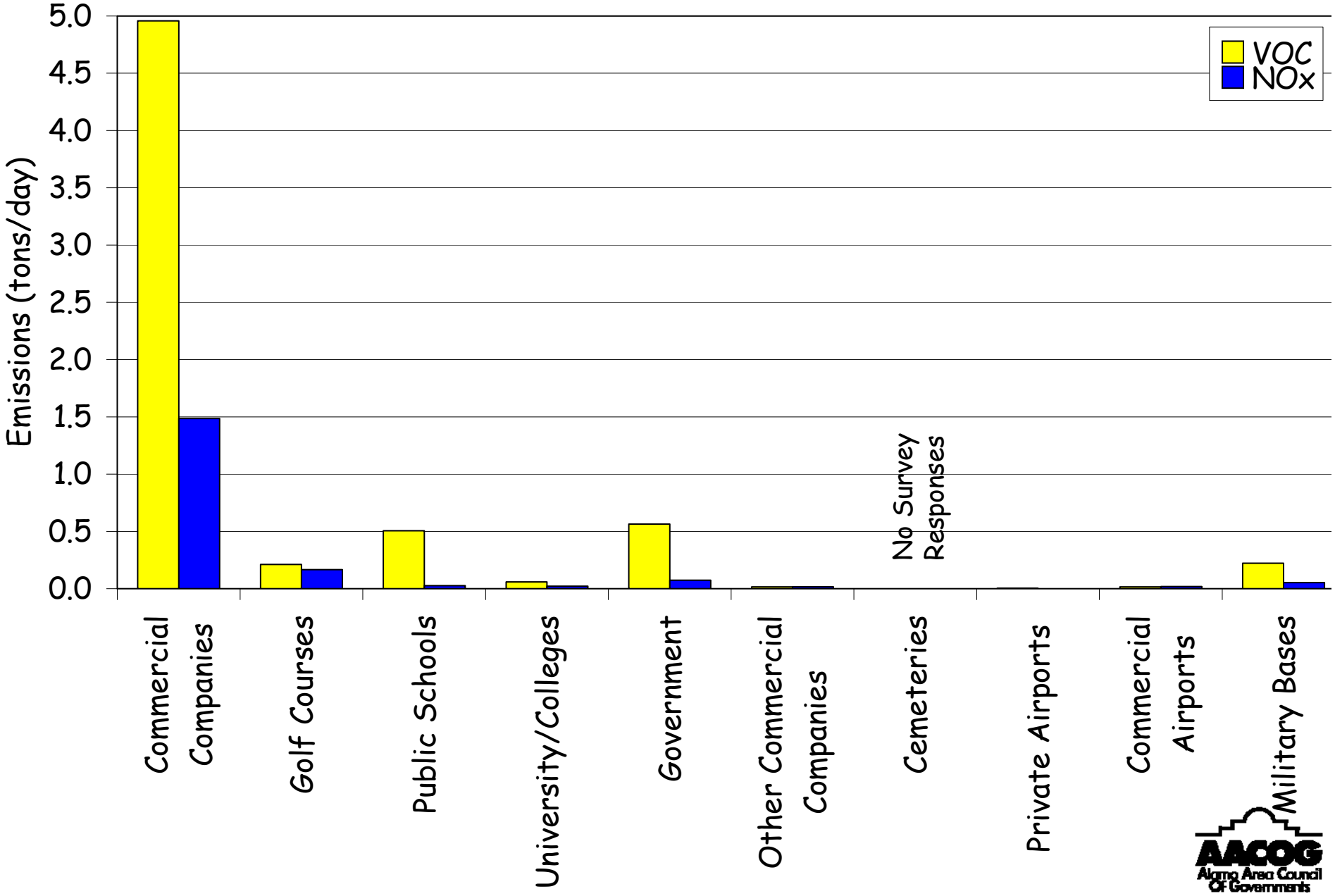
Commercial Lawn and Garden Equipment VOC and NOx Emissions Estimates for the San Antonio region, 2005



Commercial Lawn and Garden Equipment VOC and NOx Emission Estimates from the AACOG Survey Responses and NON-Road Default, San Antonio region, 2005, tons/day

Emission Source	VOC	NOx
Commercial Companies	4.957	1.486
Golf Courses	0.212	0.166
Public Schools	0.505	0.027
University/Colleges	0.060	0.022
Government	0.564	0.073
Other Commercial Companies	0.016	0.018
Cemeteries	0.000	0.000
Private Airports	0.002	0.001
Commercial Airports	0.016	0.018
Military Bases	0.223	0.053
Total	6.556	1.864
NonRoad 2004 Defaults	14.262	2.654

No survey responses from Cemeteries

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Spatial Allocation

- Emissions were geocoded to locations of commercial companies, golf courses, public schools, universities/colleges, private airports, and population
- Emissions were then aggregated to the 4km photochemical model grid system
- Allocating emissions to actual locations can increases the accuracy of ozone predictions in photochemical models

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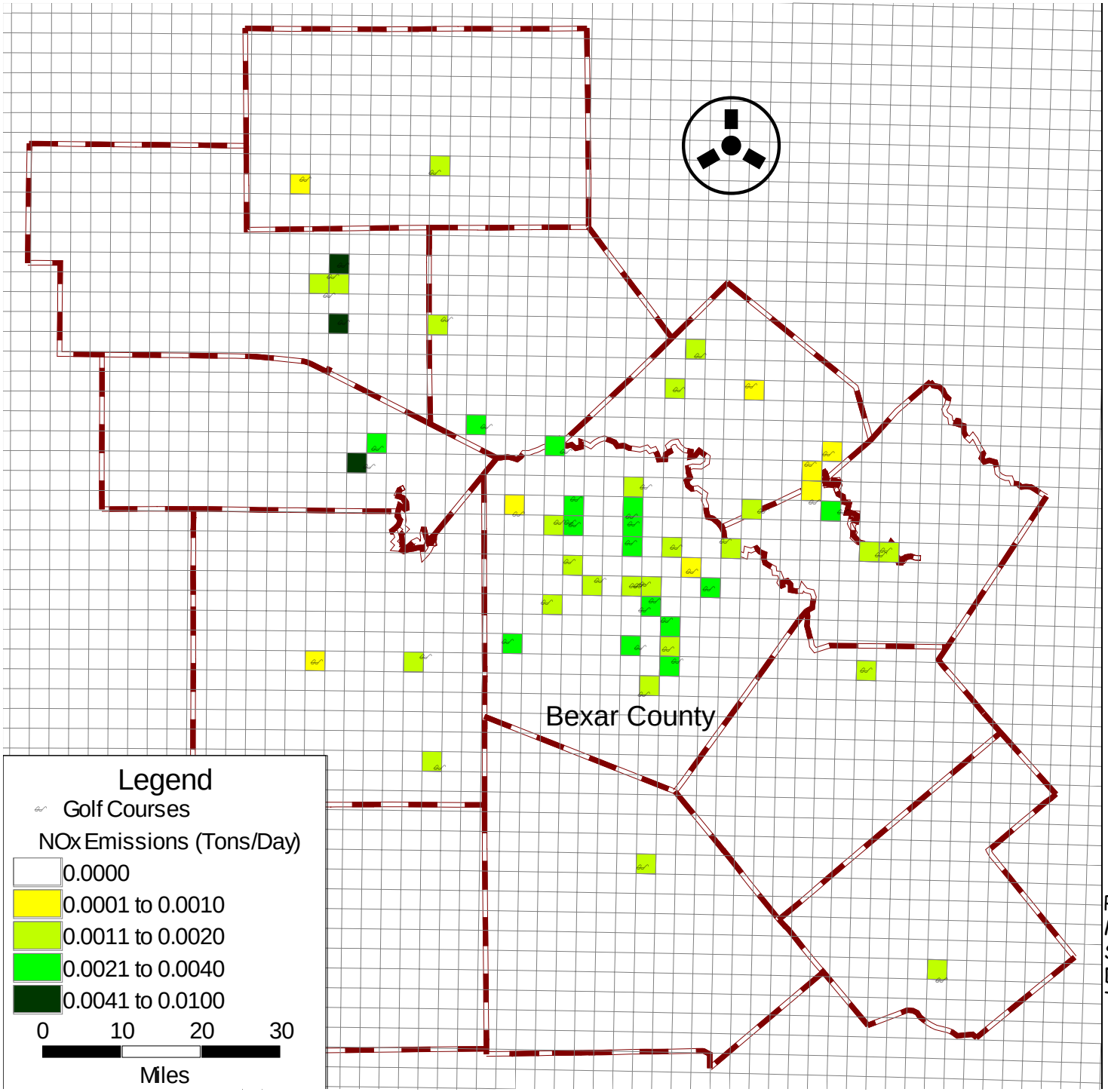
NOx emissions from Diesel Lawn and Garden Equipment at Golf Course, 2005



Plot Date: November 9, 2005
Map Compilation: October 12, 2005
Source: Aerial Photography, District Appraisal Data, and Telephone Survey

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Summary and Next Steps

- Conducting a detailed survey of commercial lawn and garden equipment usage enabled significant improvements to the accuracy of emission inventory estimates.
- Emission estimates for San Antonio were significantly lower then the NONROAD model results.
- San Antonio climate is dry and hot which may reduce the usage of commercial lawn and garden equipment
- Further research on this topic includes expanding the survey to increase the responses from cemeteries and updating emission results with NONROAD model 5.0 or MOVES.

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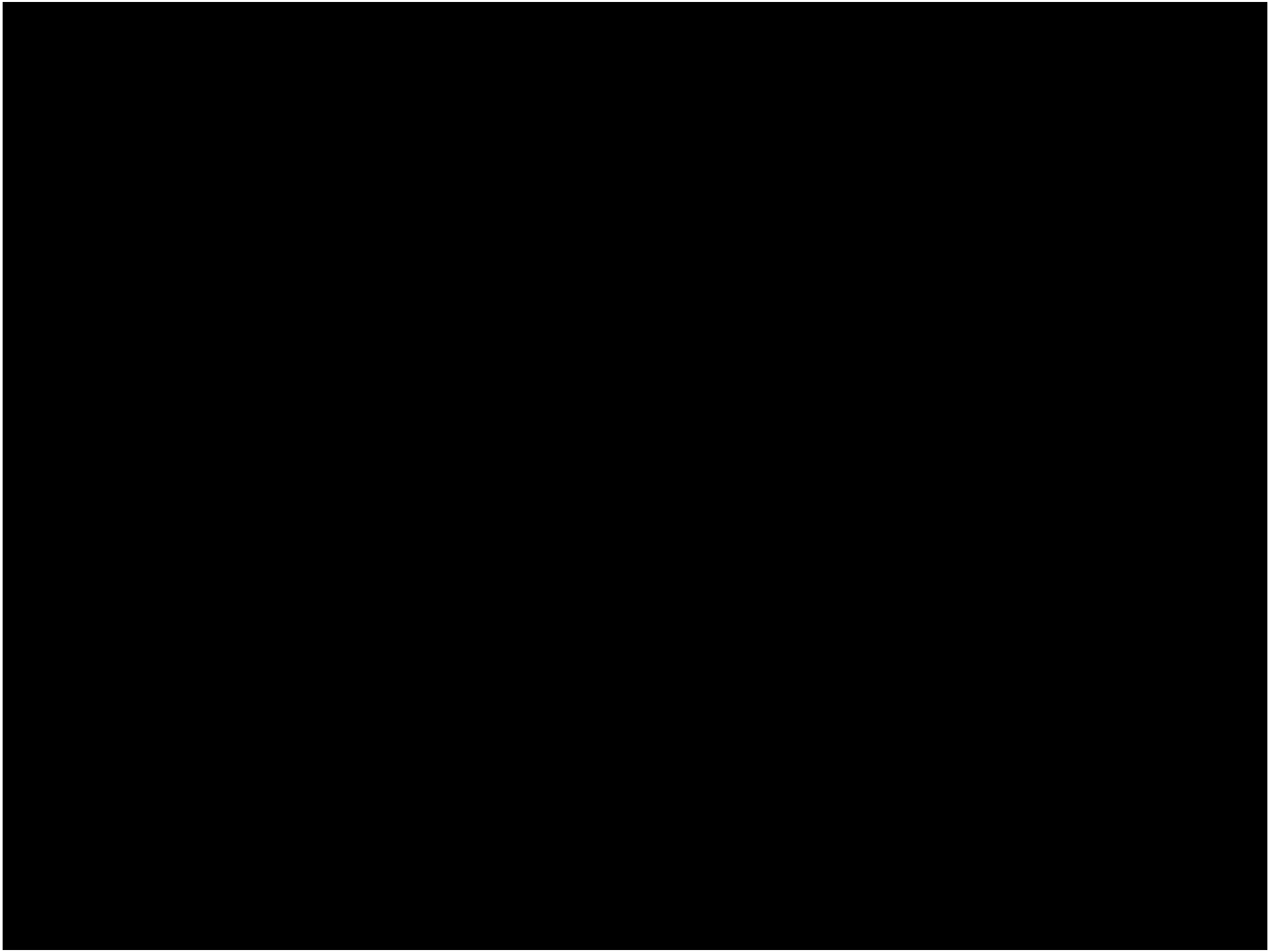

Survey Response Rates

- Commercial Lawn and Garden Companies: 19% Response Rate
- Golf Courses: 15% Response Rate
- Public Schools: 43% Response Rate
- Universities/Colleges: 62% Response Rate
- Gov. Fac., Parks, and Hospitals: Not Calculated
- Other Commercial Companies: Not Calculated
- Cemeteries: No Survey Responses
- Private Airports: 24% Response Rate
- Commercial Airports: 100% Response Rate
- Military Bases: 100% Response Rate

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Non-Road Lawn & Garden

- Allocation Methodologies of Sample Results
  - Commercial L&G Companies was based on average equipment per company
  - Golf Courses was based on improved acres
  - Universities/Colleges was based on improved acres
  - Public Schools was based on number of schools in each school district
  - Government – no allocation
  - Sent out second survey to entities that did not respond to the first survey (significantly increased response rates)

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