

# Use of Market Forensics to Estimate the Environmental Load of Ingredients from Consumer Products

Paul C. DeLeo, American Cleaning Institute

Stephen M. Mudge, Exponent

Scott D. Dyer, The Procter and Gamble Company

8<sup>th</sup> National Monitoring Conference

Portland, Oregon

May 2, 2012



american cleaning institute®  
for better living

**Exponent**®  
Engineering and Scientific Consulting

**P&G**



# Who are we?



The 120-member trade association of the \$30 billion US cleaning products industry



# Background

- ACI has conducted ingredient safety research for 50 years typically focusing on surfactants
- Surfactants are common ingredients in cleaning products and are used in high volumes
- Common consumer products containing surfactants include shampoos, laundry detergent, dish detergent and hand soap



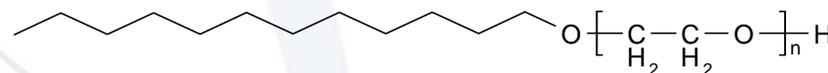
american cleaning institute®  
for better living

# Case Study: Alcohol-based Ingredients

- Numerous alcohol-based surfactants

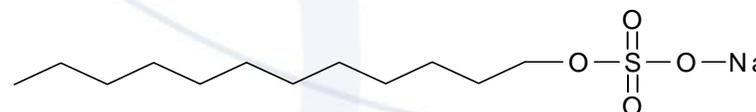
- Nonionic

- Alcohol ethoxylate (AE)



- Anionic

- Alcohol sulfates (AS)
    - Alcohol ethoxysulfates (AES)



- Free alcohols



american cleaning institute®  
for better living

# Alcohol-based Ingredients (cont.)

- Global volume of detergent alcohol surfactants
  - AE/AES – 2 billion pounds
  - Alcohol sulfates – 300 million pounds
  - Free alcohols – 225 million pounds
- Products disposed of “down-the-drain”
- High removal during wastewater treatment, but high volume means some residues in effluent
- Chronic aquatic toxicity typically <1 mg/L



american cleaning institute®  
for better living

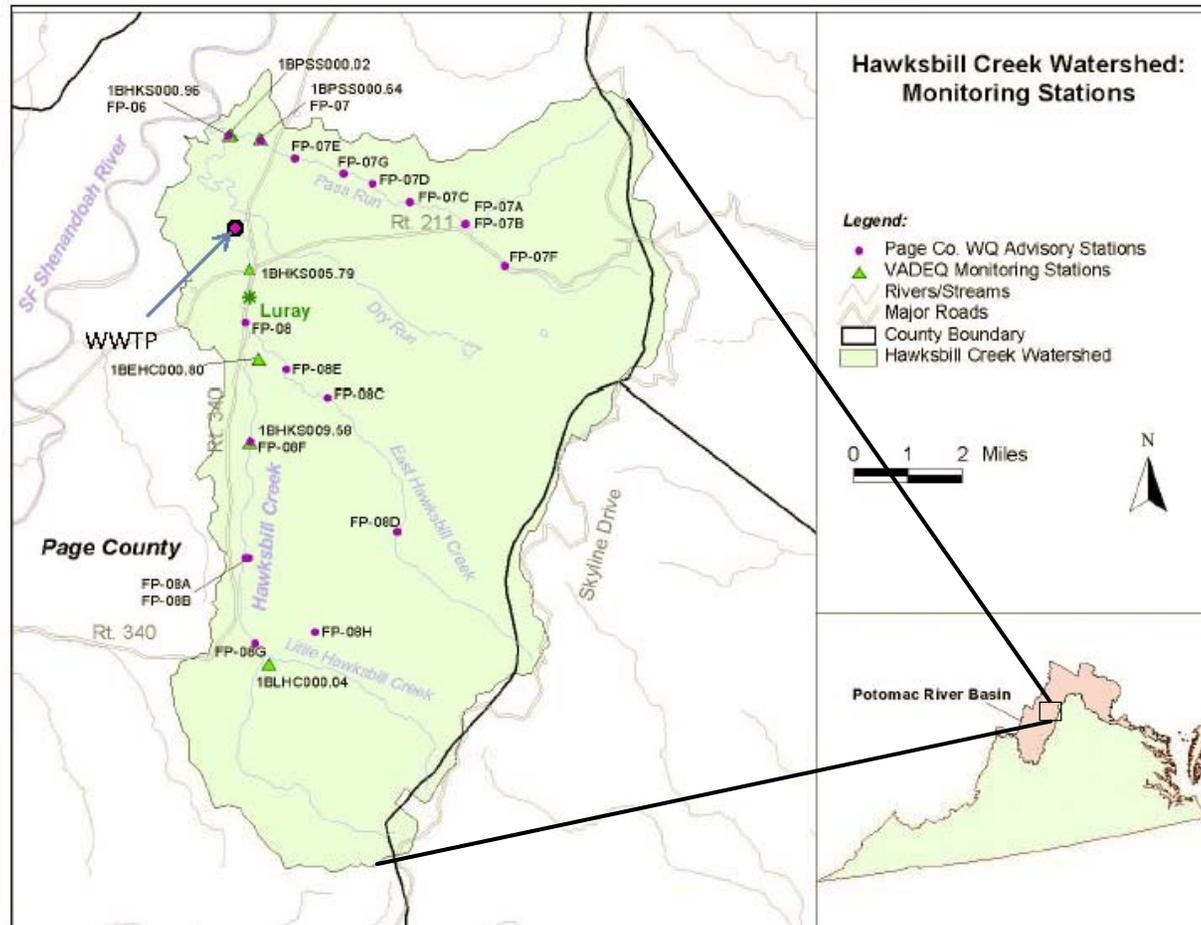
# What is the anthropogenic input of alcohol-based surfactants from consumer products?

WWTP load = Population served × Per capita use rate



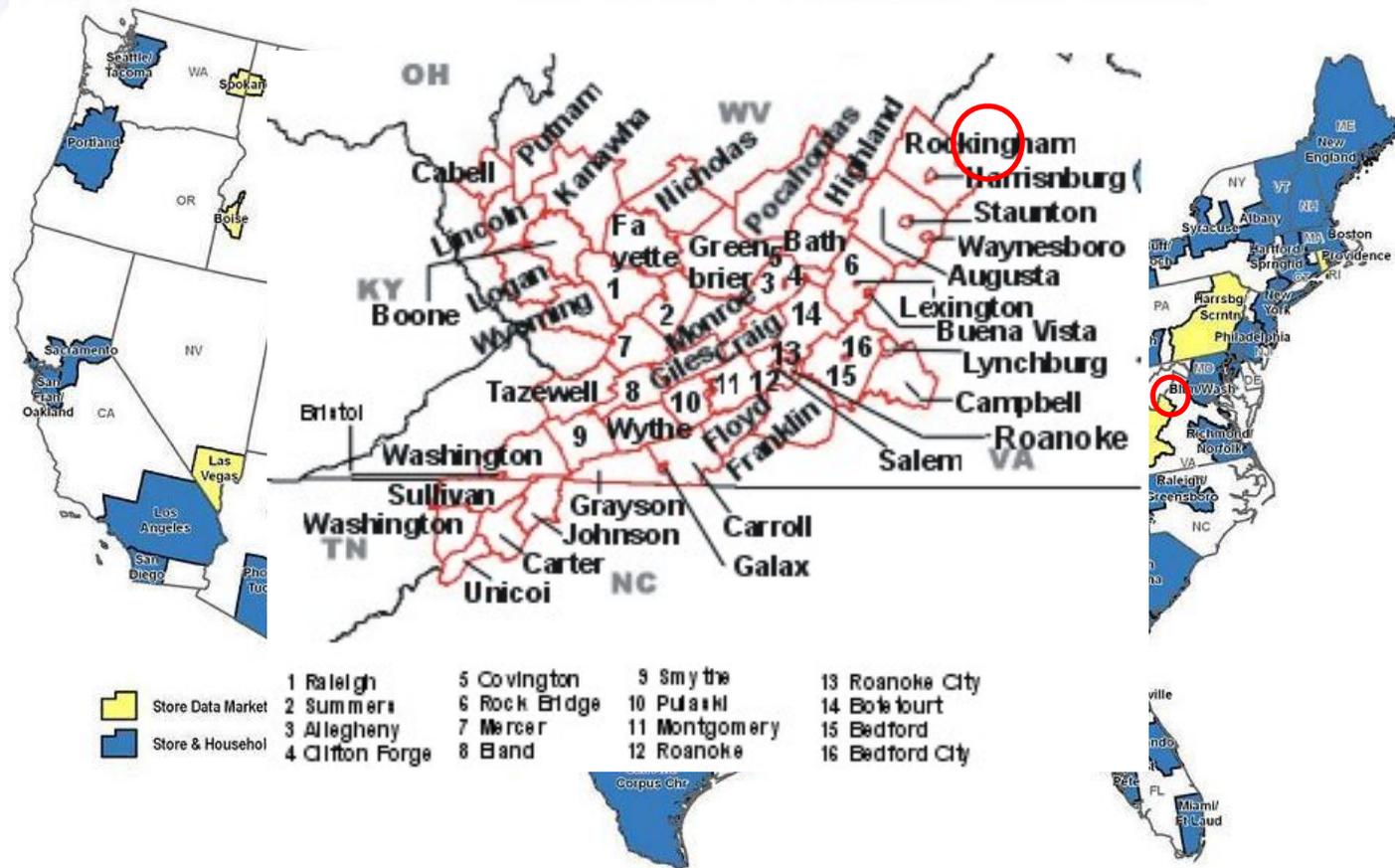
american cleaning institute®  
for better living

# Detailed Field Study of Alcohol-Based Surfactants Hawksbill Creek Watershed, Luray, VA



american cleaning institute®  
for better living

# IRI Grocery Store Data Markets



american cleaning institute®  
for better living

# Product Market Information

(10/5/2008 - 3/22/2009)

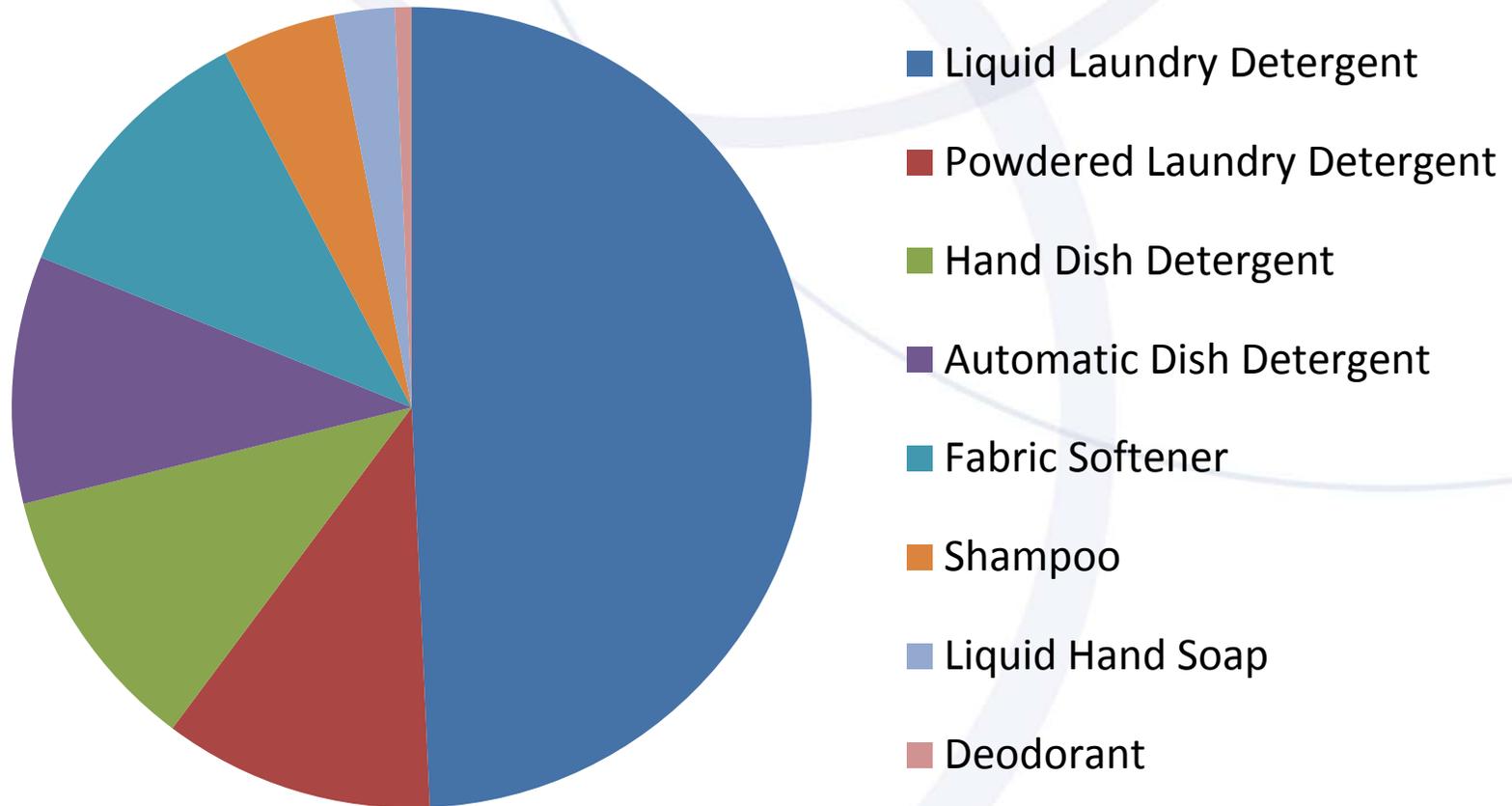
- Categories
  - Liquid Laundry Detergent (58)
  - Powdered Laundry Detergent (27)
  - Fabric Softener (38)
  - Automatic Dish Detergent (33)
  - Hand Dish Detergent (53)
  - Hand Soap (77)
  - Shampoo (474)
  - Deodorant (157)



american cleaning institute®  
for better living

# Volume of Alcohol-Based Products

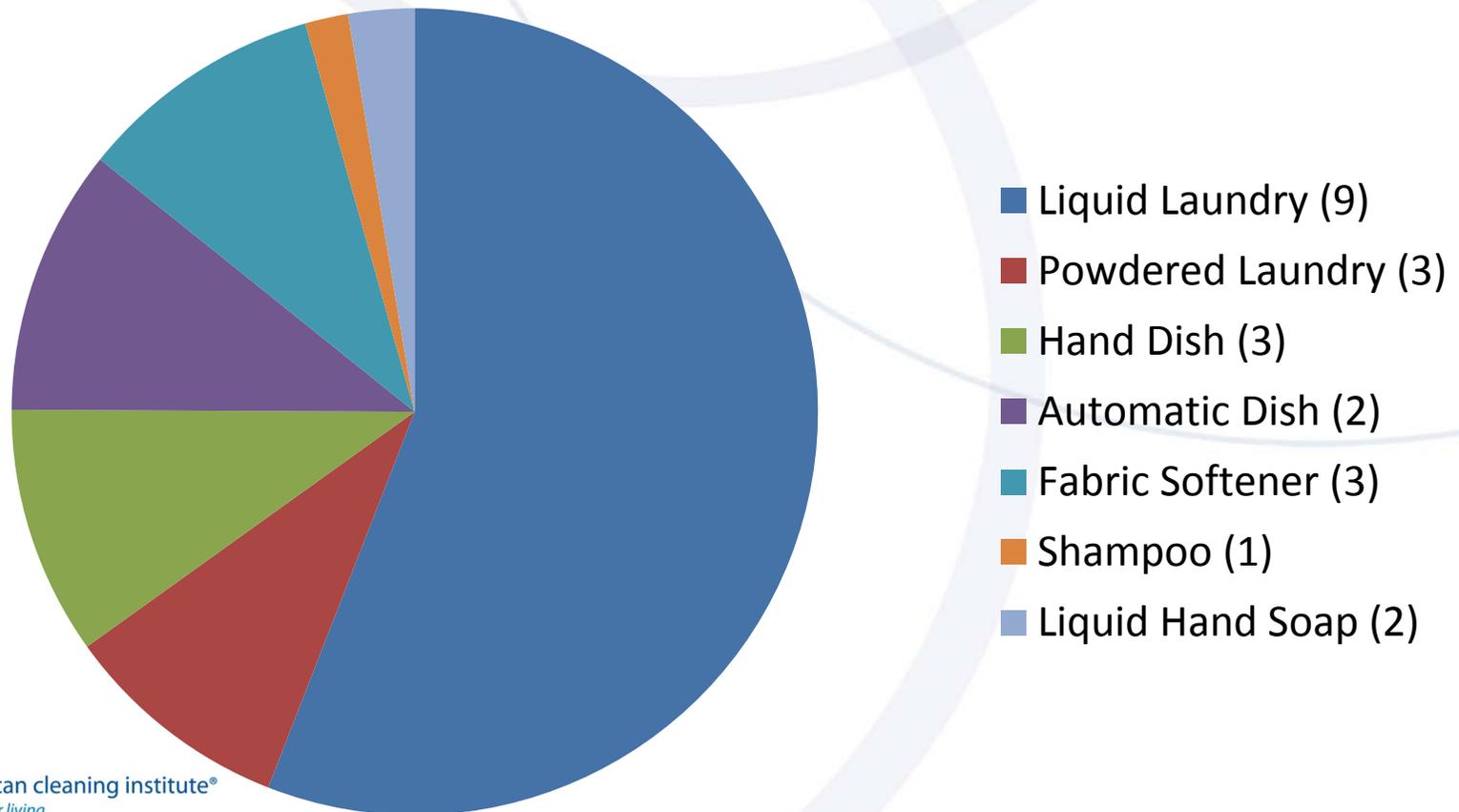
## Roanoke Grocery Market



american cleaning institute®  
for better living

# Leading Brands + Private Label

From 1,000 products, 82.5% of the market volume is captured in 23 branded products (including flankers) and 5 private label product areas



american cleaning institute®  
for better living

# Flanking Brands – Example: Dawn

- Dawn Dish Detergent
- Dawn Plus with Powerscrubbers Dish Detergent
- Dawn Plus Hand Renewal Dish Detergent
- Dawn Plus Bleach Alternative Dish Detergent
- Dawn Plus Odor Erasers Dish Detergent
- Dawn Plus Hand Care Dish Detergent
- Dawn Plus OXI Dish Detergent
- Dawn Direct Foam Dish Detergent
- Dawn Simple Pleasures Dish Detergent
- Dawn Botanicals Dish Detergent
- Dawn with Bleach Alternative Dish Detergent
- Dawn Fresh Escapes Dish Detergent



american cleaning institute®  
for better living

# Private Label Brands

- Private Label Brands were a significant portion of market share in five categories
  - Liquid laundry detergent
  - Hand dish detergent
  - Automatic dish detergent
  - Liquid Fabric Softener
  - Shampoo



american cleaning institute®  
for better living

# Inventory of Products for Collection

Product Type	Branded Product (#)	Private Label (#)	Walmart Label (#)
Liquid Laundry	9*	1	1
Powdered Laundry	3		
Hand Dish Detergent	3	1	1
Automatic Dish	2	1	1
Liquid Fabric Softener	3	1	1
Shampoo	1		
Liquid Hand Soap	2	1	1
Deodorant	2		
<b>Total</b>	<b>25</b>	<b>5</b>	<b>5</b>

\*The #9 liquid laundry detergent was not available in the stores in Luray



american cleaning institute®  
for better living

# Confirmatory Analysis of Products

Product Type	Number Analysed	Number with fatty alcohol-based ingredients (percentage)
Liquid Laundry Detergents	10	8 (80%)
Powdered Laundry Detergent	3	3 (100%)
Hand Dish Detergents	5	5 (100%)
Automatic Dish Detergent	4	0 (0%)
Liquid Fabric Softeners	5	0 (0%)
Shampoo	1	1 (100%)
Liquid Hand Soap	4	3 (75%)*
Deodorant	2	2 (100%)

\*The brand of liquid hand soap without alcohol-based surfactants appeared to alternate to alpha-olefin sulfonate in its formulation



american cleaning institute®  
for better living

# Per Capita Contribution in Roanoke Market

- Contributing products:
  - 489,960 deodorant units (75 gram)
  - 8,826,261 units of all other products (16 oz.)
- Mean concentration of alcohols in products\*:
  - Deodorant: 17.5%
  - All other products: 3%
- Population: 2,291,845
- Survey period: 24 weeks (168 days)
- Per capita contribution (alcohols):
  - Deodorant: 0.02 grams/person/day
  - All other products: 0.31 grams/person/day



american cleaning institute®  
for better living

\*Modler, R.F., 2007. Detergent Alcohols. In *CEH Marketing Research Report*, pp. 16. SRI Consulting.

# Alcohols Contribution to Luray Watershed

- 0.33 grams per person per day
- Population served by Luray WWTP: 6,586
- Daily contribution to Luray WWTP: ~2 kg



american cleaning institute®  
for better living

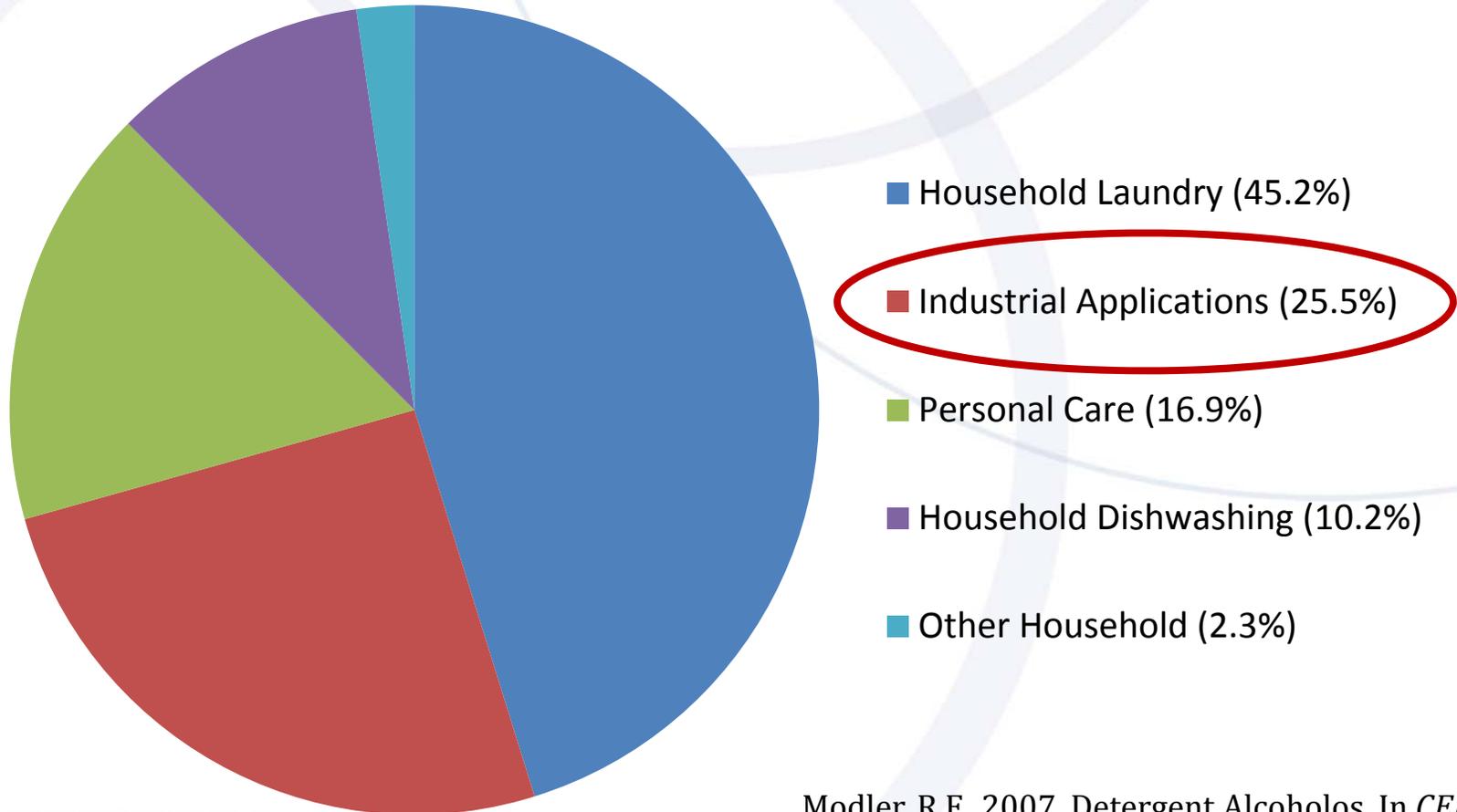
# Observations

- Potential overestimation
  - Manufactures substitute ingredients
  - Ingredients will degrade in the sewer system
- Potential underestimation
  - There are other alcohol-based surfactants
  - There are other consumer product sources
  - The market data did not include Walmart sales
  - There are other industrial, commercial and agricultural sources



american cleaning institute®  
for better living

# North American Consumption of Detergent Alcohols



american cleaning institute®  
for better living

Modler, R.F., 2007. Detergent Alcohols. In *CEH Marketing Research Report*, pp. 16. SRI Consulting.

# Conclusions

- Market research data can be used to estimate the order-of-magnitude contribution of a chemical to wastewater influent
- The contribution may represent the exposure component of a risk-based prioritization of chemicals in wastewater
- A more accurate assessment can be made but would require greatly increased resources



american cleaning institute®  
for better living

# Contact Information

Dr. Paul C. DeLeo  
Senior Director, Environmental Safety  
American Cleaning Institute  
1331 L Street, N.W., Suite 650  
Washington, D.C. 20005  
202-662-2516  
pdeleo@cleaninginstitute.org  
<http://www.aciscience.org>

DeLeo, P.C., Mudge, S.M., and Dyer, S.D. 2011. Use of market forensics to estimate the environmental load of ingredients from consumer products. *Environmental Forensics*, 12 (4), pp 349-356. <http://dx.doi.org/10.1080/15275922.2011.622350>.



american cleaning institute®  
for better living