



# Prioritizing Contaminants of Emerging Concern for Aquatic Ecological Applications

In this Issue:

# ET&C FOCUS

In honor of ET&C's anniversary, we are pleased to present the third in a regular series of succinct and timely articles to sharpen our understanding of current and emerging topics of interest to the scientific community at large.



## Prioritizing Contaminants of Emerging Concern for Ecological Screening Assessments

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Trace Organics



FINAL REPORT



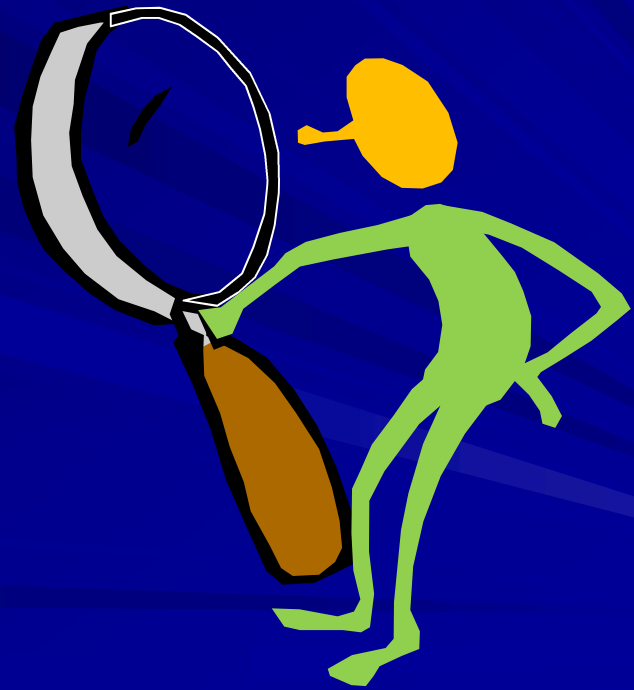
Development of Diagnostic Tools for Trace Organic Compounds and Multiple Stressors

# WERF Project CEC5R08

# Research Objectives

- **Develop and apply a procedure to prioritize CECs**
- Develop and test diagnostic tools to identify whether CECs are a cause of biological impairment
- Develop a relational database of CEC exposure data
- Develop a Collaboration Plan for fostering partnerships among stakeholders in Phase 2

# Which CECs should I monitor?



# CEC Prioritization Issues

- Often based on production data, chemical use, fate, and predicted toxicity  
(e.g., HPV chemical prioritizations)
- Thousands of chemicals could be considered.
- Many uncertainties as to whether certain predicted CECs of high importance actually occur (could occur) in surface waters
- Toxicity of many CECs unknown
- Local water agencies need a way to tailor the process for their sites, their constituencies, their particular sources

# Regulated Entities Need to Know:

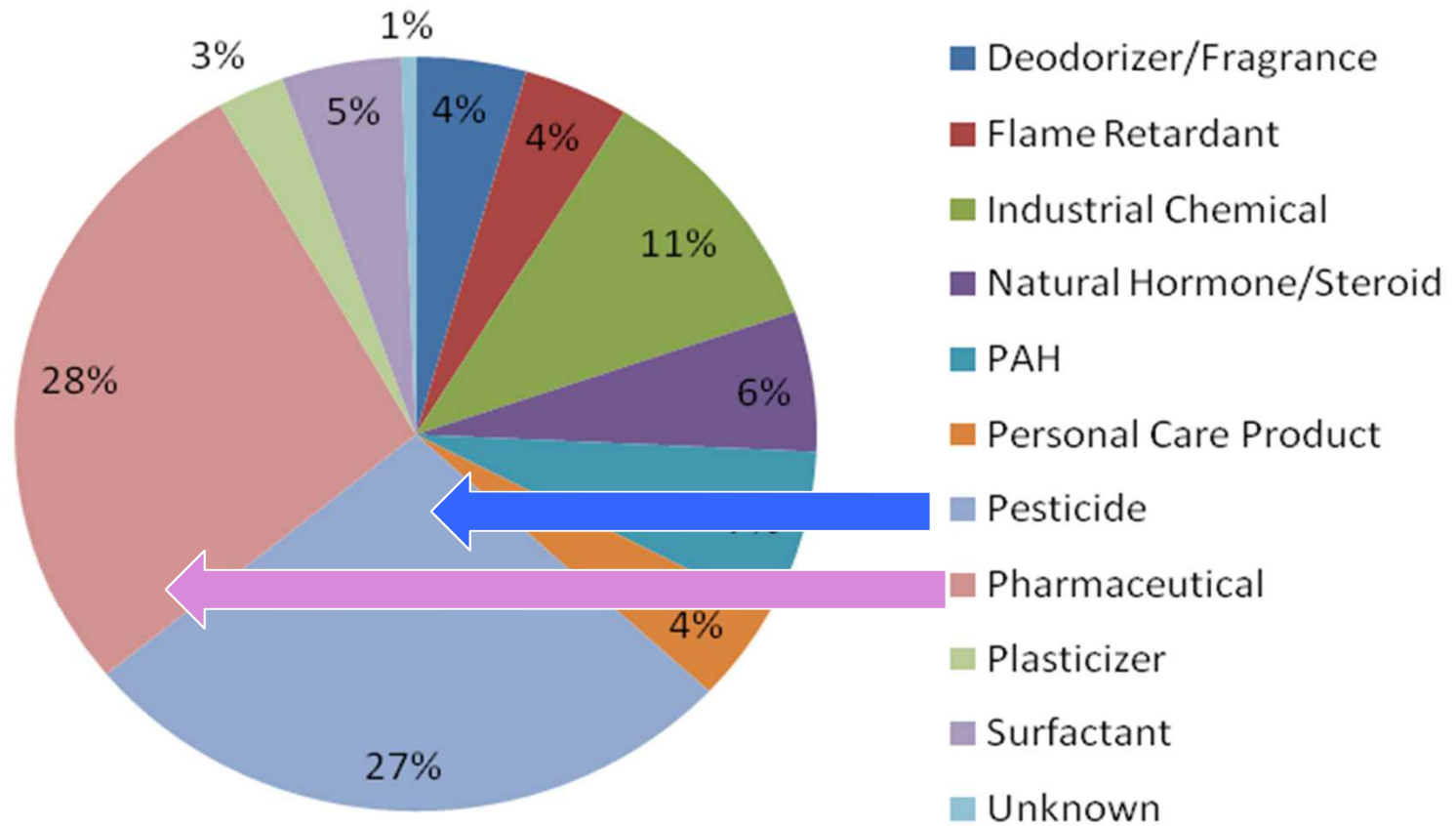
- Which chemicals should they monitor
  - Which CECs present the most risk to biota
- How to interpret the chemical results
  - What levels could potentially pose a risk
- How to screen their site to determine the need for further evaluation

# **The approach we took:**

Start with the CECs that have been monitored and that people are finding in surface waters



# What are people monitoring?





# CEC Prioritization Approach

## Compiled:

- CEC occurrence data
- CEC fate information (ECOSAR, PBT Profiler)
- Predicted toxicity and endocrine activity thresholds (ECOSAR, PBT Profiler, EU, FDA)

# Occurrence Data

- Over 100 studies examined; 70 studies used
- Information from > 700 sites
- Over 500 CECs, including 48 high risk, high production volume CECs with no occurrence information (Howard and Muir 2010)
- Over 30 monitoring organizations represented
- Information included as supplemental information

# Prioritized CECs Based on:

- 1) Maximum observed concentration vs. conservative effect thresholds  
(Hazard-based)
- 2) Hazard-based + persistence and bioaccumulation scores  
(Hazard + PB)
- 3) Persistence, Bioaccumulation, Toxicity  
(PBT)

# Screening Calculation of Hazard

- Hazard Value (HV) – based on “traditional” toxicological endpoints.
- Value  $\geq 0.10$  used to identify higher risk CECs

$$\text{Hazard Value} = \frac{\text{Max Occurrence Concentration}}{\text{Lowest Chronic Toxicity Threshold}}$$

# Also Calculated Endocrine Activity-Based Hazard

- Endocrine activity for each CEC normalized to EE2 using predicted no effect and probable effect concentration
- Calculated both a **No Effect Endocrine Risk Value** and a **Probable Effect Endocrine Risk Value** for each CEC

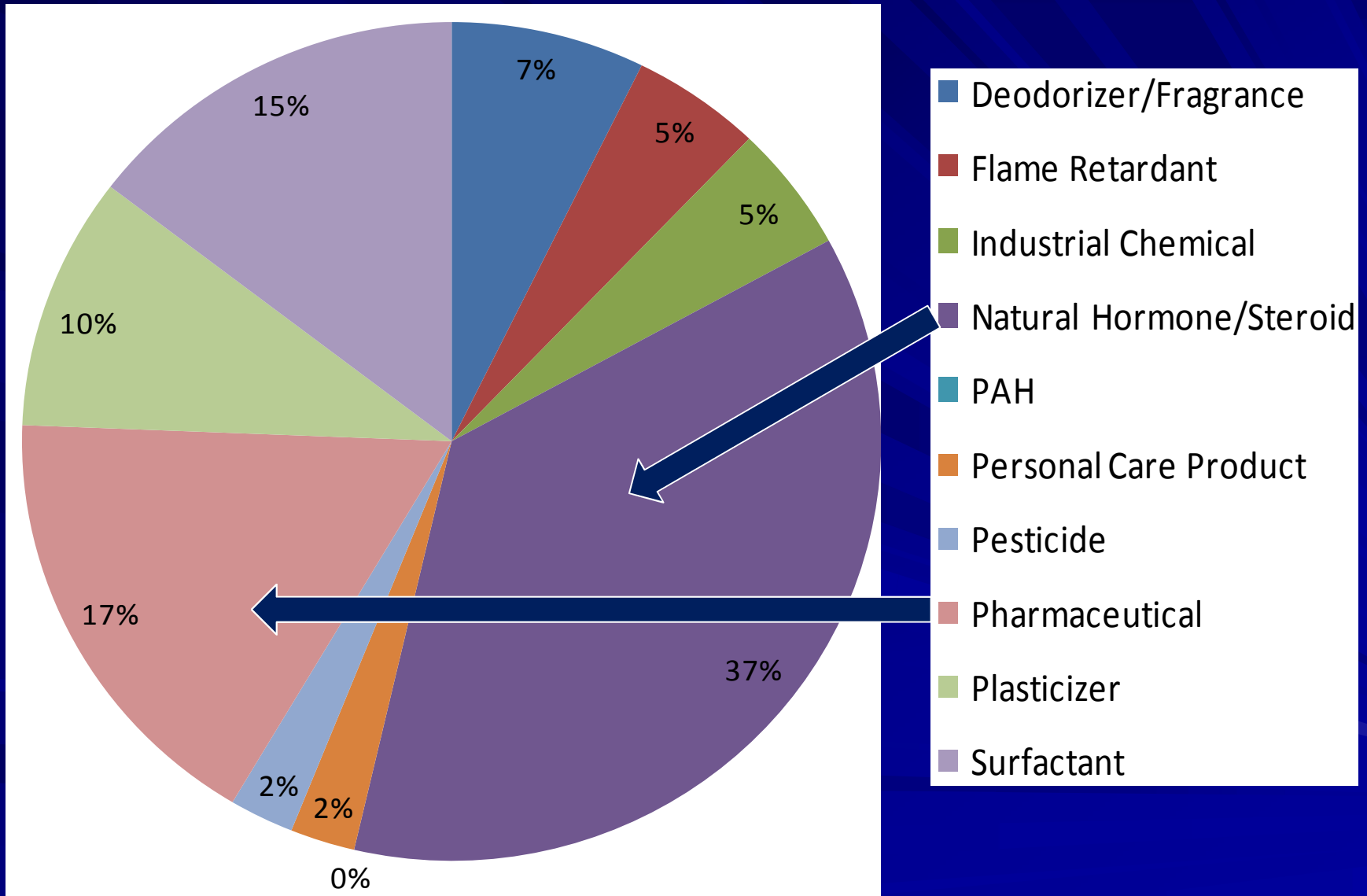
$$\text{No Effect EARV} = \frac{\text{Max Occurrence Concentration}}{\text{Normalized PNEC}}$$

■ No Effect < 1.0 = likely no effect

$$\text{Probable Effect EARV} = \frac{\text{Max Occurrence Concentration}}{\text{Normalized PEC}}$$

■ Probable Effect  $\geq 1.0$  = likely effect

# Hazard-based Approach





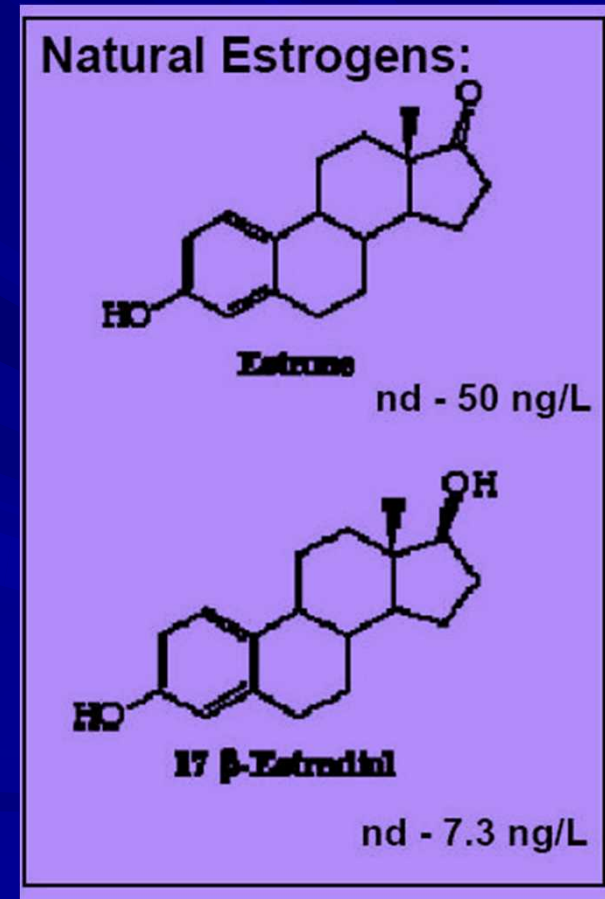
# Hazard-based Approach

- Relatively few pharmaceuticals ranked as high priority as compared to the number monitored
  - Exceptions are synthetic steroids and hormones



# Hazard-based Approach

- Most sensitive endpoint was predicted chronic toxicity rather than estrogenic activity for most high priority CECs
  - **Exceptions are the few hormones**



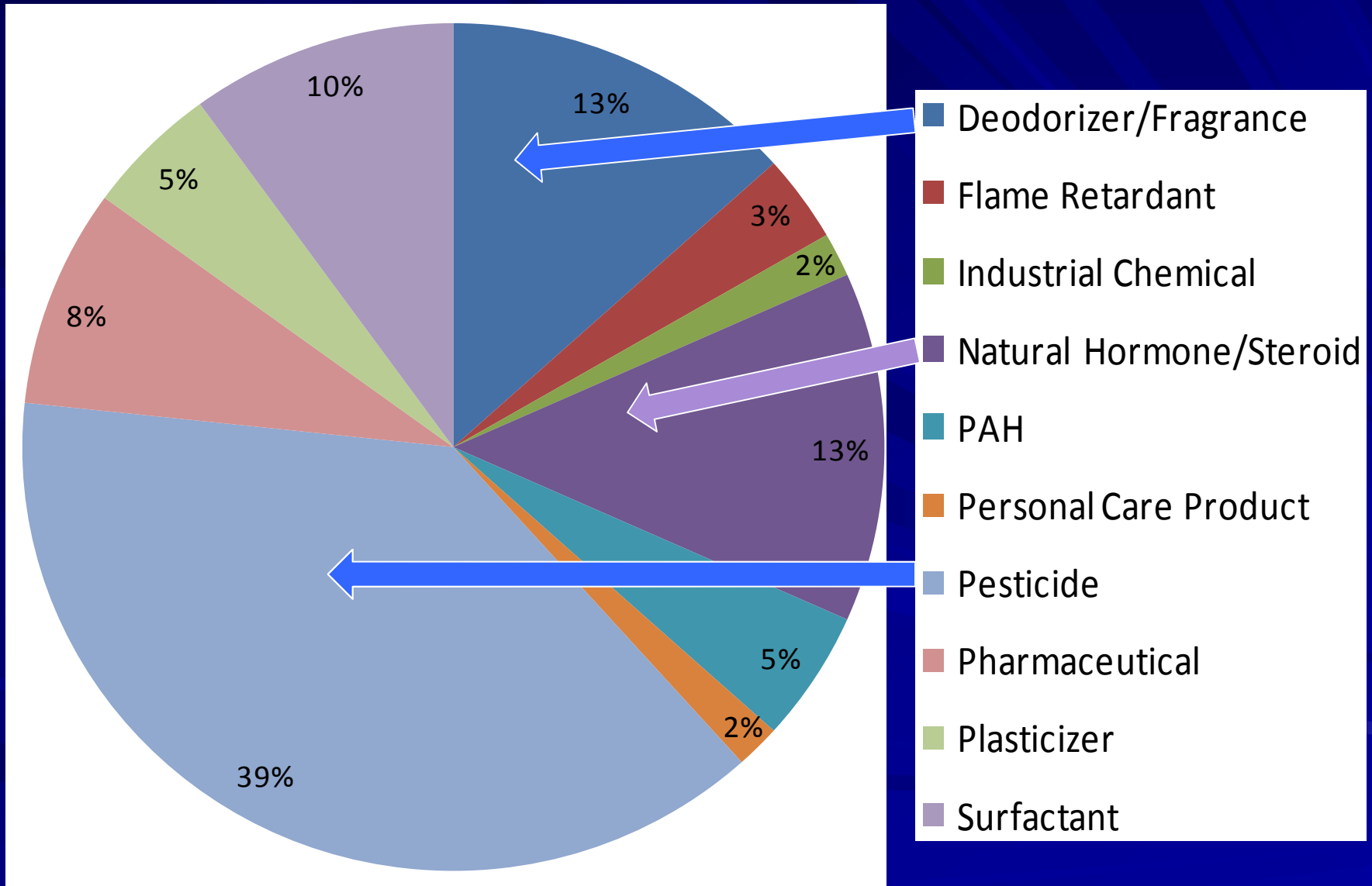
# Hazard-based Approach

- Shortest CEC list of all 3 approaches (41)
- Most pharmaceuticals monitored may not present a hazard to aquatic life.
- **HOWEVER**, many unknowns in terms of estrogenic and other endocrine activity effects of many of these chemicals

# Uncertainties using Occurrence Data

- Occurrence data should be treated with some caution because:
  - Many questions regarding analytical methods, quantification of CECs
  - Not a complete compilation of all data collected in the U.S.

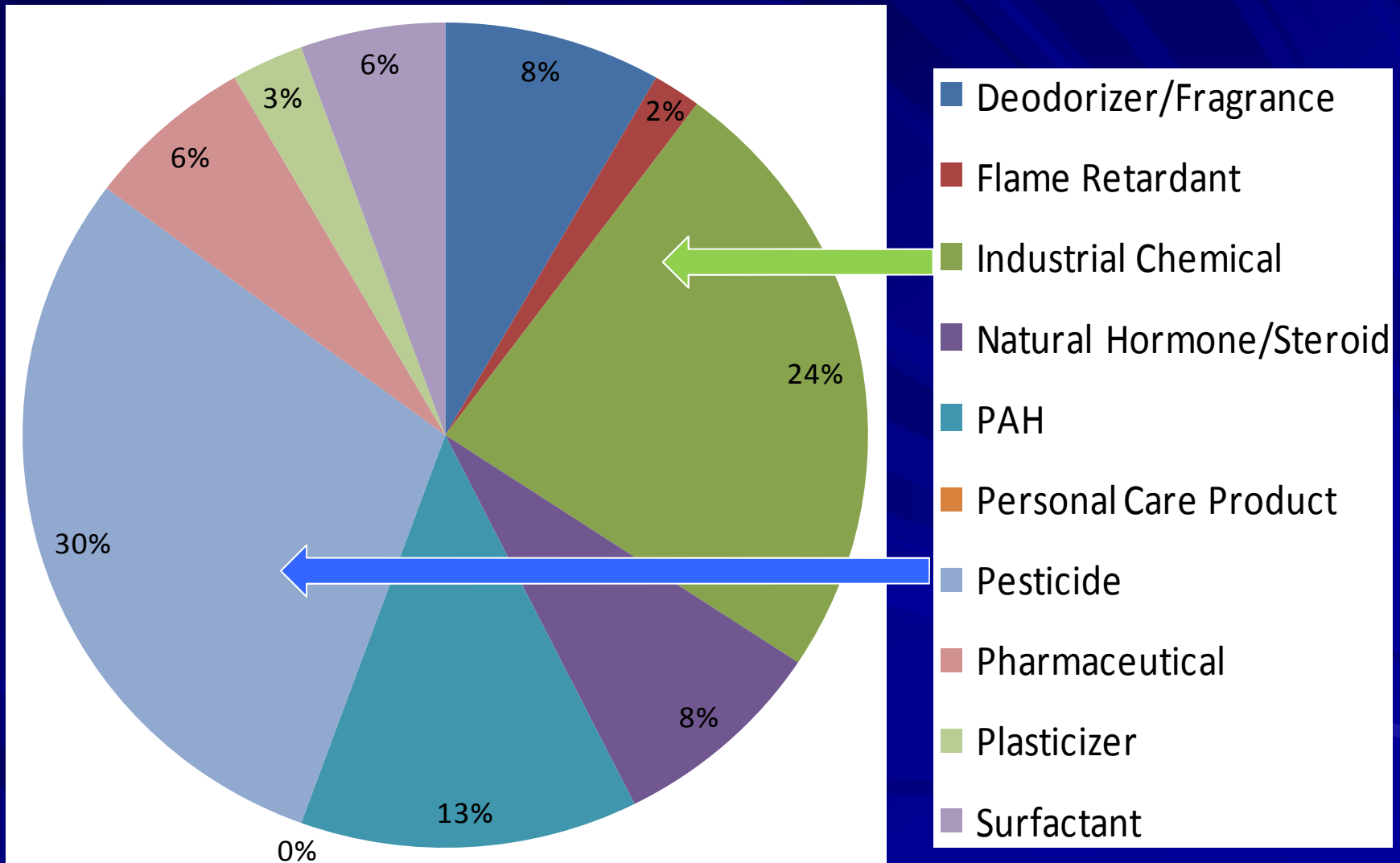
# Hazard + PB Approach



# Hazard + PB Approach

- Hormones, steroids, pharmaceuticals, and surfactants still important
- Half of the CECs are persistent or bioaccumulative chemicals: pesticides and fragrances.

# PBT Approach





# PBT Approach

- Most are pesticides, PAHs, and industrial chemicals
- This is the longest list of high priority CECs (108).

# Some Common CECs May Be Low Risk

- Caffeine is almost always measured but was low hazard using all 3 approaches
- But some CECs that are low hazard may be useful surrogates for co-occurring high hazard CECs that are more difficult to measure
- Not enough information to determine which CECs tend to co-occur in surface waters and probably is site-specific (depending on sources present).

# CEC Lists Should Serve as a Tool!

- Lists of high priority CECs should not be taken as monitoring requirements or chemicals for regulation
- High priority CECs might vary with site factors, treatment available, etc.
- Prioritization approaches should help utilities and others organize and manage screening of CECs.
- A chemical by chemical approach may be okay for prioritizing CECs, but need to consider the cumulative risk of CECs at a site.



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Visit WERF's Trace Organic Web  
Site:

[www.werf.org/traceorganics](http://www.werf.org/traceorganics)

Final report is under project **CEC5R08** at:

[www.werf.org/diagnostictools](http://www.werf.org/diagnostictools)

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