2007 USGS Venture Capital Award:

"Assessing the risk of contaminated floodwater sediment to human and ecosystem health"

Elena Nilsen
Robert Rosenbauer
Kathy Kuivila

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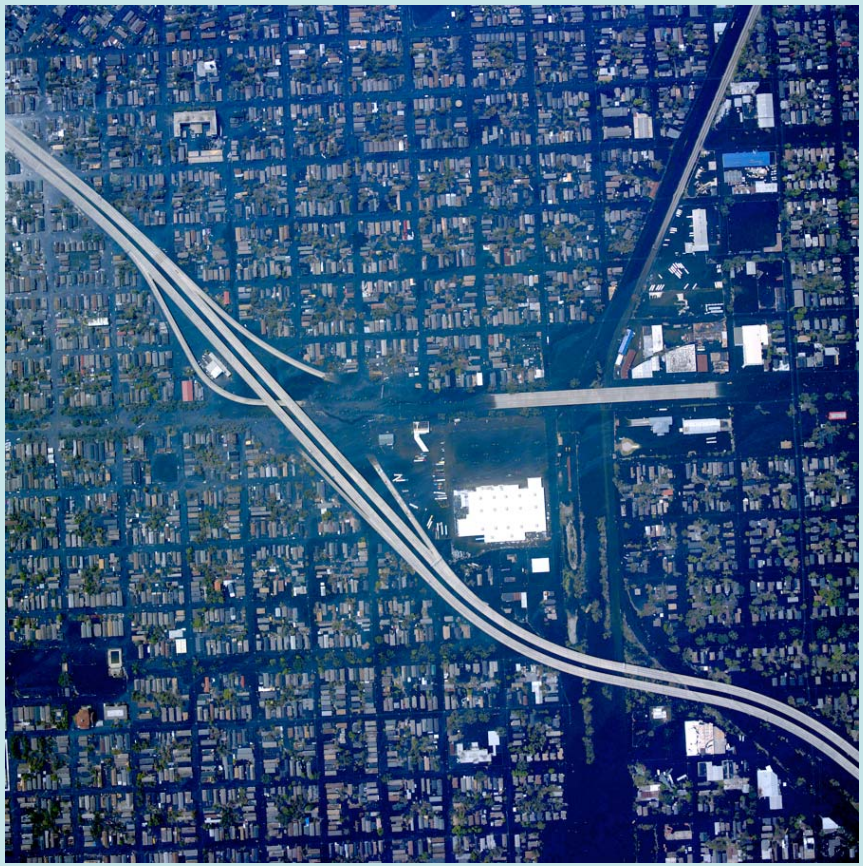
Hurricane Katrina

August, 2005



- 80% of New Orleans flooded
- 3 million w/o electricity
- 1.5 million displaced
- $75 billion in damages
- Over 1,400 lives lost
- 3,200 people missing

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Scientific Response

EPA - LDEQ - USGS - Academia

http://www.eps.gov/katrina/sediments/index.html#2

↓

USGS Environmental characterization of flood sediments

↓

7 USGS Centers

↓

>20 USGS and collaborating labs

↓

Rosenbauer Organic Geochemistry Lab
Menlo Park

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Chalmette, 9/16/05

Photos by John Lovelace

Downtown, 9/16/05

Organic contaminants?
Organic matter sources?

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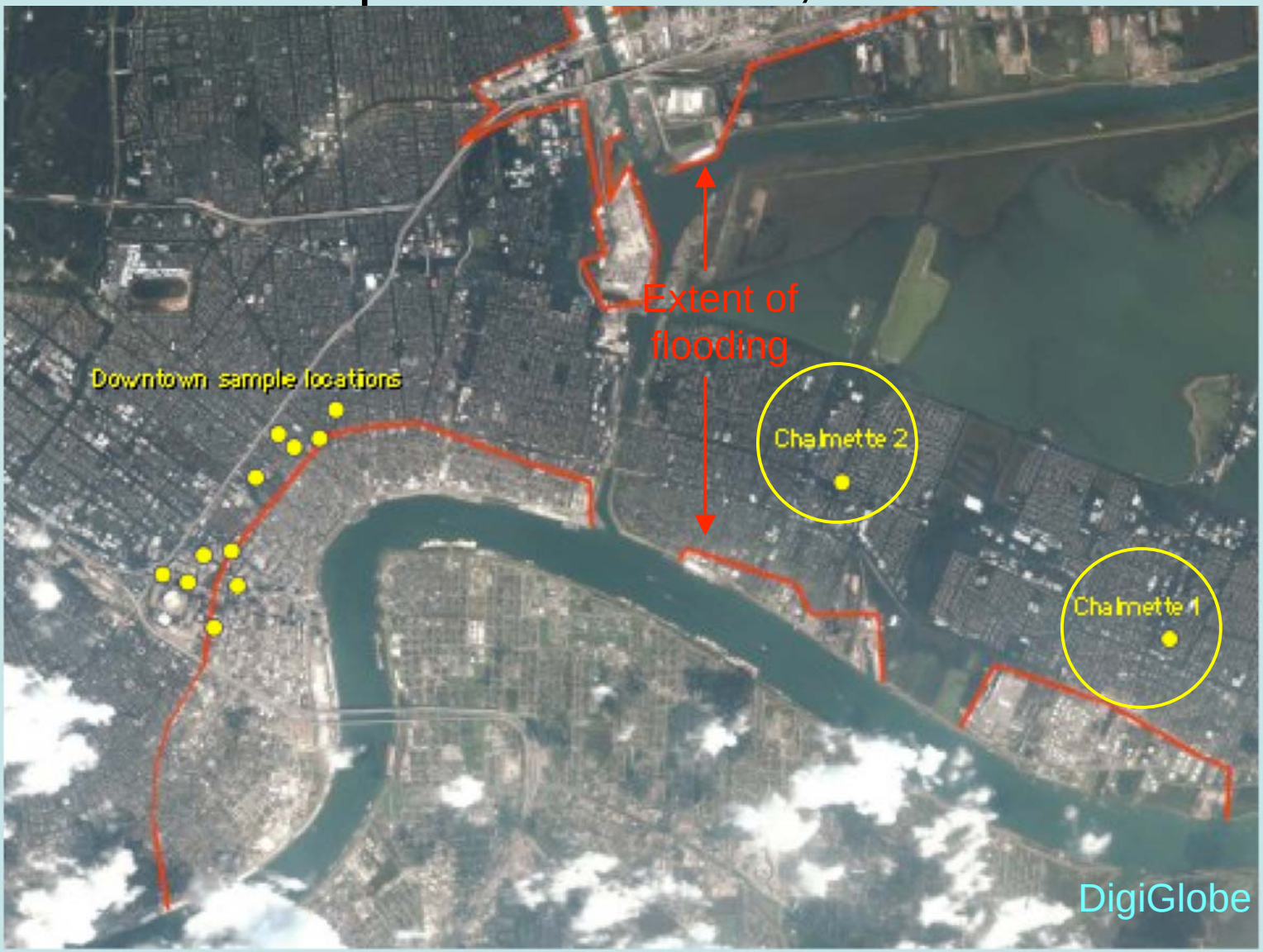
New Orleans Sampling Locations

September 15 &16, 2005



Flood sediments

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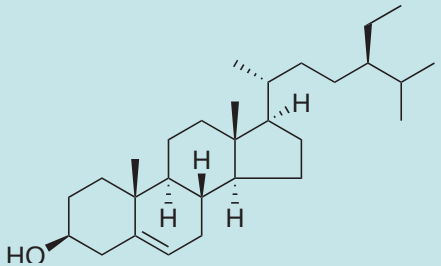
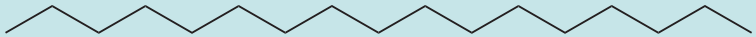
Organic Compounds Targeted

Organic Matter Source Info:

- **Sterols** (e.g., β-sitosterol)

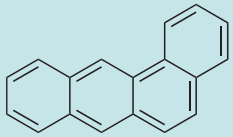


- **Normal alkanes** (n-alkanes)

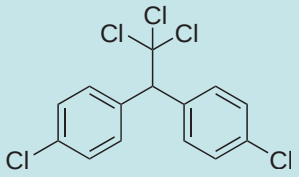


Contaminants:

- **Polycyclic aromatic hydrocarbons** (PAH)



- **Agrochemicals** (e.g., DDT)



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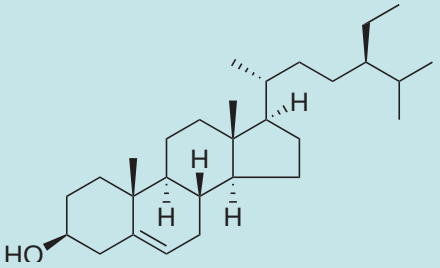
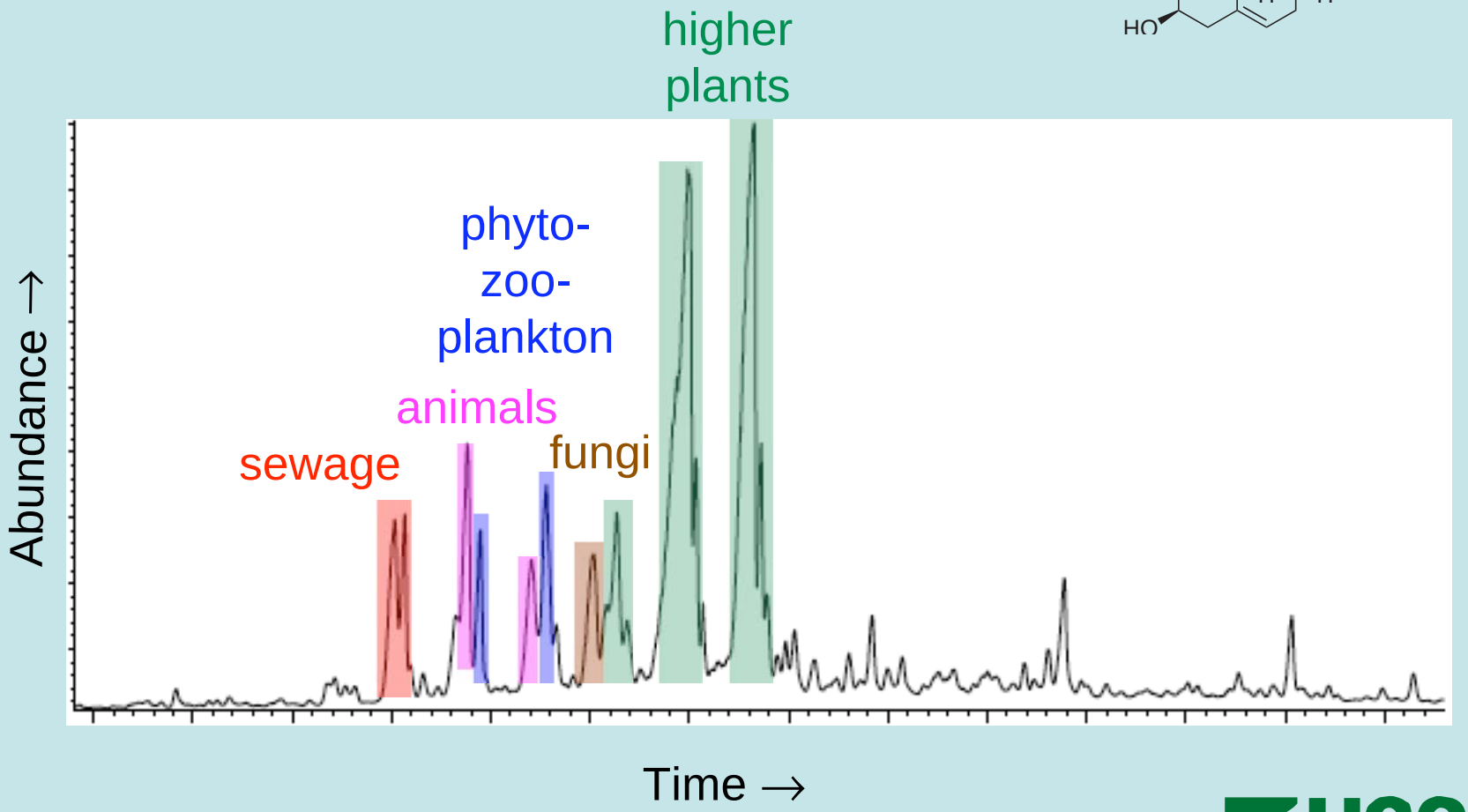
Sterols

organic matter sources





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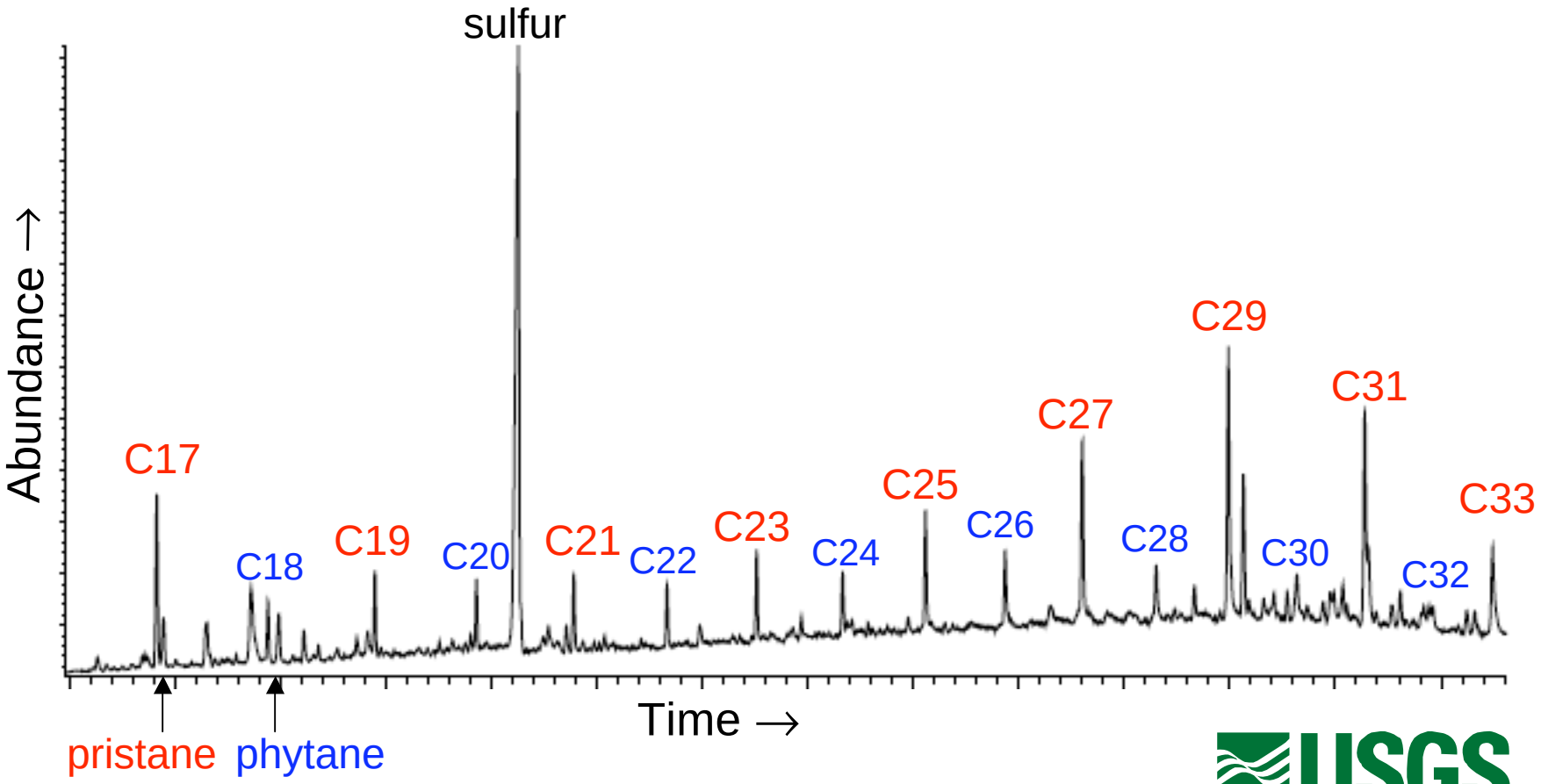
n-alkanes

Chalmette 1



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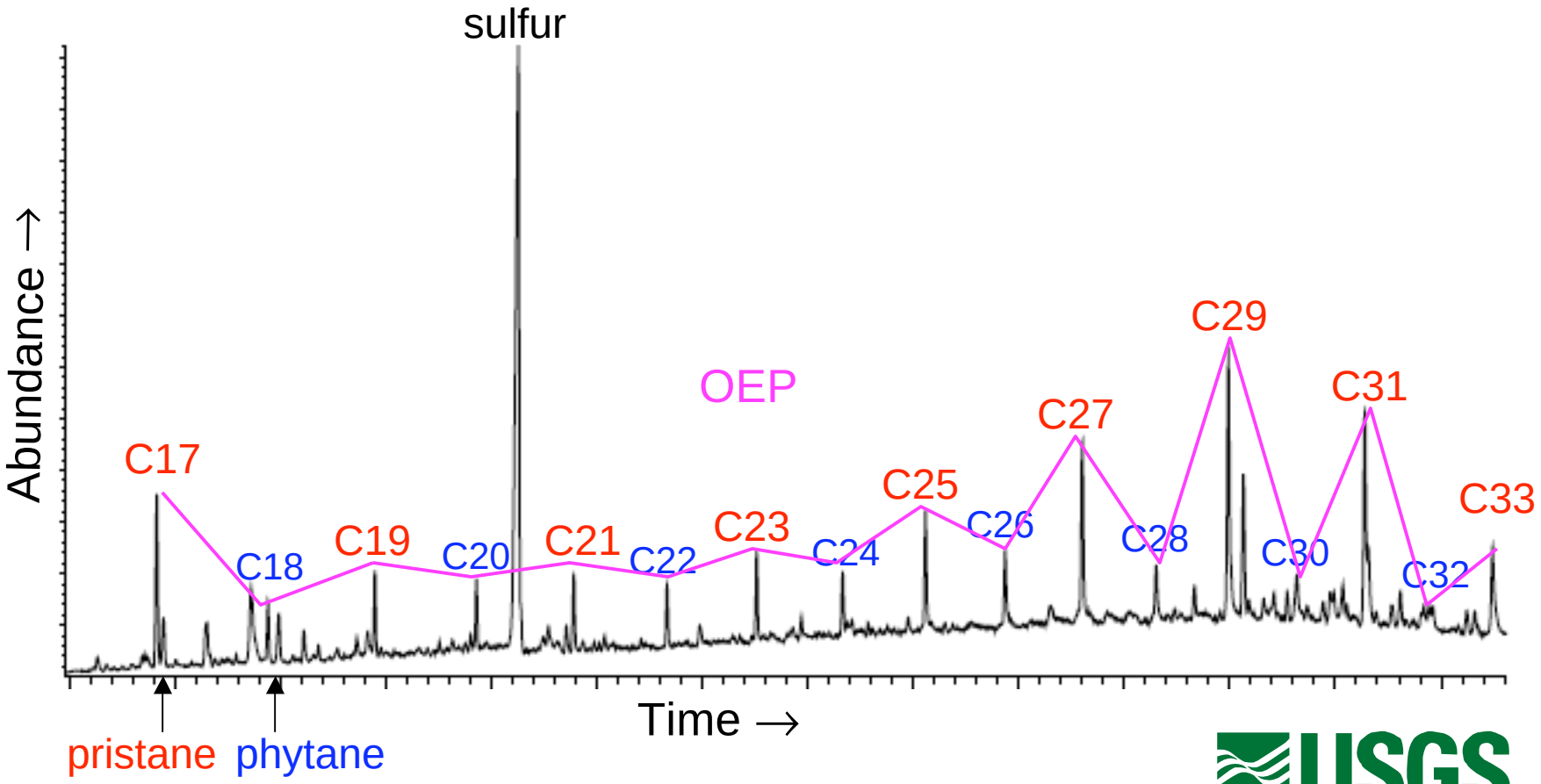
n-alkanes

Chalmette 1



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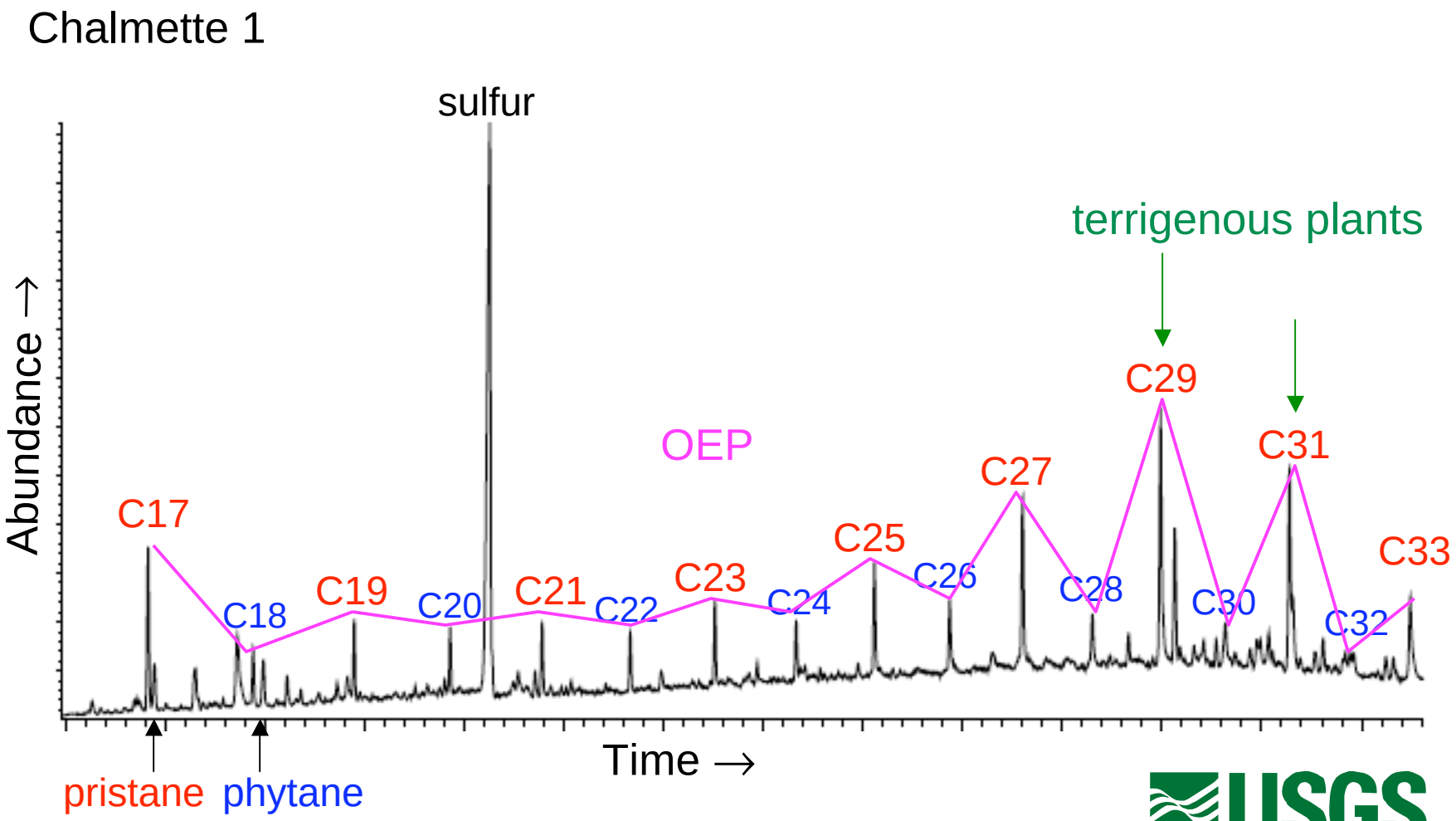
n-alkanes



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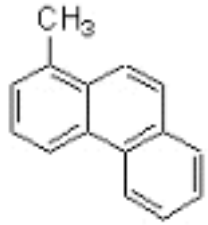
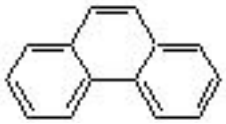


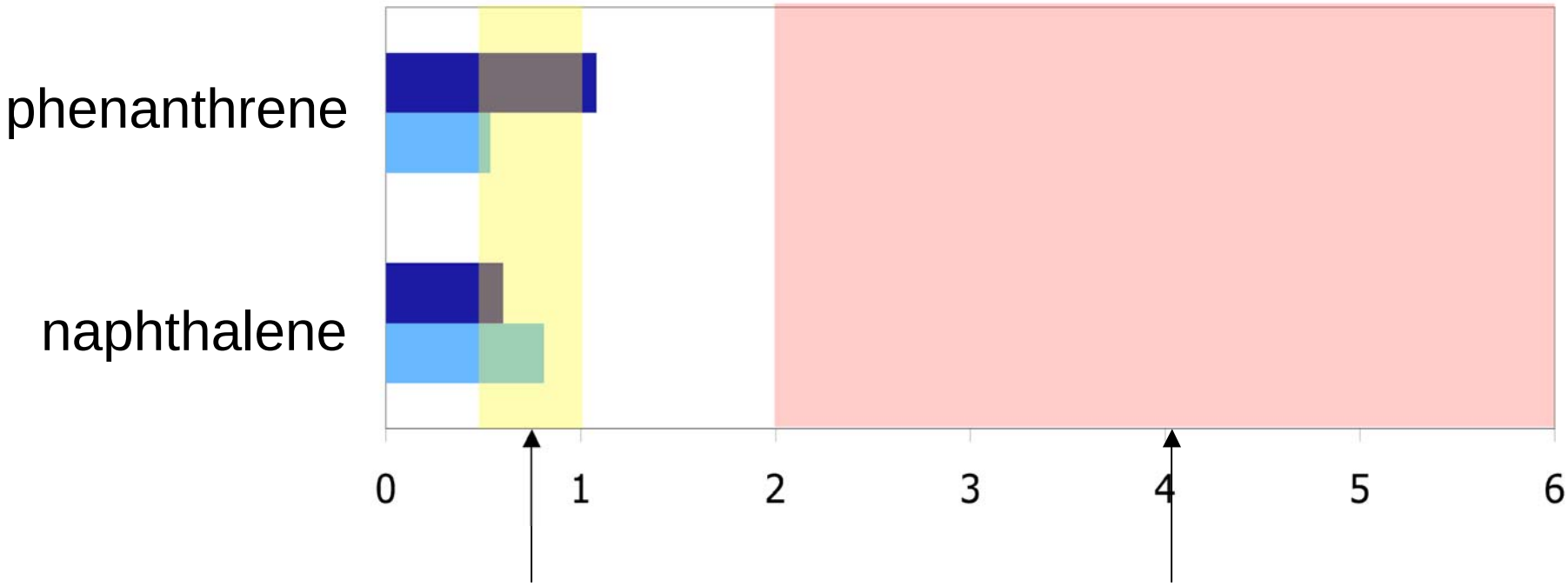
methylphenanthrene

PAHs



phenanthrene

Ratios of petrogenic to pyrogenic compounds



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Pyrogenic PAHs

	Chalmette 1	Chalmette 2	> Toxicity Limits	Carcinogenicity
Naphthalene	**21**	**15**	**1.5-2x**	**n/a**
Acenaphthylene	nd	9	<	n/a
Acenaphthene	nd	21		n/a
Fluorene	21	30	<	n/a
Phenanthrene	**90**	**139**	**2-3x**	**n/a**
Anthracene	103	43	<	n/a
Fluoranthene	155	396	<	n/a
Pyrene	110	353		n/a
Benzo[a]anthracene	66	154	<	medium
Chrysene	66	160	<	weak
Benzo[b]fluoranthene	138	229		medium
Benzo[k]fluoranthene	52	135		medium
Benzo[a]pyrene	**445**	**186**	**3-7x**	**strong**
Indendo[1,2,3-cd]pyrene	62	143		medium
Dibenzo[a,h]anthracene	nd	41		medium
Benzo[ghi]perylene	45	103		n/a
benzo[e]pyrene	72	150		n/a
perylene	352	447		n/a

values in ng/g dry sediment
detection limit: ~1 ng/g sediment
< below recommended criteria

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Organic Geochemical Characterization of Flood Sediments Left in New Orleans after Hurricane Katrina

Marty Bahamonde/FEMA

John Lovelace/USGS

Robert Rosenbauer
Elena Nilsen*
Fran Hostettler

USGS
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*Presenting author, 2006 Ocean Sciences Meeting, Honolulu, HI

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Prepared by the U.S. Geological Survey Office of Water Quality, National Water Quality Laboratory

Determination of Wastewater Compounds in Sediment and Soil by Pressurized Solvent Extraction, Solid-Phase Extraction, and Capillary-Column Gas Chromatography/Mass Spectrometry

Chapter 2
Section B, Methods of the National Water Quality Laboratory
Book 5, Laboratory Analysis

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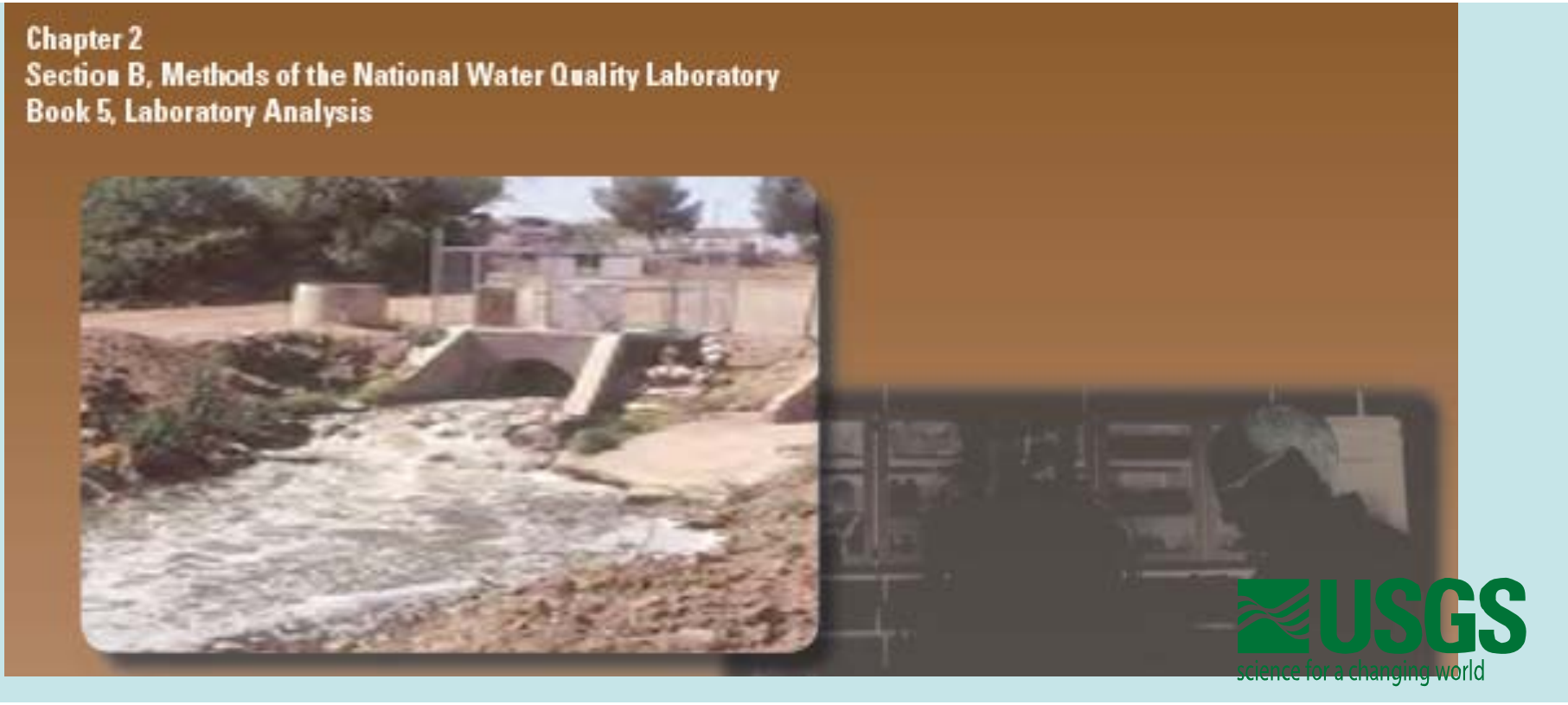
PRESENCE AND DISTRIBUTION OF WASTEWATER-DERIVED PHARMACEUTICALS IN SOIL IRRIGATED WITH RECLAIMED WATER

CHAD A. KINNEY,†‡ EDWARD T. FURLONG,*† STEPHEN L. WERNER,† and JEFFERY D. CAHILL†
†National Water Quality Laboratory, U.S. Geological Survey, Denver Federal Center, P.O. Box 25046, Building 95, MS 407, Denver, Colorado 80225-0046
‡Department of Chemistry and Biochemistry, Eastern Washington University, Cheney, Washington 99004-2440, USA



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‡Department of Chemistry and Biochemistry, Eastern Washington University, Cheney, Washington 99004-2440, USA

Survey of Organic Wastewater Contaminants in Biosolids Destined for Land Application†

CHAD A. KINNEY,‡
EDWARD T. FURLONG,*,§
STEVEN D. ZAUGG,§
MARK R. BURKHARDT,§
STEPHEN L. WERNER,§
JEFFERY D. CAHILL,§ AND
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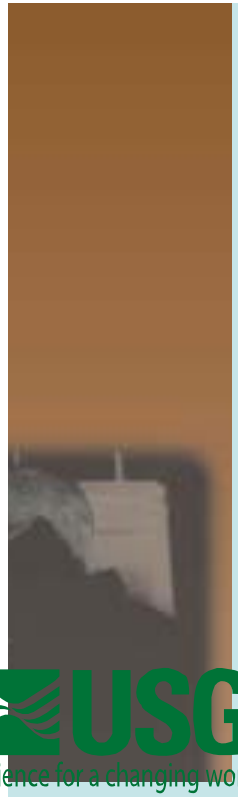

Environmental Science & Technology, Sept. 2006

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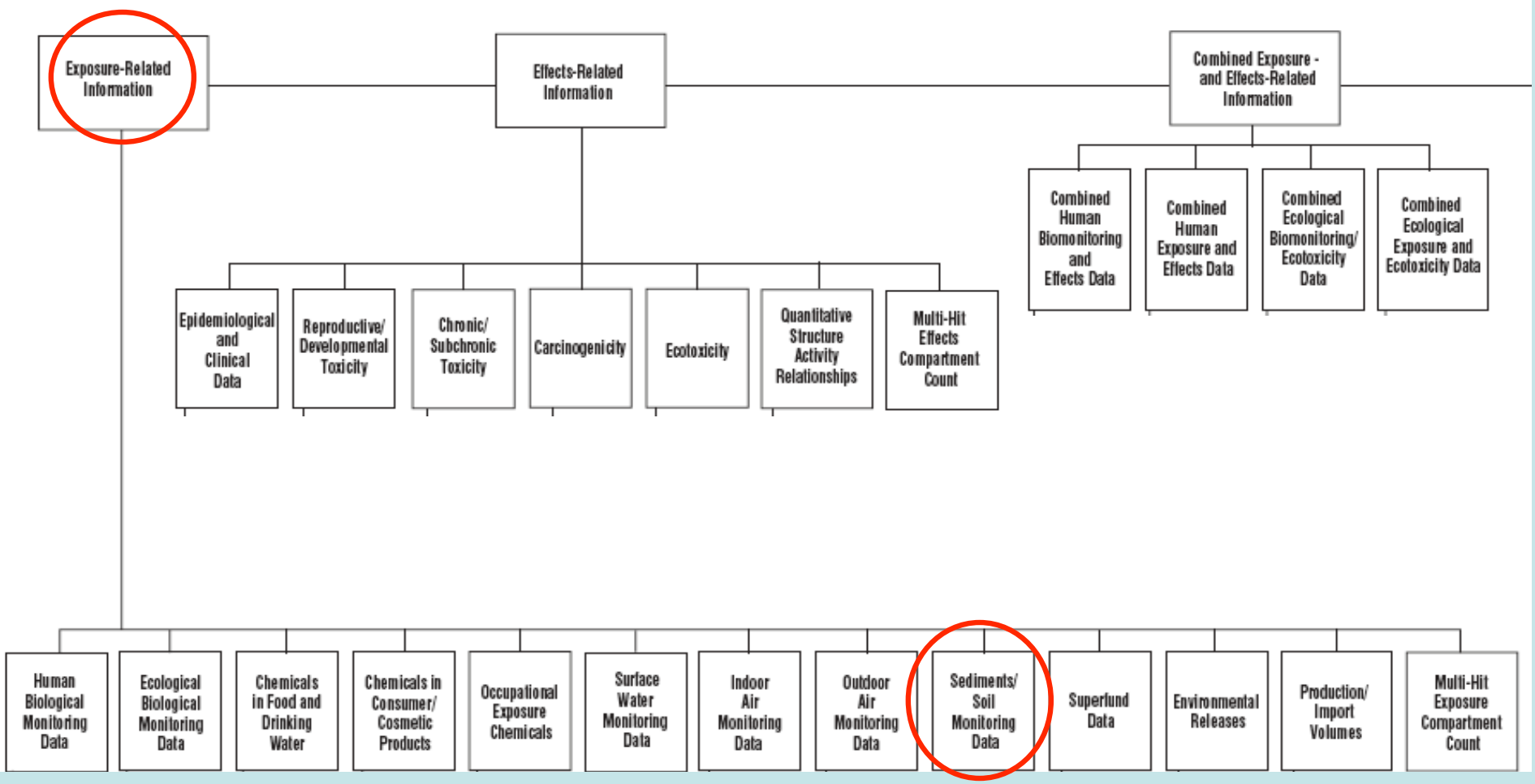
Compartment-based Priority Setting for EPA's Endocrine Disruptor Screening Program



http://www.epa.gov/scipoly/oscpendo/pubs/7_31arch.pdf

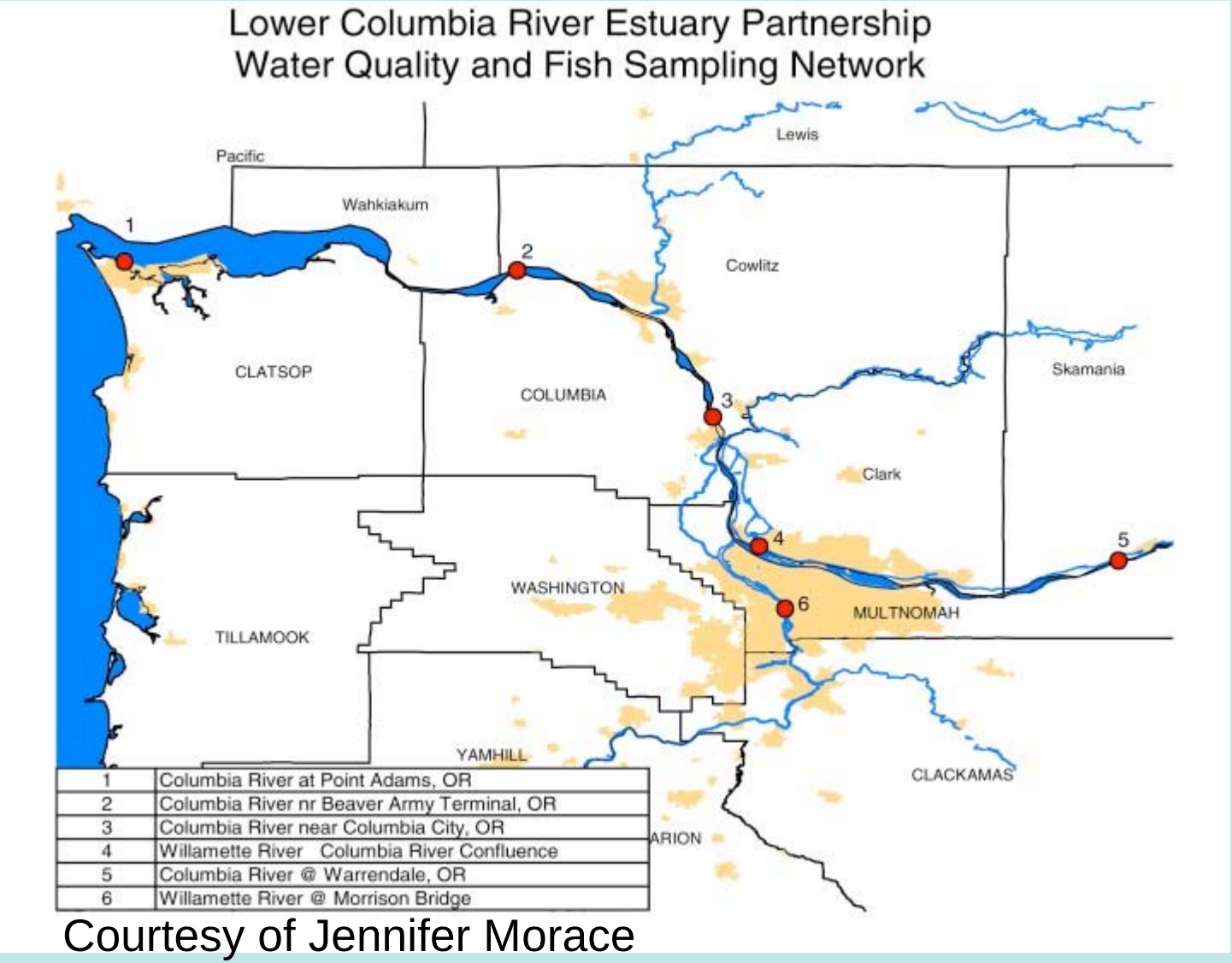
Origins and Fate of PPCPs in the Environment

http://epa.gov/nerlesd1/chemistry/pharma/images/drawing.pdf

Update on Water Quality and Salmonid Data from the Ecosystem Monitoring Project

Lyndal Johnson, NOAA Fisheries
Jennifer Morace, USGS

Selecting Sampling Locations



Courtesy of Jennifer Morace

Initial:

- Existing data
- Point sources

Ultimate:

- Backwater areas
- Dams
  - -restoration
- Fish tissue

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Wastewater compounds detected in water

- Pharmaceuticals
  - Acetaminophen -analgesic
  - Diphenhydramine -antihistamine
  - Anhydroerythromycin -degradate of erythromycin (common antibiotic)
  - Trimethoprim -respiratory & urinary tract infections, aquaculture

- Personal care products
  - AHTN (tonalide) -musk fragrance
  - Anthraquinone -dye/textures, seed treatment, bird repellant
  - Bisphenol A -polycarbonate resins, antioxidant, flame retardant
  - Deet -insecticide, urban uses, mosquito repellant
  - Tri(2-chloroethyl) phosphate -plasticizer, flame retardant

Courtesy of Jennifer Morace

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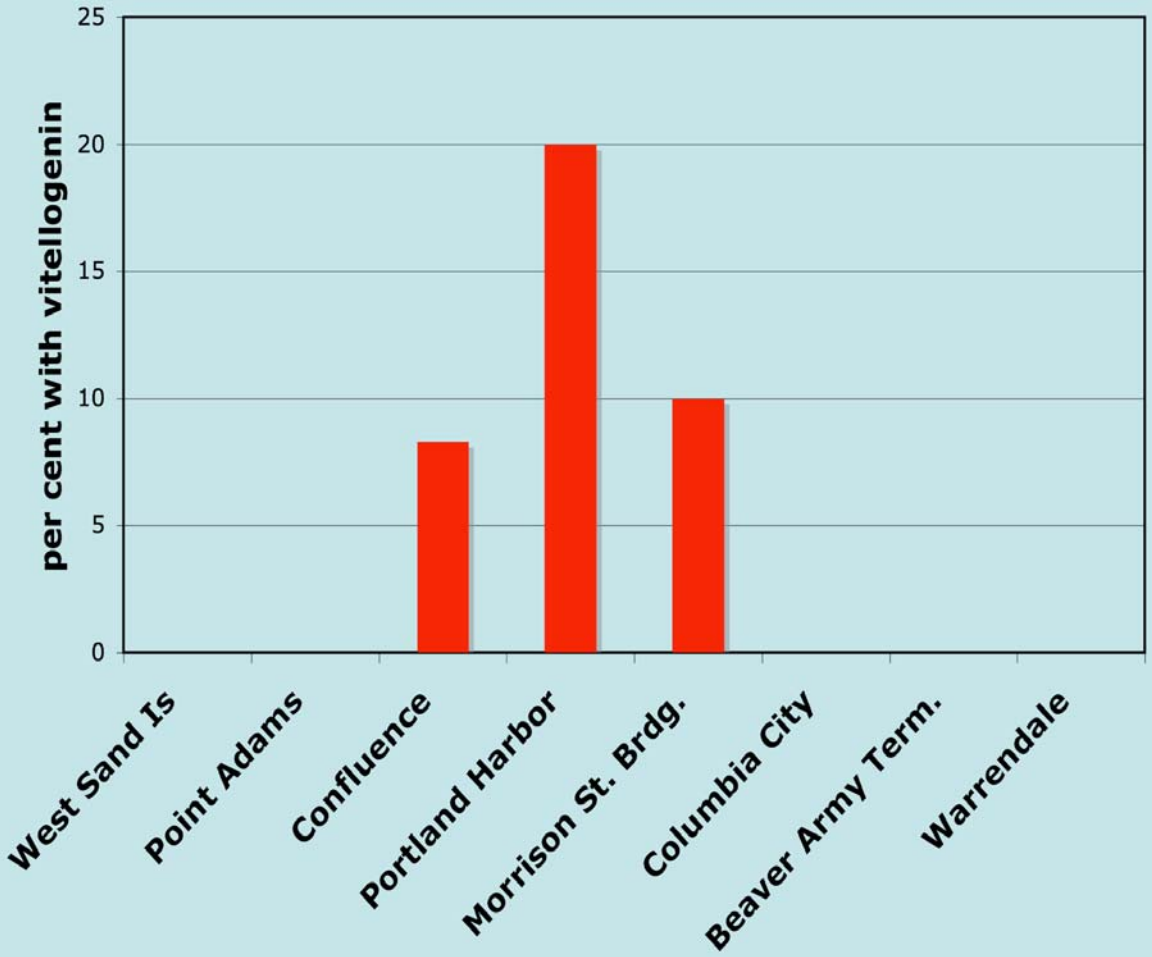
Screening juvenile salmon for exposure to estrogens



Vitellogenin production in juvenile salmon from Portland sites

USGS sampling at same sites showed potentially estrogenic compounds in water (bisphenol A, musks)

Courtesy Lyndal Johnson and Jennifer Morace

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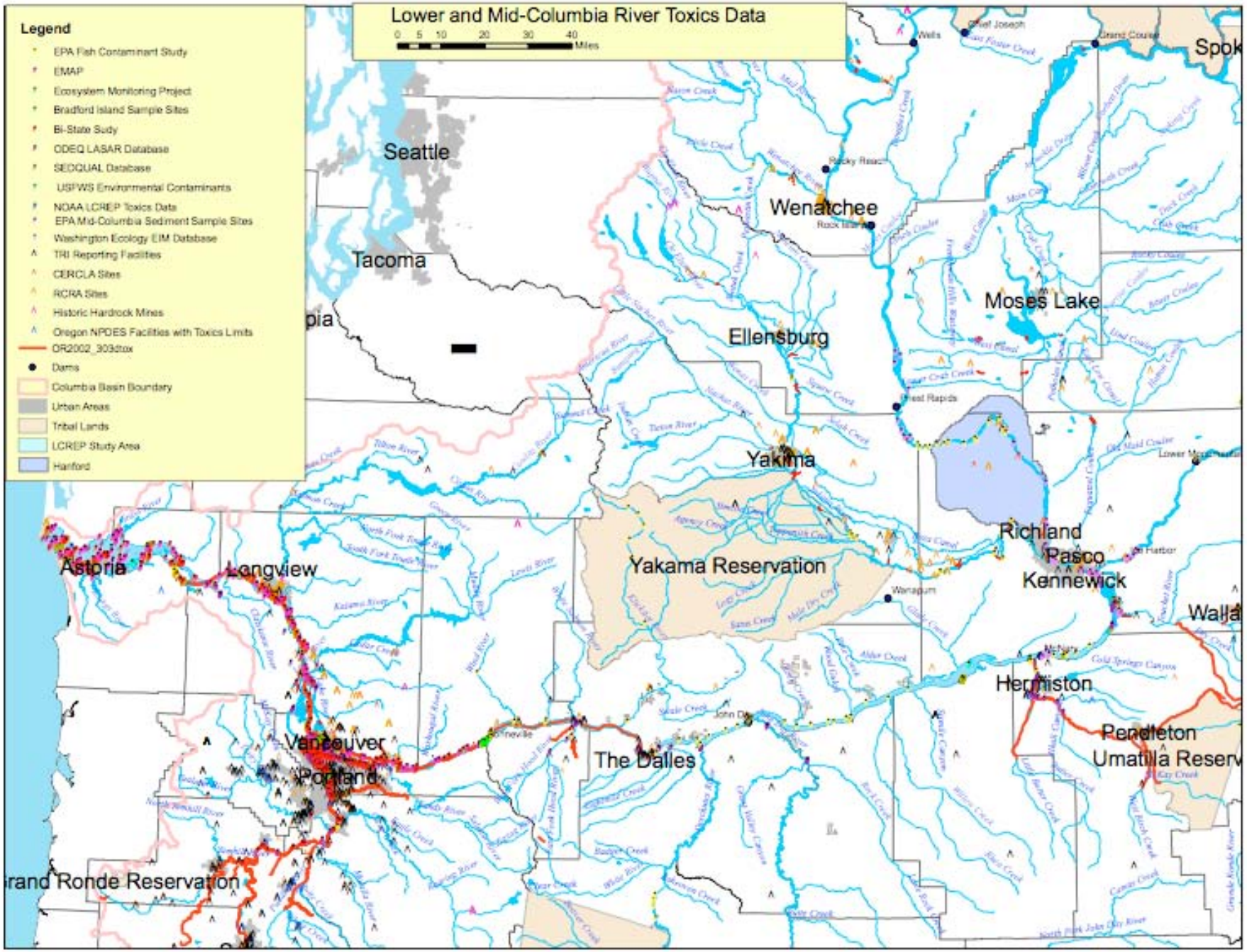
PPCP Contaminants Measurable in Biosolids and Soils

	PPCP COMPOUNDS	USE
1	1,7-dimethylxanthine	Caffeine Metabolite
2	acetaminophen	Antipyretic
3	caffeine	Stimulant
4	cotinine	Nicotine Metab.
5	albuterol	Antiasthmatic
6	carbamazapine	Antiepileptic
7	dehydronifedipine	Antianginal
8	diltiazem	Antihypertensive
9	erythromycin-H20	Antibiotic degradate
10	fluoxetine	Antidepressant
11	gemfibrozil	Antihyperlipidemic
12	sulfamethoxazole	Antibiotic
13	thiabendazole	Anthelmintic/Pesticide
14	trimethoprim	Antibiotic
15	warfarin	Anticoagulant
16	cimetidine	Antacid
17	codeine	Analgesic
18	diphenhydramine	Antihistamine
19	miconazole	Antifungal
20	d-limonene	Fragrance
21	**tonalide (AHTN)**	Fragrance
22	galaxolide (HHCB)	Fragrance
23	acetophenone Fragrance	Fragrance
24	indole	Fragrance
25	4-tert-octylphenold	Detergent Metabolite
26	para-nonylphenol-totald	Detergent Metabolite
27	NoNonylphenol, monoethoxy–totald	Detergent Metabolite
28	NoNonylphenol, dithoxy–totald	Detergent Metabolite
29	4-cumylphenol Detergent	Metabolite
30	**bisphenol A**	Fire Retardant/Plasticizer

	PPCP COMPOUNDS	USE
31	tetrabromodiphenyl ether	Fire Retardant
32	3-beta-coprostanol	Steroid
33	cholesterol	Steroid
34	beta-sitosterol	Steroid
35	stigmastanol	Steroid
36	estrone	Hormone
37	phenol	Disinfectant
38	triclosan	Disinfectant
39	ethanol,2-butoxy-,phosphate	Plasticizer
40	diethylhexyl phthalated	Plasticizer
41	para-cresol	Preservative
42	1,4-dichlorobenzene	Pesticide
43	3,4-dichlorophenyl isocyanate	Organic Synthesis
44	skatol	Fecal Indicator
45	benzophenoned	Fixative
46	anthraquinone	Dye


Lower and Mid-Columbia River Toxics Data
0 5 10 20 30 40
Miles
Legend
EPA Fish Contaminant Study
EMAP
Ecosystem Monitoring Project
Bradford Island Sample Sites
Bi-State Sudy
ODEQ LASAR Database
SEDQUAL Database
USFWS Environmental Contaminants
NOAA LCREP Toxics Data
EPA Mid-Columbia Sediment Sample Sites
Washington Ecology EIM Database
TRI Reporting Facilities
CERCLA Sites
RCRA Sites
Historic Hardrock Mines
Oregon NPDES Facilities with Toxics Limits
OR2002_303dtox
Dams
Columbia Basin Boundary
Urban Areas
Tribal Lands
LCREP Study Area
Hanford
Seattle
Tacoma
Wenatchee
Moses Lake
Ellensburg
Yakima
Yakama Reservation
Richland
Pasco
Kennewick
Walla
Hermiston
Pendleton
Umatilla Reserv
Astoria
Longview
Vancouver
Portland
The Dalles
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