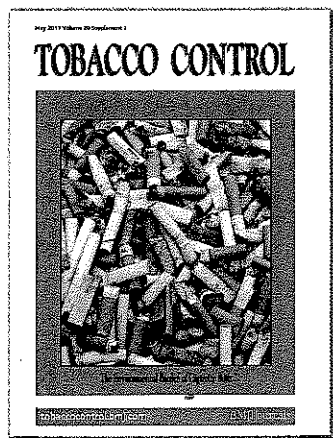


# TOBACCO CONTROL



*The Environmental Burden of Cigarette Butts*



Cover image: Artwork courtesy of Tyson Volkmann, San Diego State University.

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# Smoke-free college campuses: no ifs, ands or toxic butts

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## ABSTRACT

**Objective** To better estimate the burden of toxic cigarette butt waste and create awareness of the hazardous nature of cigarette butts on two large university campuses in San Diego by organizing and conducting student cigarette butt clean-up activities.

**Methods** Two separate campus-wide clean-ups were conducted by student volunteers at San Diego State University (SDSU) and at University of California San Diego (UCSD) between April and July 2010.

**Results** In 1 h, 63 volunteers at SDSU collected 23 885 butts; 6525 cigarette butts were collected in 1 h by 17 volunteers at UCSD. The average number of cigarette butts picked up per individual was 379.1 at SDSU and 383.8 at UCSD (range 25–1030 per volunteer).

**Conclusions** The amount of cigarette waste on college campuses nationally may be quite substantial given the many thousands of cigarette butts gathered at each of the San Diego institutions. In just 10 s on average a volunteer could locate, walk to, pick up and put a cigarette butt in the collection bag and then begin looking for another discarded butt, indicating the saturation of cigarette butts on campus. Smoke-free policies on campus could have far-reaching effects not only in reducing smoking behaviour on campus and ground clean-up costs, but also on the environment. Campus cigarette waste clean-ups can be utilized to call attention to the issue of cigarette butt waste in the environment.

## INTRODUCTION

Cigarette waste consisting primarily of filters are the most common form of litter worldwide and are considered toxic waste due to the environmental leachates such as nicotine and ethylphenol and the non-biodegradable cellulose acetate used to make cigarette filters.<sup>1–4</sup> Cigarette butts are often tossed carelessly on the ground, making their way to waterways and ultimately our oceans and beaches. In fact, records from beach clean-up report cigarette filters the most commonly littered object found on beaches year after year, and may comprise up to 25% of roadside waste as well.<sup>5</sup> Cigarette butts deposited by smokers at large outdoor venues such as at colleges and universities may contribute substantially to the total quantity of cigarette waste found in the environment, though specific studies have never been conducted. However, US colleges and university campuses must deal with the challenges of gathering and disposing of cigarette waste as approximately 17.9% of college students smoked in the previous 30 days in 2008, and 9.2% smoke daily.<sup>6</sup> This translates nationally

into approximately 3.72 million current student smokers on college campuses in the US in 2007.<sup>7, 8</sup>

According to the Americans for Non-Smoker's Rights Foundation (ANR), as of January 2011, 466 out of 4409 (approximately 10.6%) college and university campuses are 100% smoke free.<sup>8, 9</sup> While many cigarette butt clean-ups have been conducted nationwide on beaches and urban environments, specific college campus butt clean-ups have not been reported. Clean-ups on beaches have led to the development of outdoor smoke-free policies based on environmental concerns.<sup>10</sup> This paper describes two recent campus clean-ups in San Diego, California.

## METHODS

A campus-wide cigarette filter clean-up was planned by a group of public health students at San Diego State University (SDSU). Volunteers for the clean-up were recruited through undergraduate public health courses at SDSU through announcements made in class, and they were offered extra credit for participating in the clean-up. An orientation was held at SDSU 3 days prior to the clean-up to inform volunteers about the environmental burden of cigarette butt waste and how to prepare for the cigarette butt clean-up.

The SDSU Physical Plant Division on campus was contacted to confirm the clean-up was permitted and to assure compliance with safety standards. The Physical Plant Division provided latex gloves and trash pickers to aid the volunteers in the collection of butts, and also a list of locations on campus where greater cigarette butt accumulation has been noted. In addition, paper bags for butt collection were provided by a national grocery chain store, and SDSU provided hand sanitiser solution and sunscreen for the volunteers. Volunteers were instructed to pick up cigarette butts from the ground and not to remove them from the trash or existing cigarette receptacles. Volunteers were told to keep count of the number of butts each collected as well as, cigar waste, cigarette packaging and anything else cigarette/smoking related. Each volunteer collected as many cigarette butts as possible in 1 h in each specific location.

On 17 April 2010 at SDSU, 63 students participated in the 1 h cigarette butt clean-up. In order to cover the entire 300-acre campus, six different groups were selected to cover six location grids, based on information provided by the Physical Plant Department. At the end of the clean-up, each volunteer wrote the number of cigarette butts collected on each bag. Each bag was counted to give the total number of cigarette butts collected from the entire campus.



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A second cigarette waste clean-up was also conducted as part of a summer global health course by 17 high schools students on the University of California San Diego (UCSD) campus (La Jolla) on 20 July 2010. Students were sent to eight different geographic areas on campus that covered all major walkways within the central area of the 1200-acre campus. The methodology for the clean-up and reporting were similar to that described for SDSU.

SDSU and UCSD are both located within San Diego County, a coastal environment with extensive beach environments to the west and a desert biome to the east. Their enrolments are approximately 35 000 and 27 500 respectively. Both universities have numerous cigarette specific receptacles and the Physical Plant at each university report picking up cigarette waste during normal trash collecting activities at least weekly. No clean-ups specifically for cigarette waste were reported by the universities.

### RESULTS

In 1 h, the 63 volunteers at SDSU collected 23 885 butts, 10 cigarette-packaging containers and 2 cigars; 6525 cigarette butts were collected in 1 h by 17 volunteers at UCSD. The average number of cigarette butts picked up per individual was 379.1 at SDSU and 383.8 at UCSD (range 25–1030 per volunteer). The amount of butts per volunteer depended largely on the respective area to which they were assigned. The overall rate of cigarette clean-up per volunteer amounted to 1.05 cigarette butts picked up every 10 s.

As part of Earth Day activities (2010) at SDSU, the cigarette butt waste was displayed in two large clear cylinders, along with a poster describing the clean-up (figure 1), to call attention to the issue of cigarette waste on campus. In addition, the results were presented by one of the authors (MS) to a meeting of the Associated Students in order to stimulate discussion on developing a smoke-free campus policy.

### DISCUSSION

The amount of cigarette waste on college campuses nationally may be quite substantial given the many thousands of cigarette butts gathered at each of the San Diego institutions. Perhaps most indicative of the saturation of cigarette butt waste on campuses is the rate of butt discovery, where in just

10 s on average a volunteer could locate, walk to, pick up and put a cigarette butt in the collection bag, and then begin looking for another discarded butt. This rate of pick-up surprised the volunteers and impressed on them how many discarded cigarette butts may be encountered on each of the campuses.

### Smoking in college

Smoking rates have been on the decline for decades in the US, to the current level of 20.6% among adults 18 and over.<sup>11</sup> The 30-day and daily use prevalence of cigarettes among full-time students at 4-year colleges is 17.9 and 9.2% respectively, which is lower than their age-mates not enrolled full time who had 30-day and daily use prevalence rates of 31.4 and 24.7%.<sup>6</sup> Nationwide only 11.1% of those with an undergraduate degree smoke indicating that increasing education may influence smoking behaviour.<sup>11</sup> There is a high desire to quit among college students, with one study reporting that among students at trade or technical schools 74% had reported a previous quit attempt.<sup>12</sup> Other studies report between 52.6 and 64.0% of college smokers wanted to quit before graduation.<sup>12 13</sup> About three out of four college smokers started smoking before college, and 39.4% of smokers say their level of smoking increased during college.

These statistics illustrate a high level of transition in smoking behaviour during the college years. Tobacco control policies on campus should realise the important opportunity that exists to reduce smoking prevalence on campus by implementing smoke-free campuses and increased attention to the environmental issues associated with discarded cigarette butts. In a large nationwide survey conducted by the Princeton Review, two-thirds (64%) of incoming freshman in 2010 reported that a comparison of a college's commitment to environmental issues would contribute to the student's decision to apply to or attend a school, indicating a high level of ecoconsciousness among college students.<sup>14</sup>

### Smoke free policies

There is overwhelming evidence of how smoke-free policies in the workplace have been effective in assisting workers to quit smoking.<sup>15 16</sup> Furthermore, smoke-free policies in restaurants have been shown to slow initiation of smoking among adolescents in a community by reducing the transition from experimentation with smoking to established use.<sup>17</sup> Similar to the workplace and restaurant smoke-free policies, campus-wide smoking bans could reduce the number of smokers on campus and perceived social norms regarding tobacco use thus representing a potentially powerful prevention and control mechanism. Surveys of college students have shown that smokers and non-smokers generally support tobacco control policies on campus.<sup>18 19</sup> While decreasing the number of students who smoke on campus would undoubtedly result in health benefits among student smokers, and those exposed through secondhand smoke, it would also reduce the amount of toxic cigarette waste produced on campus.

College campuses are places of leadership, learning, enlightenment and change. Regarding the adoption of policies to reduce environmental waste footprints, colleges and universities have the responsibility to raise the level of attention to smoking as an environmental hazard. As college and university administrators strive to reduce their environmental waste footprint they should consider how continuing to allow smoking on campus results in environmental contamination. Agencies that provide rankings on how 'green' a campus is

## SDSU Cigarette Butt Cleanup

April 17, 2010



#### WHY?

- Thousands of cigarette butts are tossed illegally around SDSU campus every day
- Cigarette butts contain nicotine, heavy metals, and known carcinogens, toxic to living things
- Discarded cigarette butts, mainly the plastic filter, are a form of non-biodegradable waste
- They wash out to drains, streams, and the ocean.

#### HOW MUCH?

On the SDSU campus, 62 volunteers found—

- in ONE day,
- in ONE hour,
- in ONE square mile,

**23,885 butts and 2 cigars!**

#### WHAT TO DO?

- **STOP SMOKING!**
- Advocate for a smoke-free campus.
- Hold onto your butts!
- Politely remind smokers not to toss their butts into the environment



Figure 1 Poster with cigarette butt clean-up results created for Earth Day, San Diego State University, San Diego, California, USA, 2010.

### What this paper adds

- ▶ Many descriptive studies have reported the burden of toxic cigarette waste in beaches, parks and other outdoor venues. No study has ever reported the results of a cigarette butt clean-up on a college campus.
- ▶ The two campuses evaluated within this report have a substantial burden of cigarette waste. A 1 h campus-wide clean-up methodology was used to measure cigarette waste on campus. The methods described herein can be used to (1) measure the burden of cigarette waste, (2) monitor smoking policy behaviour and (3) monitor changes in cigarette butt littering behaviour. Disseminating the results of cigarette waste clean-ups on campus may be beneficial in enacting policy change that could reduce smoking among students and improve the physical environment.

such as the Sierra Club, the Sustainable Endowments Institute and Greenopia should consider cigarette waste and smoke-free policies in their rankings. A smoke-free policy on campus would reduce avoidable toxic waste produced by smoking on campus. Raising attention to the issue of cigarette waste as an environmental hazard on campus could be helpful in further reducing smoking prevalence or enacting smoke-free policies.

### Costs to facilities

Cigarette butts are not only unattractive on campus, but filters are non-biodegradable plastic and therefore may accumulate in the environment. As colleges and universities often operate as mini-municipalities with their own facilities management divisions, the brunt of clean-up costs for cigarette waste is placed upon the institutions themselves, increasing operating costs. Grounds administrators at Penn State University estimated that annual costs associated with cigarette waste reach US \$150 000.<sup>20</sup> Costs include machinery used to gather cigarette butts, trash and butt receptacles and personnel costs.

### Limitations

While the total number of butts collected by each volunteer is self-reported and prone to counting errors, we believe our data indicate widespread cigarette waste on campus. This is evident in the fact that at each respective campus, the number of cigarette butts gathered per volunteer was similar (379 at SDSU vs 383 at UCSD). The density of cigarette butt receptacles and the schedule of routine sidewalk cleaning by the universities may have biased our results. However, even with routine cleaning, the apparent age of some cigarette butts collected indicate that many are simply missed in the process. Had there been more volunteers, undoubtedly thousands more cigarette butts would have been gathered as there were still many visible cigarette butts at the end of the 1 h clean-up sessions. Furthermore, the clean-up at UCSD was conducted during the summer quarter when substantially fewer students and consequently less smokers were on campus in the weeks preceding the clean-up. Therefore we believe our findings underreport the true burden of cigarette waste on each campus.

### CONCLUSIONS

The two campuses evaluated within this report are substantially burdened by cigarette waste. Campus cigarette waste

clean-ups can be used to call attention to the issue of cigarette butt waste in the environment. Smoke-free policies on campus would have far-reaching effects on not only the health of students but also on the campus environment. Future research could validate the use of this 1 h clean-up methodology in future campus clean-ups as a tool to monitor smoking policy compliance and changes in littering behaviour. Furthermore, research should be performed to determine if college students would be more likely to quit smoking or support outdoor smoke-free policies after considering the environmental impact caused by toxic and hazardous cigarette waste. Further research should be conducted to see how outdoor smoke-free policies on campus effect (1) smoking behaviour including initiation, quit rates and perceived social norms among college students, (2) the amount of cigarette waste on campus and (3) the economic benefit to campuses in reduced clean-up costs.

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**Competing interests** None.

**Contributors** MS planned and coordinated the San Diego State University (SDSU) clean-up and the Earth Day activities as well as contributed to the manuscript; RL coordinated the University of California San Diego (UCSD) clean-up and wrote the manuscript; TN supervised the research projects and revised the manuscript.

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### REFERENCES

1. **Novotny TE**, Lum K, Smith E, *et al.* Cigarettes butts and the case for an environmental policy on hazardous cigarette waste. *Int J Environ Res Public Health* 2009;**6**:1691–705.
2. **Micevska T**, Warne MS, Pablo F, *et al.* Variation in, and causes of, toxicity of cigarette butts to a cladoceran and microtox. *Arch Environ Contam Toxicol* 2006;**50**:205–12.
3. **Moriwaki H**, Kitajima S, Katahira K. Waste on the roadside, 'poi-sute' waste: its distribution and elution potential of pollutants into environment. *Waste Manag* 2009;**29**:1192–7.
4. **Smith EA**, McDaniel PA. Covering their butts: responses to the cigarette litter problem. *Tobacco control* 2011;**20**:100–6.
5. **Ocean Conservancy.** *International Coastal Cleanup: Summary Report for the United States.* The Ocean Conservancy. 2007. <http://www.oceanconservancy.org/site/News2?page=NewsArticle&id=11411> (accessed 14 Sept 2010).
6. **Johnston LD**, O'Malley PM, Bachman JG, *et al.* *Monitoring the Future National Survey Results on Drug Use, 1975–2008: Volume II, College Students and Adults Ages 19–50.* Bethesda, MD: National Institute on Drug Abuse, 2009.
7. **Johnston L**, O'Malley P, Bachman J, *et al.* *Monitoring the future. National Survey Results on Drug Use, 1975–2007. Volume II: College Students and Adults ages 19–45.* 2007. (NIH Publication No. 08-6418B). Bethesda, MD: National Institute on Drug Abuse, 2007.
8. **National Center for Education Statistics, Education Directory, Colleges and Universities.** 2009. [http://nces.ed.gov/programs/digest/d09/tables/dt09\\_187.asp](http://nces.ed.gov/programs/digest/d09/tables/dt09_187.asp) (accessed Mar 2011).
9. **American Nonsmokers Rights Association.** *U.S. Colleges and Universities with Smokefree Air Policies.* 2011. <http://www.no-smoke.org/pdf/smokefreecollegeuniversities.pdf> (accessed 15 Feb 2011).
10. **Moore SL**, Gregorio D, Carreon M, *et al.* Composition and distribution of beach debris in Orange County, California. *Mar Pollut Bull* 2001;**42**:241–5.
11. **Centers for Disease Control and Prevention.** Vital signs: current cigarette smoking among adults aged—18 years—United States, 2009. *MMWR Morb Mortal Wkly Rep* 2010;**59**:1135–40.
12. **Loukas A**, Murphy JL, Gottlieb NH. Cigarette smoking and cessation among trade or technical school students in Texas. *J Am Coll Health* 2008;**56**:401–7.
13. **Levinson AH**, Campo S, Gascoigne J, *et al.* Smoking, but not smokers: identity among college students who smoke cigarettes. *Nicotine Tob Res* 2007;**9**:845–52.
14. **The Princeton Review.** *2010 College Hopes & Worries Survey Report.* 2010. [http://www.princetonreview.com/uploadedFiles/Test\\_Preparation/Hopes\\_and\\_Worries/HopeAndWorries\\_Full%20Report.pdf](http://www.princetonreview.com/uploadedFiles/Test_Preparation/Hopes_and_Worries/HopeAndWorries_Full%20Report.pdf) (accessed 14 Sept 2010).
15. **Bauer JE**, Hyland A, Li O, *et al.* A longitudinal assessment of the impact of smoke-free worksite policies on tobacco use. *Am J Public Health* 2005;**95**:1024–9.

16. **Fichtenberg CM**, Glantz SA. Effect of smoke-free workplaces on smoking behaviour: systematic review. *BMJ* 2002;**325**:188.
17. **Siegel M**, Albers AB, Cheng DM, *et al*. Local restaurant smoking regulations and the adolescent smoking initiation process: results of a multilevel contextual analysis among Massachusetts youth. *Arch Pediatr Adolesc Med* 2008;**162**:477–83.
18. **Rigotti NA**, Regan S, Morari SE, *et al*. Students' opinion of tobacco control policies recommended for US colleges: a national survey. *Tob Control* 2003;**12**:251–6.
19. **Thompson B**, Coronado GD, Chen L, *et al*. Preferred smoking policies at 30 Pacific Northwest colleges. *Public Health Rep* 2006;**121**:586–93.
20. **Lackey K**. *Penn State Commission Pushes for Smoking Ban*. University Park, PA: The Daily Collegian, 2007.

