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Open Hearing on
a Tobacco-Free Campus Policy

March 10, 2014

US NEWS & WORLD REPORT'S TOP 100 AMERICAN UNIVERSITIES (2013-2014)

Those with smoke-free or tobacco-free policies for their entire campuses appear in italics.

1 Princeton
2 Harvard
3 Yale
4 Columbia
5 Stanford
6 U. of Chicago
7 Duke
7 MIT
7 U. of Pennsylvania
10 Cal Tech
10 Dartmouth
12 Johns Hopkins
12 Northwestern
14 Brown
14 *Washington University in St. Louis*
16 Cornell
17 Vanderbilt
18 Rice
18 Notre Dame
20 *Emory*
20 Georgetown
20 *UC - Berkeley*
23 Carnegie Mellon
23 *UCLA*
23 U. of Southern California
23 U. of Virginia
23 Wake Forest
28 Tufts
28 *U. of Michigan*
30 U. of North Carolina - Chapel Hill
31 Boston College
32 Brandeis
32 College of William & Mary
32 *NYU*
32 U. of Rochester
36 Georgia Tech
37 Case Western Reserve
37 Penn State - University Park
39 *UC - Davis*
39 *UC - San Diego*
41 Boston University
41 Lehigh
41 *Rensselaer Polytechnic Institute*
41 *UC - Santa Barbara*
41 *U. of Illinois - Urbana-Champaign*
41 U. of Wisconsin - Madison
47 *U. of Miami*
47 Yeshiva
49 *Northeastern*
49 *UC - Irvine*
49 *U. of Florida - Gainesville*
52 *George Washington U.*
52 *Ohio State U. - Columbus*
52 *Tulane*
52 *U. of Texas - Austin*
52 U. of Washington - Seattle
57 Fordham
57 Pepperdine
57 U. of Connecticut
60 Southern Methodist U.
60 U. of Georgia - Athens
62 *BYU*
62 Clemson
62 Syracuse
62 *U. of Maryland - College Park*
62 U. of Pittsburgh
62 Worcester Polytechnic Institute
68 Purdue
69 Rutgers
69 Texas A&M
69 *U. of Minnesota*
69 Virginia Tech
73 Michigan State U.
73 *U. of Iowa*
75 *American University*
75 *Baylor*
75 Clark University
75 *Indiana University - Bloomington*
75 Marquette
75 *Miami University - Oxford, Ohio*
75 U. of Delaware
82 Stevens Institute of Technology
82 *SUNY - Stony Brook*
82 Texas Christian University
82 *U. of Vermont*
86 *SUNY College of Environmental Science*
86 U. of Alabama
86 *UC - Santa Cruz*
86 U. of Colorado - Boulder
86 U. of Tulsa, Oklahoma
91 *Auburn*
91 Colorado School of Mines
91 *Florida State University*
91 *U. of Denver*
91 *U. of Massachusetts - Amherst*
91 *U. of San Diego*
97 *SUNY - Binghamton*
97 Drexel
97 *U. of Missouri*
97 U. of New Hampshire

Smoke/Tobacco-Free 38:62 not. 38/100 = 38%

US NEWS & WORLD REPORT'S TOP 100 AMERICAN UNIVERSITIES (2013-2014)

East Coast Universities, from New Hampshire to Georgia

Those with smoke-free or tobacco-free policies for their entire campuses appear in italics.

1 Princeton
2 Harvard
3 Yale
4 Columbia
7 Duke
7 MIT
7 U. of Pennsylvania
10 Dartmouth
12 Johns Hopkins
14 Brown
16 Cornell
20 *Emory*
20 Georgetown
23 Carnegie Mellon
23 U. of Virginia
23 Wake Forest
28 Tufts
30 U. of North Carolina - Chapel Hill
31 Boston College
32 Brandeis
32 College of William & Mary
32 *NYU*
32 U. of Rochester
36 Georgia Tech
37 Penn State - University Park
41 Boston University
41 Lehigh
41 *Rensselaer Polytechnic Institute*
47 Yeshiva
49 *Northeastern*
52 *George Washington U.*
57 Fordham
57 U. of Connecticut
60 U. of Georgia - Athens
62 Clemson
62 Syracuse
62 *U. of Maryland - College Park*
62 U. of Pittsburgh
62 Worcester Polytechnic Institute
69 Rutgers
69 Virginia Tech
75 *American University*
75 Clark University
75 U. of Delaware
82 Stevens Institute of Technology
82 *SUNY - Stony Brook*
82 *U. of Vermont*
86 *SUNY College of Environmental Science*
91 *U. of Massachusetts - Amherst*
97 Drexel
97 *SUNY - Binghamton*
97 U. of New Hampshire

Smoke/Tobacco-Free 12: 40 not. 12/52=23%

US NEWS & WORLD REPORT'S TOP 100 AMERICAN UNIVERSITIES (2013-2014)
Universities in New Jersey, Pennsylvania, Maryland, DC, & Virginia
Those with smoke-free or tobacco-free policies for their entire campuses appear in italics.

- 1 Princeton
- 7 U. of Pennsylvania
- 12 Johns Hopkins
- 20 Georgetown
- 23 Carnegie Mellon
- 23 U. of Virginia
- 32 College of William & Mary
- 37 Penn State - University Park
- 41 Lehigh
- 52 *George Washington U.*
- 62 *U. of Maryland - College Park*
- 62 U. of Pittsburgh
- 69 Rutgers
- 69 Virginia Tech
- 75 *American University*
- 75 U. of Delaware
- 82 Stevens Institute of Technology
- 97 Drexel

Smoke/Tobacco-Free 3:15 not. 3/18 = 1790

28%

is not a negligibly small number.

28% of UD's undergraduates pay about $100 million in tuition each year.

If we lost that tuition revenue, what would UD do?

1. Raise tuition rates?
2. Lower admission standards?
3. Lay off faculty?
4. All of the above?

It might well make sense to institute tobacco-free zones on well-delimited portions of UD's campus, such as the Health Sciences portion of the STAR Campus.

Many other universities have such policies for their medical campuses.

So does the Christiana Hospital, where many UD students are trained.

Toxic Volatile Organic Compounds in Environmental Tobacco Smoke: Emission Factors for Modeling Exposures of California Populations

Final Report

Contract No. A133-186

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October 1994

Key to Abbreviations

ng = nanogram = 10^{-9} gram = 10^{-12} kilogram = 10^{-15} metric ton
μg = microgram = 10^{-6} gram = 10^{-9} kilogram = 10^{-12} metric ton
mg = milligram = 10^{-3} gram = 10^{-6} kilogram = 10^{-9} metric ton

cig. = cigarette

Table 1.1. Summary of environmental tobacco smoke emission factors determined for six commercial cigarettes and Kentucky reference cigarette 1R4F.

Compound	Emission Factor, ng/mg		Emission Factor, μg/cig.		Uncertainty[b] of Emission Factors, %
	Average± Std. Dev.[a]	1R4F	Average± Std. Dev.[a]	1R4F	
Acetaldehyde	3,340±525	3,430	2,150±477	2,220	14
Acrolein[c]	(126±109)	(120)	(86±86)	(78)	14
Acrylonitrile	154±16	185	99±18	120	16
Benzene	630±31	653	406±71	423	7
1,3-Butadiene	236±29	276	152±27	179	25
2-Butanone (MEK)	451±25	585	291±56	379	8
Butyl acetate[d]	<4	<4	<3	<3	7
Butyraldehyde[d]	<29	<29	<18	<18	7
m,p-Cresol[e]	128±27	106	83±26	68	14
o-Cresol[e]	55±11	59	35±5	38	15
Ethyl acetate[d]	<6	<6	<4	<4	7
Ethyl acrylate[d]	<5	<5	<3	<3	14
Ethylbenzene	157±14	178	130±10	89	7
Formaldehyde	2,040±414	2,060	1,310±348	1,330	10
3-Methyl-1-butanol[d]	<23	<23	<14	<14	17
Nicotine	1,410±260	1,540	919±240	993	9
N-Nitrosodiethylamine[d]	<0.033	<0.033	<0.020	<0.020	13
N-Nitrosodimethylamine	0.88±0.11	0.69	0.57±0.12	0.44	13
N-Nitrosomorpholine[d]	<0.033	<0.033	<0.020	<0.020	13
N-Nitrosopyrrolidine	0.16±0.02	0.15	0.10±0.02	0.10	13
Phenol[e]	438±76	368	281±61	238	9
Pyridine	663±126	989	428±122	641	18
Pyrrole	626±94	816	402±90	529	16
Styrene	229±16	250	147±24	162	15
Toluene	1,020±78	1,130	656±107	732	6
3-Vinylpyridine[e]	1,020±149	1,054	662±155	683	10
m,p-Xylene	467±40	504	299±52	327	7
o-Xylene	104±13	115	67±16	75	6
PM-2.5[e]	12,400±1,300	11,900	8,100±2,000	7,700	2

SOOT

a. Average ± Standard Deviation for six commercial cigarettes.
b. Estimated by propagation of errors method for μg/cig values.
c. Use of the acrolein emission factors for exposure modeling is not recommended.
d. Less-than values are lower limits of detection.
e. Emission factors are corrected for deposition losses to chamber surfaces.

Totals: about 10,000 μg = 10 milligrams of VOCs
about 8,000 μg = 8 milligrams of PM-2.5

Key to Abbreviations

ppb = parts per billion

ppm = parts per million cig = cigarette

mg = milligram = 10^{-3} gram = 10^{-6} kilogram = 10^{-9} metric ton

Table 6.23. Environmental chamber concentrations of carbon monoxide and nitric oxide from environmental tobacco smoke during experiments with six commercial cigarettes and Kentucky reference cigarette 1R4F.

Cigarette	Carbon Monoxide, ppm[a.]	Nitric Oxide Peak, ppb[a.]	Nitric Oxide after 250 min, ppb[b.]	Carbon Monoxide Emission Factor, mg/cig	NO Emission Factor, mg/cig
A	13	110	102	99	0.90
A[c.]	13	119	106	99	0.97
B	12	109	96.0	92	0.89
C	7	76.8	65.5	54	0.63
D	9	113	93.9	69	0.93
E	18	138	106	139	1.13
F	16	103	85.2	122	0.84
1R4F	12	107	91.2	92	0.87
Average[d.]	12	109	91.7	96	0.89
Std. Dev.[d.]	4.1	19.8	14.8	32	0.16
C. V.[d., e.]	33	18	16	33	18

a. Maximum gas concentration for three cigarettes. Within the uncertainty of the measurements, the CO peak concentrations did not change over time.
b. Nitric oxide concentration at end of the chamber experiment for three cigarettes.
c. Analysis of a duplicate sample.
d. 1R4F omitted; n = 6.
e. C. V.: Coefficient of Variation = (Std. Dev. X 100) /Average.

Peak CO levels remained unchanged in the sealed chamber over the course of the experiments within the sensitivity of the CO monitor. The concentrations of CO in the chamber over the 4-hour period ranged from 7 to 18 ppm for the eight experiments with an average of 12 ppm. For comparison, the current ambient (outdoor) air quality standard for CO is 9 ppm for an 8-hour exposure. The average emission factor for CO was determined for these experiments to be 96 ± 32 mg/cig. This value is within the range of previously reported SS emission factors (NRC, 1986).

The NO_x levels in the chamber were only slightly above the NO levels. Therefore, the NO_2 levels, which are measured with the chemiluminescence monitor as the difference between NO_x and NO, were only slightly above background laboratory levels. Also, the uncertainty in the calculated NO_2 levels was high. Consequently, only NO levels are reported in Table 6.23. Although the NO levels decayed throughout the experimental period, the average difference between the peak and final levels was only 15%. Since air infiltration alone would account for a 12% decrease in the airborne concentration over the period, the loss of NO can be attributed to air infiltration rather than chemical reactions of NO. These results suggest that there was very little chemical reaction in the chamber to generate NO_2 under the conditions of this study.

Facts

Idling Vehicle Emissions for Passenger Cars, Light-Duty Trucks, and Heavy-Duty Trucks

The amount of pollution that a vehicle emits is dependent on many factors. The U.S. Environmental Protection Agency (EPA) has developed a series of computer models that estimate the average emissions for different types of highway vehicles. This fact sheet is one of a series on highway vehicle emission factors. It presents average emission rates for passenger cars, light-duty trucks, (e.g., pickup trucks, sport-utility vehicles), heavy-duty trucks (semi tractor-trailers), and motorcycles when they are idling.

Introduction

There are a number of factors that affect the rate at which any vehicle emits air pollutants, whether the vehicle is being driven or is at idle (engine running, but vehicle not moving). Some of the most important are:

- vehicle type/size (passenger cars, light-duty trucks, heavy-duty trucks, motorcycles)
- vehicle age and accumulated mileage
- fuel used (gasoline, diesel, others)
- ambient weather conditions (temperature, precipitation, wind)
- maintenance condition of the vehicle (well maintained, in need of maintenance, presence and condition of pollution control equipment)

The most current version of the computer model that EPA uses to estimate average in-use emissions from highway vehicles is MOBILE6.2. EPA, the States, and others use this model to estimate total emissions of pollutants generated by highway vehicles in various geographic areas and over specific time periods. The idle emission rates or "emission factors" presented in this fact sheet are based on national data representing the in-use fleet as of July 2008.

EPA United States Environmental Protection Agency

Office of Transportation and Air Quality
EPA420-F-08-025
October 2008

Table 1: Average Idle Emission Rates by Pollutant and Vehicle Type[2]

		GASOLINE AUTOMOBILES	LIGHT TRUCKS	HEAVY TRUCKS	DIESEL AUTOMOBILES	LIGHT TRUCKS	HEAVY TRUCKS	MOTORCYCLES
Pollutant	**Units**	**LDGV**	**LDGT**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**
VOC	g/hr	2.683	4.043	6.495	1.373	2.720	3.455	19.153
	g/min	0.045	0.067	0.108	0.023	0.045	0.058	0.319
THC	g/hr	3.163	4.838	7.260	1.353	2.680	3.503	21.115
	g/min	0.053	0.081	0.121	0.023	0.045	0.058	0.352
CO	g/hr	71.225	72.725	151.900	7.018	5.853	25.628	301.075
	g/min	1.187	1.212	2.532	0.117	0.098	0.427	5.018
NOx	g/hr	3.515	4.065	5.330	2.690	3.705	33.763	1.625
	g/min	0.059	0.068	0.089	0.045	0.062	0.563	0.027
$PM_{2.5}$	g/hr	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	1.100	N/A[1]
	g/min	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	0.018	N/A[1]
PM_{10}	g/hr	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	1.196	N/A[1]
	g/min	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	0.020	N/A[1]

COMPARISON OF SOURCES OF COMMON AIR POLLUTANTS

VOC = Volatile Organic Compounds; CO = Carbon Monoxide; NOx = NO + NO_2 = Nitrogen Oxides

POLLUTANT	A CAR IDLING FOR 5 MINUTES	SMOKING A CIGARETTE	RATIO
VOC	5×0.045 g = 0.225 g	~10 mg = ~0.010 g	~22:1
CO	5×1.187 g = 5.935 g	~96 mg = ~0.096 g	~60:1
NOx	5×0.059 g = 0.295 g	~0.9 mg = ~0.0009 g	~330:1

The car idling (or being driven) for 5 minutes emits much more of these air pollutants than 1 cigarette.

Modern automobiles emit relatively little fine Particulate Matter (PM-2.5) of 2.5 microns or less, so a comparison of their emissions with those from cigarettes would not be very meaningful.

248 Megawatt Gas-Fired Power Plant on the STAR Campus

DNREC Air Permit Application

Table B-1B: Facility Wide Emissions - NORMAL OPERATING
Wolf 1 CHP Data Center
Newark, Delaware

Facility Yearly Estimated Actual Emissions - Normal Operating

Emitting Units	LM2500 DLE CT	LM2500 DLE CT	18V50SG RGE	Cooling Towers	Facility Total
Number of Units	6	0	2	2	
Pollutant	(tons/year)	(tons/year)	(tons/year)	(tons/year)	(tons/year)
NO_x	42.2	0.0	21.69	-	63.87
CO	9.6	0.0	47.00	-	56.62
VOC	12.2	0.0	47.00	-	59.16
SO_2	8.2	0.0	0.71	-	8.88
PM_{10}	38.2	0.0	43.38	3.46	85.05
$PM_{2.5}$	38.2	0.0	43.38	3.46	85.05
PM_{Total}	38.2	0.0	43.38	3.46	85.05
H_2SO_4	6.1	0.0	1.28	-	7.42
Ammonia	55.5	0.0	11.62	-	67.13
HAPs	0.6	0.0	12.85	-	13.44
Greenhouse Gas Emissions (CO_{2e})					GWP factor / CO_{2e} (tons)
CO_2	636,843	0	175,339	-	1 / 812,182
CH_4	49.8	0.0	2.67	-	21 / 1,102
N_2O	17.4	0.0	0.27	-	310 / 5,467
SF6*	0.00225				23,900 / 54
Total Greenhouse Gas Emissions (CO_{2e})					- / 818,804

Notes:

1. Normal operating emissions for reciprocating gas engines are based on operations of 2 engines at 100% rated capacity for 8,760 hours per year.
2. Normal operating emissions for gas combustion turbines are based on operations of 6 engines at rated capacity for 8,760 hours per year, which does not take into account downtime for maintenance. Annual downtime for turbine maintenance is anticipated to be minimal.

COMPARISON OF SOURCES OF COMMON AIR POLLUTANTS

How many cigarettes would need to be smoked to produce the same annual emissions of common air pollutants as those from The Data Centers' 248 Megawatt gas-fired power plant on the STAR Campus?

VOC = Volatile Organic Compounds:
$\sim$59 English tons/year $\simeq$ 53 metric tons/year $\simeq 53\times10^6$ grams/year.
Divide this quantity by $\sim$10 milligrams/cigarette $\simeq 10^{-2}$ grams/cigarette to obtain 5.3×10^9 cigarettes/year.
Divide this quantity by 365 days/year to obtain 1.45×10^7 cigarettes/day = 14,500,000 cigarettes per day.

CO = Carbon Monoxide:
$\sim$56.6 English tons/year $\simeq$ 51 metric tons/year $\simeq 51\times10^6$ grams/year.
Divide this quantity by $\sim$100 milligrams/cigarette $\simeq 10^{-1}$ grams/cigarette to obtain 5.1×10^8 cigarettes/year.
Divide this quantity by 365 days/year to obtain 1.4×10^6 cigarettes/day = 1,400,000 cigarettes per day.

NOx = NO + NO_2 = Nitrogen Oxides
$\sim$63 English tons/year $\simeq$ 57 metric tons/year $\simeq 57\times10^6$ grams/year.
Divide this quantity by $\sim$0.9 milligrams/cigarette $\simeq 9\times10^{-4}$ grams/cigarette to obtain 6.3×10^{10} cigarettes/year.
Divide this quantity by 365 days/year to obtain 1.73×10^8 cigarettes/day = 173,000,000 cigarettes per day.

PM-2.5 = Particulate Matter of Diameter less than 2.5 Microns
$\sim$85 English tons/year $\simeq$ 77 metric tons/year $\simeq 77\times10^6$ grams/year.
Divide this quantity by $\sim$8 milligrams/cigarette $\simeq 8\times10^{-3}$ grams/cigarette to obtain 9.6×10^9 cigarettes/year.
Divide this quantity by 365 days/year to obtain 2.6×10^7 cigarettes/day = 26,000,000 cigarettes per day.

That would require each of about 26,000 members of the UD community to smoke about 1000 cigarettes per day, about 50 packs per day.

This power plant will also emit other air pollutants, such as about 7.4 tons per year of H_2SO_4 = Sulfuric Acid Mist, and about 67.1 tons per year of NH_3 = Gaseous Ammonia, which are not emitted by cigarettes.

A tobacco-free campus may not be a smoke-free campus.