Public Health Concerns about Marine Oil Spills Sorting Fact from Fiction

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Public health concerns raised by marine oil spills: Defining the hazards

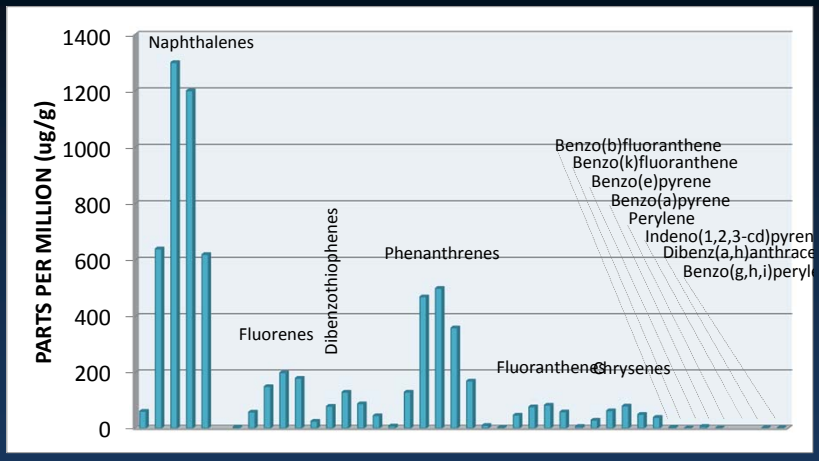
How oil & dispersants present human health hazards:

- Consumption of seafood contaminated with harmful organic and inorganic petrochemicals.
- Consumption of seafood tainted with flavors and odors.
- Contact (dermal, ocular) with oil and dispersed oil at sea and stranded on beaches and shorelines.
- Inhalation of volatile components of oil and dispersed oil at sea and stranded on beaches and shorelines.

Implement protective measures

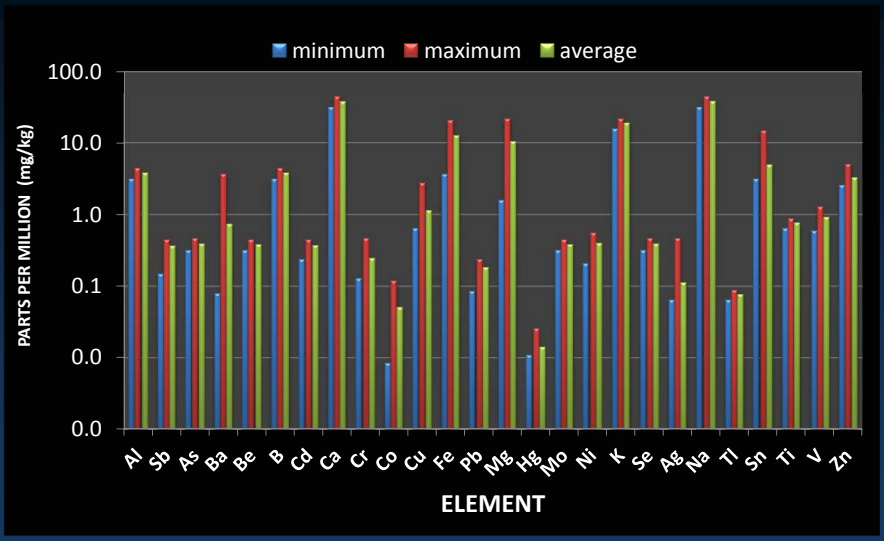
- Close oil-spill impacted waters and shorelines.
- Prepare to close areas expected to be impacted.
- Sample and test open waters and shorelines to verify baselines and that closures were protective.
- Inform and inspect primary seafood vendors & public service/commerce in impacted region.
- Develop of protocol and criteria for re-opening fisheries and shorelines.
- Develop comprehensive risk communication plan.
- Delegate/assign well defined roles and stay in lane.

Identify the Chemicals of Concern and Methods of Analysis



Example: MC252 Source Oil Aromatics Analysis

Identify the Elements of Concern and Methods of Analysis



Example: MC252 Source Oil Metals Analysis

Develop Levels of concern for target petrochemicals

For PAH with cancer end points estimates of contamination levels and consumption rates that, if sustained for period of 5 years, may result in excess consumer lifetime cancer risk of 1 x 10^{-5}

Chemical[1]	Levels of Concern (ppm)			Basis
	13 g/day (Shrimp & Crab)	12 g/day (Oysters)	49 g/day (Finfish)	
Naphthalene	123	133	32.7	Non-cancer EPA RfD[2]; 80kg bw
Fluorene	246	267	65.3	Non-cancer EPA RfD[2]; 80kg bw
Anthracene-Phenanthrene	1846	2000	490	Non-cancer EPA RfD[2]; 80kg bw
Pyrene	185	200	49.0	Non-cancer EPA RfD[2]; 80kg bw
Fluoranthene	246	267	65.3	Non-cancer EPA RfD[2]; 80kg bw
Chrysene	132	143	35.0	Cancer BaPE (TEF = 0.001)
Benzo(k)fluoranthene	13.2	14.3	3.5	Cancer BaPE (TEF = 0.01)
Benzo(b)fluoranthene	1.32	1.43	0.35	Cancer BaPE (TEF = 0.10)
Benz(a)anthracene	1.32	1.43	0.35	Cancer BaPE (TEF = 0.10)
Indeno(1,2,3-cd)pyrene	1.32	1.43	0.35	Cancer BaPE (TEF = 0.10)
Dibenz(a,h)anthracene	0.132	0.143	0.035	Cancer BaPE (TEF = 1.0)
Benzo(a)pyrene	0.132	0.143	0.035	10^5 Cancer Risk = 0.110 µg/person/day (78/5 yr)

[1] Includes alkylated homologues C1,C2,C3,C4 naphthalenes, C1,C2,C3 fluorenes, and combined C1,C2,C3,C4 Anthracene/phenanthrenes. Sum of ratios, measured to LOC may not exceed 1.

In developing levels of concern be as inclusive as possible with local advisories

E.g. For PAH with cancer end points estimates of contamination levels and consumption rates that, if sustained for period of 5 years, may result in excess consumer lifetime cancer risk of 1 x 10^{-5}

- Exposure Dose (LOCs)
- Exposure Duration
- Acute Noncancer Risk Level (RfD)
- Chronic Cancer Risk Level (CSF)
- Average Adult Body Weight
- Average Life Span
- Consumption Rate (annualized)
- Population Percentile

However, consider context……

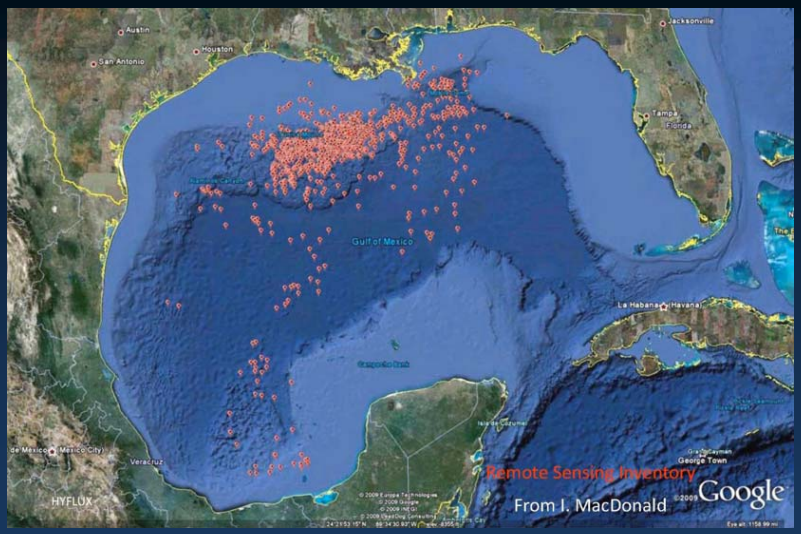
Average, Annual Releases of Petroleum (1990-1999) by Source

(NRC 2003 Oil in the sea III: inputs, fates, and effects. Washington, D.C.: National Academy Press)

Source	Gallons (millions)		
	Gulf of Mexico	North America	Worldwide
Natural Seeps	43.1 (82%)	49.6 (63%)	184.7 (83%)
Extraction of Petroleum (platforms, atmospheric deposition, produced waters)	0.8 (2%)	0.9 (1%)	11.7 (5%)
Transportation of Petroleum (pipeline spills, tanker spills, operational washings, coastal facility spills, atmospheric deposition)	1.3 (2%)	2.8 (4%)	6.3 (3%)
Consumption of Petroleum (land-based, recreational, operational discharges, atmospheric deposition, jettisoned aircraft fuel)	7.1 (14%)	25.9 (33%)	20.2 (9%)
Total	52.3	79.2	222.9

Distribution of natural seeps within the Gulf of Mexico

(Soley 2010, MacDonald 1998, Garcia 2009)



Deep water hydrocarbon seep (Chemosynthetic) communities (Cordes et al. 2007, 2010, Fisher et al. 2007)

Determine Baseline, Background, Benchmark

Coastal Zone Surveillance - NOAA Mussel Watch Program

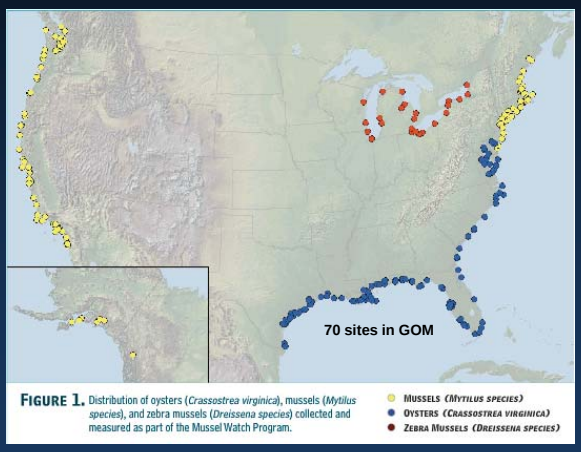


FIGURE 1. Distribution of oysters (*Crassostrea virginica*), mussels (*Mytilus species*), and zebra mussels (*Dreissena species*) collected and measured as part of the Mussel Watch Program.

At a Glance

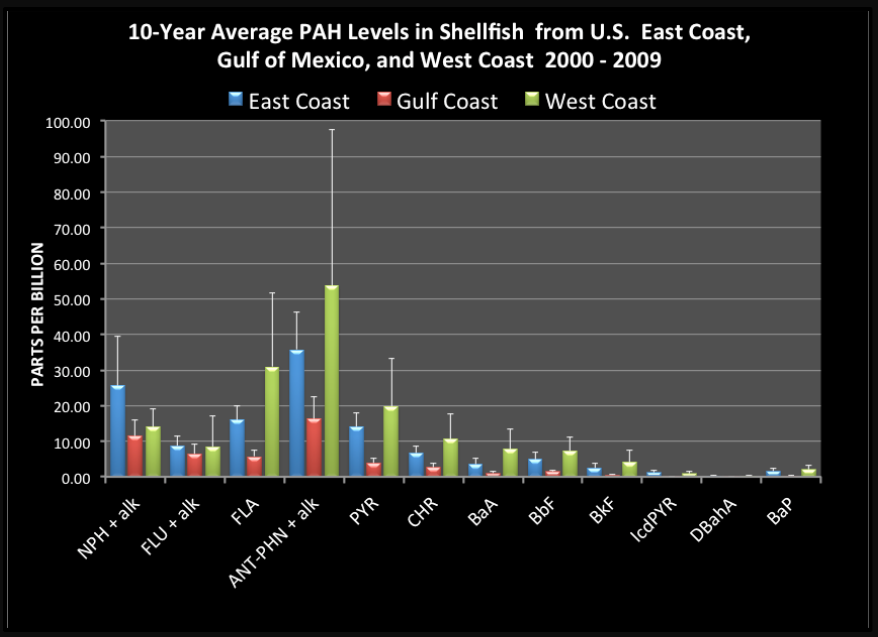
300 monitoring sites

Stations 10 to 100 km apart

140+ contaminants monitored

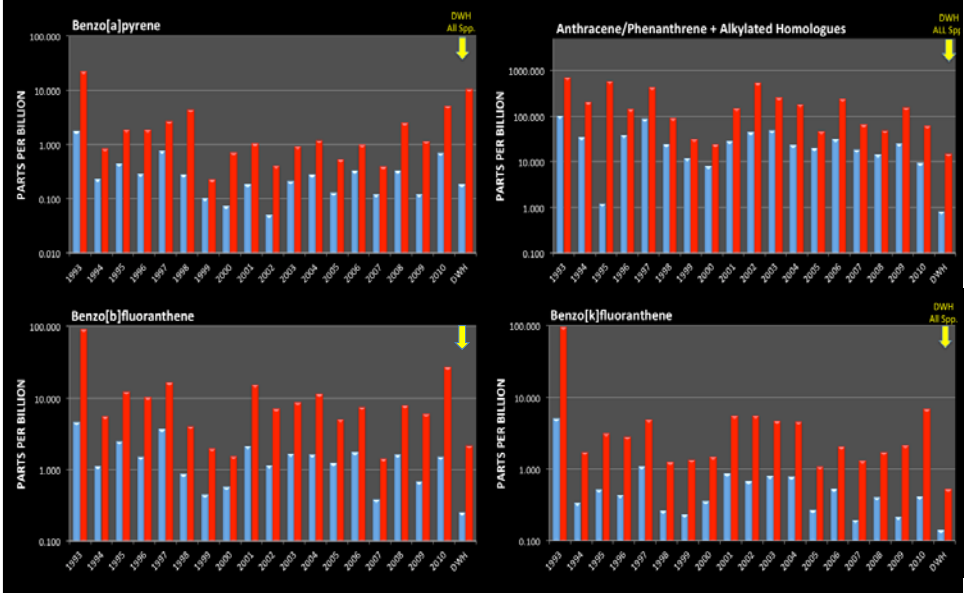
51 PCB congeners
65 PAHs
17 Metals and Metalloids

Comparative Regional Background



Data from NOAA National Status & Trends Mussel Watch Program

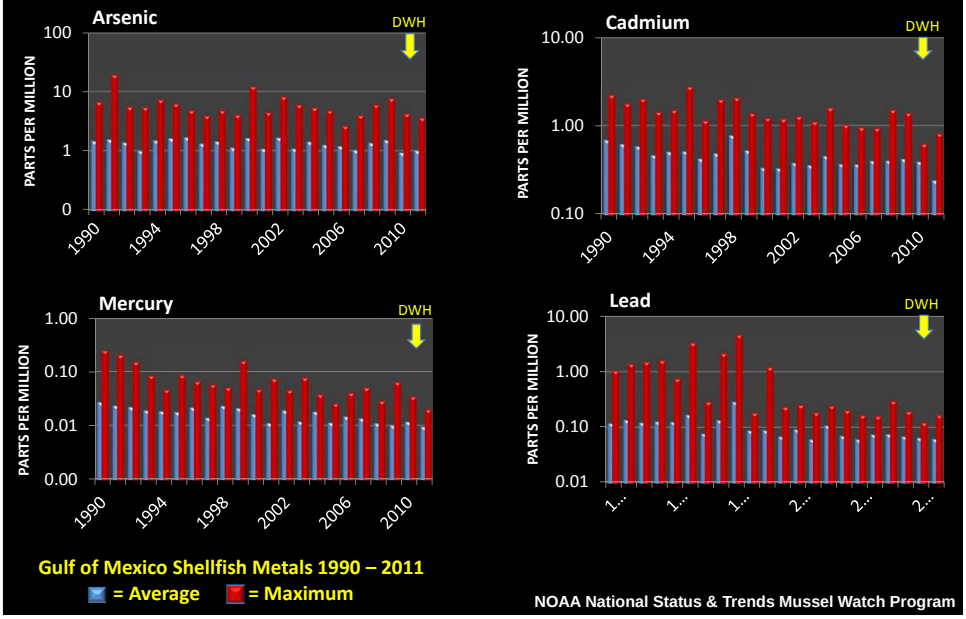
Background Aromatics in Specific Areas of Concern



North Central Gulf of Mexico Shellfish PAH Levels
= Average = Maximum

NOAA National Status & Trends Mussel Watch Program

Background Metals in Specific Areas of Concern



Gulf of Mexico Shellfish Metals 1990 – 2011

= Average = Maximum

NOAA National Status & Trends Mussel Watch Program

Factual Perspective

PAH	Meat & meat products[a]	Fish & seafood[a]	Vegetables	Fruits & confections[b]	Cereals & cereal products[c]	Beverages	Oils & fats	Dairy products[d]
Naphthalene	0.9 – 55	ND – 156	0.06 – 0.5	0.18 – 4.3	2.6	-	ND – 57	0.27 – 0.9
Pyrene	1.2 – 452	ND – 217	ND – 70	ND – 12	ND – 48	ND – 9.3	MD – 330	ND – 4.8
Benzo[a]pyrene	ND – 212	ND – 173	ND – 25	ND – 1.5	ND – 5.4	ND – 0.6	ND - 164	ND – 1.3
Benzo(b)fluoranthene[f]	ND – 197	ND – 134	ND – 28.7	ND – 3.5	0.03 – 1.3	ND – 0.65	ND – 91	ND – 0.7
Benzo(k)fluoranthene	ND –172	ND – 55	ND – 17	ND – 0.2	0.02 – 1.4	ND – 0.24	ND – 99	ND – 0.1

Range of concentrations (ppb) of select PAHs in major food groups
Extracted examples from Table 13 of
FAO/WHO 2006 Evaluation of Certain Food Contaminants. WHO Technical Report Series 930. Geneva: WHO, International Programme on Chemical Safety.
Available: http://whqlibdoc.who.int/trs/WHO_TRS_930_eng.pdf [accessed 7 October 2011].

Naturally Occurring Mutagens & Carcinogens found in Foods & Beverages, examples

Chemical	Foods/Beverage
Acetaldehyde	Apples, Bread, Coffee, Tomatoes
Acrylamide	Bread, Rolls
Aflatoxin	Nuts, Grains
Isothiocyanates	Arugula, Broccoli, Mustard
Aniline	Carrots
Benzaldehyde	Apples, Coffee, Tomatoes
Benzene	Butter, Coffee, Roast Beef
Benzo(a)pyrene	Bread, Coffee, Pumpkin Pie, Rolls, Tea, Kale
Benzofuran	Coffee

Chemical	Foods/Beverage
Benzyl Acetate	Tea
Caffeic Acid	Apples, Carrots, Celery, Tomatoes, Coffee
Catechol	Coffee
Coumarin	Cinnamon
Dibenz (a) Anthracene	Coffee
Estragole	Apples, Basil
Ethyl Alcohol	Bread, Red Wine, Rolls
Ethyl Acrylate	Pineapple
Ethyl Benzene	Coffee

Corexit® Ingredients

Ingredient Name	CASRN	Common Uses	BCF/BAF	Rodent p.o. LD_{50}
2-Butoxyethanol	111-76-2	Soaps, cosmetics and personal care products ≤ 10% Also, lacquers and paints, agricultural chemicals Indirect & Direct Food Additive: 21 CFR 175.105(FAP 1B0233); 178.1010(FAP 4A1375); +++	2 - 3	0.2–12 g/kg
Propylene Glycol	57-55-6	Drugs, cosmetics and personal care products Food products (GRAS): 21 CFR 175.105(FAP 1B0233, 2B0650); 178.3300; 175.300; 175.320; 177.2420; +++	< 10	18-46 g/kg
Dipropylene glycol monobutyl ether	29911-28-2	Cleaners, degreasers, paints, plasticizers	< 10	3-5 g/kg
Dioctyl sodium sulfosuccinate	577-11-7	OTC Laxatives, cosmetics Indirect & Direct Food Additive: 21 CFR 73.1; 131.130; 133.124; ++++	< 10	2.6-5.7 g/kg
Petroleum distillates	64742-47-8	Paints, varnishes, lubricants (e.g. HW-40), hand-cleaners (e.g. Mojo & Goop); C-8 to C-20 Aliphatic HC; Norpar-13 (CASNR 94094-93-6) is Food-Grade	60 - 80	> 5g/kg
Span 80	1338-43-8	Cosmetics & personal care products Drugs and parenteral products Food Products: 21 CFR 73.1; 107.105; 172.515; 172.623; ++++	36 - >300	NOAEL >5 g/kg d
Tween 80	9005-65-6			
Tween 85	9005-70-3			

FDA approval means that the compound is safe for its approved uses and the human exposures associated with those uses

Integrating Status and Trends in Human and Environmental Health

- Environmental contaminant baseline monitoring data.
- Human health and nutrition baseline data.
- Human population demographic data.
- Integrate research approaches to connect and understand potential impacts to human health, economy, infrastructure and natural resources.
- Comprehensive Risk Communication is very important to prevent –

Incomplete information leading to suspicion, fear & dissemination of misinformation

Complete information lead to suspicion, fear & dissemination of misinformation

Thank you