October 12, 2011

VIA COURIER

Division of Dockets Management
Food and Drug Administration
Department of Health and Human Services
5630 Fishers Lane, Room 1061
Rockville, MD 20852

CITIZEN PETITION

The Natural Resources Defense Council ("NRDC") submits this petition under section 406 of the Federal Food, Drug, and Cosmetic Act, 21 U.S.C. § 346, and pursuant to 21 C.F.R. § 10.30. This petition requests that the Commissioner of the FDA set tolerance levels for eighteen polycyclic aromatic hydrocarbons ("PAHs") in seafood. PAHs are a class of compounds that are linked to a number of health effects including cancer, birth defects, neurological impacts, and liver toxicity.

NRDC petitions the Food and Drug Administration to set tolerances for PAHs in seafood for three reasons: (1) to ensure protection of public health, particularly the health of children and other vulnerable populations, from eating contaminated seafood; (2) to improve the federal government's response to future oil spills; and (3) to modernize the FDA's risk assessment procedures in accordance with the most recent National Academy of Sciences' recommendations.

Petitioner NRDC is a national, non-profit environmental and public health membership organization with more than 350,000 members nationwide. NRDC has no financial interest in PAHs. NRDC's members are at risk of harm from exposure to PAHs in seafood.

I. ACTION REQUESTED

NRDC petitions the Commissioner to set tolerance levels for PAHs in seafood, pursuant to 21 C.F.R. § 109.4.

FDA should develop a tolerance level for each of the eighteen PAHs for which toxicity data exist, using a risk assessment methodology informed by the latest best practice, specifically the National Academy of Sciences' latest report addressing risk assessment, *Science and Decisions: Advancing Risk Assessment*.[1] Specifically, FDA should establish tolerances for the following eighteen PAHs, prioritized by the FDA and the U.S. Environmental Protection Agency as contaminants of concern for human health, taking into account both cancer and non-cancer impacts and addressing cumulative exposures to multiple PAHs:

1. Benzo(a)pyrene
2. Benz(a)anthracene
3. Benzo(b)fluoranthene
4. Benzo(k)fluoranthene
5. Chrysene
6. Dibenz(a,h)anthracene
7. Indeno(1,2,3-cd)pyrene
8. Naphthalene
9. Fluorene
10. Anthracene
11. Pyrene
12. Fluoranthene
13. Phenanthrene
14. Acenaphthene
15. Acenaphthylene
16. Benzo(e)pyrene
17. Benzo(j)fluoranthene
18. Benzo(g,h,i)perylene

Individual tolerances should be set for each PAH, but the seafood samples should be evaluated based on the cumulative risk posed by the combined exposure to those contaminants acting by a common mechanism. For example, when assessing cancer risk from contaminated seafood, the FDA should compare the measured levels of PAHs against the individual tolerances and not permit the sum of the ratios to exceed one.[2]

[1] National Academy of Sciences – Committee on Improving Risk Analysis Approaches Used by the US EPA, National Research Council. 2009. *Science and Decisions: Advancing Risk Assessment.* The National Academies Press. Washington DC

[2] U.S. Food and Drug Administration. 2010. Protocol for Interpretation and use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting due to the Deepwater Horizon Oil Spill.

Pursuant to the National Academy of Sciences' recommendations, to set health-protective tolerance levels for PAHs, the FDA must, at a minimum, take into account vulnerable subpopulations (in light of appropriate consideration of bodyweight, seafood consumption, and early life vulnerability) and the opinions of authoritative bodies, including the National Toxicology Program, the U.S. Environmental Protection Agency, the National Academy of Sciences, the World Health Organization, and the California Environmental Protection Agency. It should also take into account other factors highlighted in the National Academy of Sciences report, including assessment of cumulative and aggregate exposures; use of health-protective default assumptions, such as a linear dose-response curve for both carcinogens and non-carcinogens; and quantification of uncertainty in the risk assessment process.

II. STATEMENT OF GROUNDS

A. Legal Grounds

Under the Federal Food, Drug and Cosmetic Act ("FFDCA"), 21 U.S.C. § 301 et seq., foods containing "added" substances that render them unsafe are considered adulterated and are illegal. A "food shall be deemed adulterated" if it "bears or contains any added poisonous or added deleterious substance [that is not a pesticide, food or color additive, or a new animal drug] which may render it unsafe within the meaning of section 406" of the Act. FFDCA § 402(a)(2)(A), 21 U.S.C. § 342(a)(2)(A). "Any poisonous or deleterious substance added to any food, except where such substance is required in the production thereof or cannot be avoided by good manufacturing practice shall be deemed to be unsafe." FFDCA § 406(1), 21 U.S.C. § 346(1). An added poisonous or deleterious substance is "a poisonous or deleterious substance that is not a naturally occurring poisonous or deleterious substance. When a naturally occurring poisonous or deleterious substance is increased to abnormal levels through mishandling or other intervening acts, it is an added poisonous or deleterious substance to the extent of such increase." 21 C.F.R. § 109.3(d). A naturally occurring poisonous or deleterious substance is "a poisonous or deleterious substance that is an inherent natural constituent of a food and is not the result of environmental, agricultural, industrial, or other contamination." 21 C.F.R. §109.3(c).

However, "when such [added poisonous or deleterious] substance is so required or cannot be so avoided, the Secretary *shall* promulgate regulations limiting the quantity" of the substance in food to the extent "he finds necessary for the protection of public health." FFDCA §406, 21 U.S.C. § 346 (emphasis added). Any amount of the added poisonous or deleterious substance that exceeds the set tolerance level "shall also be deemed to be unsafe" for the purposes of determining whether food is deemed adulterated pursuant to section 402 of the FFDCA. *Id.* A tolerance "may prohibit any detectable amount of the substance in food." *Id.* § 109.4(a).

FDA may promulgate a tolerance level when the following three criteria are met: 1) "the substance cannot be avoided by good manufacturing practice"; 2) the tolerance level protects public health, taking unavoidability and other consumer exposures to the same or related poisonous or deleterious substance into account; and 3) "no technological or other changes are foreseeable in the near future that might affect the appropriateness of the tolerance established." 29 C.F.R. § 109.6(b). The types of technological and other changes considered "include anticipated improvements in good manufacturing practice that would change the extent to which use of the substance is unavoidable and anticipated studies expected to provide significant new toxicological or use data." *Id.* § 109.6(b)(3).

In setting tolerance levels, FDA must "take into account" the "extent to which the use of such substance is required or cannot be avoided in the production of" the food article and "the other ways in which the consumer may be affected by the same or other poisonous or deleterious substances." FFDCA § 406, 21 U.S.C. § 346. Tolerances "are established at levels based on the unavoidability of the poisonous or deleterious substance concerned and do not establish a permissible level of contamination where it is avoidable." 21 C.F.R. § 109.7(a).

FDA has previously used this authority to set tolerances for the class of chemicals called polychlorinated biphenyls ("PCBs"). FDA explained,

> [b]ecause of their widespread, uncontrolled industrial applications, PCB's have become a persistent and ubiquitous contaminant in the environment. As a result, certain foods and animal feeds, principally those of animal and marine origin, contain PCB's as unavoidable, environmental contaminants. PCB's are transmitted to the food portion (meat, milk, and eggs) of food-producing animals ingesting PCB-contaminated animal feed. 21 C.F.R. §109.30.

Based on these findings, FDA set tolerances for "mixtures of chlorinated biphenyl compounds, irrespective of which mixture of PCB's is present as the residue." *Id.* As discussed in detail in this petition, PAHs are similarly persistent and ubiquitous contaminants in the environment that subsequently contaminate seafood. Accordingly, FDA should set tolerances for PAHs under this authority to protect public health.

1. PAHs Are Poisonous or Deleterious Substances

PAHs are a class of chemicals that have been linked to cancer as well as neurological, renal, hepatic, hematologic, reproductive and developmental toxicity both as a mixture and through the toxicity of the individual constituent chemicals.

The U.S. Environmental Protection Agency ("EPA") has classified PAHs as "particularly significant fish contaminants, due to the human health threat posed by consuming PAH contaminated seafood."[3] EPA has classified seven PAHs as probable human carcinogens – benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. The National Toxicology Program's 12th Report on Carcinogens identified naphthalene as reasonably anticipated to be a human carcinogen.[4] The State of California lists naphthalene as known to cause cancer, with sufficient evidence to calculate a cancer potency factor of 0.12 $(mg/kg\text{-}day)^{-1}$. The cancer potency factor, used to set health protective standards, quantifies the amount of cancer risk associated with exposures to naphthalene.[5] Animal studies suggest that acenaphthene, acenanapthylene, benzo(j)fluoranthene and benzo(g,h,i)perylene may be carcinogens. [6] [7]

EPA has established risk thresholds for non-cancer effects for five PAHs: naphthalene (damage to red blood cells), fluorene (damage to blood cells and hemoglobin), anthracene (liver damage), pyrene (kidney damage), and fluoranthene (liver, neurological, and blood toxicity).[8] [9] [10] The liver toxicity of phenanthrene has been considered comparable to that of anthracene. [11] Studies have documented synergistic effects whereby individual non-cancer causing PAHs, like benzo(e)pyrene, enhance the potency of co-occurring carcinogenic PAHs, like benzo(a)pyrene.[12]

There are more than 100 different PAHs, and they generally occur as mixtures of compounds, not as individual compounds.[13] Because PAHs are generally present in the

---

[3] U.S. Environmental Protection Agency. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 2: Risk Assessment and Fish Consumption Limits -Third Edition. EPA 823-B-00-008.

[4] National Toxicology Program. 2005. 12th Report on Carcinogens. Research Triangle Park, NC:NTP

[5] Office of Environmental Health Hazard Assessment. 2005. No significant risk level (NSRL) for the Proposition 65 carcinogen naphthalene. Naphthalene NSRL. California: California Environmental Protection Agency.

[6] Law RJ, Kelly C, Baker K, Jones, J, McIntosh, AD, Moffat, CF. 2002. Toxic equivalency factors for PAH and their applicability in shellfish pollution monitoring studies. J. Environ. Monit. 4: 383-388.

[7] Agency for Toxic Substances and Disease Registry . 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. U.S. Department of Health And Human Services Atlanta, Georgia

[8] U.S. Environmental Protection Agency. 1998. Integrated Risk Information System.

[9] U.S. Food and Drug Administration. 2010. Protocol for Interpretation and use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting due to the Deepwater Horizon Oil Spill.

[10] Agency for Toxic Substances and Disease Registry. 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. U.S. Department of Health And Human Services Atlanta, Georgia

[11] U.S. Food and Drug Administration. 2010. Protocol for Interpretation and use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting due to the Deepwater Horizon Oil Spill.

[12] Agency for Toxic Subsistence and Disease Registry. 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. U.S. Department of Health And Human Services Atlanta, Georgia

[13] *Ibid*.

environment as mixtures of multiple compounds, much of the human health data focus on exposure to combined PAHs. The health risks associated with exposures to these PAH mixtures have been documented in human health studies. Based on these studies, the Agency for Toxic Substances and Disease Registry ("ATSDR") has concluded that most individual PAHs are also likely to be toxic.[14] Although not all PAHs have been studied individually, according to ATSDR, results from animal studies and structural similarities among PAHs indicate that the toxicities of the less-studied PAHs are likely to be similar to those of other known PAHs.[15] In this petition, the term "PAHs" refers to any given mixture of these compounds.

Studies have shown that mixtures of PAHs cause mammary tumors in rats, and they appear to increase breast cancer risk in a variety of ways. In addition, PAHs interact directly with DNA and can lead to DNA mutations.[16] Several studies have connected high levels of PAH-DNA adducts (i.e. PAH's bonded to DNA) and breast cancer. These studies, from the Long Island Breast Cancer Study Project, reported a 29 to 35 percent increase in the risk of developing breast cancer in relation to PAH-DNA adducts in lymphocytes.[17] Other studies compared breast tissue from women who had breast cancer with women who had benign breast diseases and found that the cancerous samples were more than twice as likely to have elevated PAH-DNA adducts.[18]

Exposure to mixtures of PAHs during pregnancy causes genetic damage to the developing fetus. PAHs are generally considered lipid soluble and therefore the majority of the common PAHs, including benzo(a)pyrene – the most toxic known PAH, cross the placenta.[19] [20] Animal studies have found that ingestion of PAHs during pregnancy results in much greater genetic damage in the fetus compared to the mother.[21] Human children exposed prenatally to PAHs have statistically significant increases in DNA aberrations in specific chromosomes, low

---

[14] *Ibid*.

[15] *Ibid*.

[16] *Ibid*.

[17] Gammon MD, Santella RM. PAH, genetic susceptibility and breast cancer risk: an update from the Long Island Breast Cancer Study Project. Eur J Cancer. 2008 Mar;44(5):636-40.

[18] Rundle A, Tang D, Hibshoosh H, Estabrook A, Schnabel F, Cao W, Grumet S, Perera FP. The relationship between genetic damage from polycyclic aromatic hydrocarbons in breast tissue and breast cancer. Carcinogenesis. 2000 Jul;21(7):1281-9.

[19] Calabrese E. 1978. Pollutants and High Risk Groups: The Biological Basis of Increased Human Susceptibility to Environmental and Occupational Pollutants. New York, NY: John Wiley and Sons.

[20] Shendrikova IA, Aleksandrov VA. 1974. Comparative penetration of polycyclic hydrocarbons through the rat placenta into the fetus. Bull Exp Biol Med 77(2):169-171.

[21] Harper BL, Ramanujam VM, Legator MS. 1989. Micronucleus formation by benzene, cyclophosphamide, benzo(a)pyrene, and benzidine in male, female, pregnant female, and fetal mice. Teratog Carcinog Mutagen 9(4):239-252.

birth weight, and intrauterine growth restriction.[22] [23] [24] [25] [26] African American children may be especially susceptible to the effect of PAH exposure on growth *in utero*.[27] [28] Prenatal exposure to airborne PAHs is linked to negative cognitive effects during childhood.[29] [30] [31] PAHs have also been found in human breast milk resulting in additional exposures during critical windows of infant development.[32] [33]

2. PAHs Are Added Poisonous or Deleterious Substances

An added poisonous or deleterious substance is "a poisonous or deleterious substance that is not a naturally occurring poisonous or deleterious substance. When a naturally occurring poisonous or deleterious substance is increased to abnormal levels through mishandling or other

---

[22] Choi H, Jedrychowski W, Spengler J, Camann DE, Whyatt RM, Rauh V et al. 2006. International studies of prenatal exposure to polycyclic aromatic hydrocarbons and fetal growth. Environ Health Perspect 114(11):1744-1750.

[23] Dejmek J, Solansky I, Benes I, Lenicek J, Sram RJ. 2000. The impact of polycyclic aromatic hydrocarbons and fine particles on pregnancy outcome. Environ Health Perspect 108(12):1159-1164.

[24] Perera FP, Rauh V, Tsai WY, Kinney P, Camann D, Barr D et al. 2003. Effects of transplacental exposure to environmental pollutants on birth outcomes in a multiethnic population. Environ Health Perspect 111(2):201-205.

[25] Orjuela MA, Liu X, Warburton D, Siebert AL, Cujar C, Tang D et al. 2010. Prenatal PAH exposure is associated with chromosome-specific aberrations in cord blood. Mutat Res 703(2):108-114; doi: 10.1016/j.mrgentox.2010.08.004.

[26] Perera F, D Tang, Whyatt R, Lederman SA, Jedrychowski W. 2005. DNA Damage from Polycyclic Aromatic Hydrocarbons Measured by Benzo[a]pyrene-DNA Adducts in Mothers and Newborns from Northern Manhattan, The World Trade Center Area, Poland, and China. Cancer Epidemiol Biomarkers & Prev. 14:709-714.

[27] Choi H, Jedrychowski W, Spengler J, Camann DE, Whyatt RM, Rauh V et al. 2006. International studies of prenatal exposure to polycyclic aromatic hydrocarbons and fetal growth. Environ Health Perspect 114(11):1744-1750.

[28] Perera FP, Rauh V, Tsai WY, Kinney P, Camann D, Barr D et al. 2003. Effects of transplacental exposure to environmental pollutants on birth outcomes in a multiethnic population. Environ Health Perspect 111(2):201-205.

[29] For example, children born to mothers exposed to PAHs were found to have reduced nonverbal reasoning ability at 5 years of age, delayed cognitive development, and lower overall IQ and verbal IQ.

[30] Edwards SC, Jedrychowski W, Butscher M, Camann D, Kieltyka A, Mroz E, Flak E, Li Z, Wang S, Rauh V, Perera F. 2010. Prenatal Exposure to Airborne Polycyclic Aromatic Hydrocarbons and Children's Intelligence at 5 Years of Age in a Prospective Cohort Study in Poland. Environ Health Perspect. 118:1326-1331.

[31] Perera FP, Li Z, Whyatt R, Hoepner L, Wang S, Camann D, Rauh V. Prenatal Airborne Polycyclic Aromatic Hydrocarbon Exposure and Child IQ at Age 5 Years. Pediatrics. 124(2): e195–e202

[32] Kim SR, Halden RU, Buckley TJ. Polycyclic aromatic hydrocarbons in human milk of nonsmoking U.S. women. Environ Sci Technol. 2008. 42(7):2663-2667.

[33] Del Bubba M, Zanieri L, Galvan P, Donzelli GP, Checchini L, Lepri L. Determination of polycyclic aromatic hydrocarbons (PAHs) and total fats in human milk. Ann Chim. 2005. 95(9-10):629-641.

intervening acts, it is an added poisonous or deleterious substance to the extent of such increase." 21 C.F.R. § 109.3.

a) PAHs Are Not Naturally Occurring Poisonous Or Deleterious Substances.

"A naturally occurring poisonous or deleterious substance is a poisonous or deleterious substance that is an inherent natural constituent of a food and is not the result of environmental, agricultural, industrial, or other contamination." 21 C.F.R. § 109.3(c).

PAHs are not an inherent natural constituent of food. PAH contamination of seafood occurs largely because of the extraction, transport, and use of fossil fuels.[34] PAHs released to the air from combustion sources, such as motor vehicles, deposit on surfaces and collect in the sediments and biota of streams and other waterbodies, particularly near urban areas.[35] Studies have found PAH levels in biota to be correlated to levels of PAHs in sediments.[36] PAH levels also appear to increase with increasing proximity to anthropogenic sources such as urban development, oil spills, and industrial activities compared to rural areas without industrial activities.[37] [38] [39] [40] [41] [42]

PAHs occur in the environment primarily as a result of environmental and industrial contamination. PAHs are constituents of petroleum products, such as crude oil, coal or gas (petrogenic) and are also formed during the incomplete combustion of organic materials

---

[34] U.S. Environmental Protection Agency. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 2: Risk Assessment and Fish Consumption Limits -Third Edition. EPA 823-B-00-008.

[35] Agency for Toxic Substances and Disease Registry. 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. U.S. Department of Health And Human Services Atlanta, Georgia

[36] Garner RG, Weinstein JE, Sanger DM. 2009. Polycyclic Aromatic Hydrocarbon Contamination in South Carolina Salt Marsh-Tidal Creek Systems: Relationships Among Sediments, Biota, and Watershed Land Use. Arch Environ Contam Toxicol. 57:103-115

[37] *Ibid*.

[38] Gilroy DJ. 2000. Derivation of Shellfish Harvest Reopening Criteria Following the New Carissa Oil Spill in Coos Bay Oregon. Journal of Toxicology and Environmental Health. 60:317-329

[39] Wei S, Lau RKF, Fung CN, Zheng GJ, Lam JCW, Connell DW, Fang Z, Richardson BJ, Lam PKS. 2006. Trace Organic Contamination in Biota Collected from the Pearl River Estuary, China: A Preliminary Risk Assessment. Marine Pollution Bulletin. 52:1682-1694.

[40] Jackson TJ, Wade TL, McDonald TJ, Wilkinson DL, Brooks JM. 1994. Polynuclear Aromatic Hydrocarbon Contaminants in Oysters from the Gulf of Mexico (1986-1990)

[41] Law RJ, Kelly C, Baker K, Jones, J, McIntosh, AD, Moffat, CF. 2002. Toxic equivalency factors for PAH and their applicability in shellfish pollution monitoring studies. J. Environ. Monit. 4: 383-388.

[42] Gohlke JM, Doke D, Tipre M, Leader M, Fitzgerald T. 2011. A Review of Seafood Safety after the Deepwater Horizon Blowout. Environ Health Persp. 119:1062-1069

(pyrogenic).[43] Industrial activities such as coal coking, production of carbon blacks, creosote, and coal tar, and petroleum refining and drilling are known sources of PAHs to the environment and waterbodies.[44]

Accordingly, PAHs are not inherent constituents of food and are the result of environmental and industrial contamination. As such, they are not naturally occurring poisonous or deleterious substances.

b) If PAHs Are Considered Naturally Occurring Substances, They Occur At Abnormal Levels Due To Intervening Acts.

While PAHs may be considered naturally occurring substances because they are components of petroleum products, anthropogenic activities cause them to rise to abnormal levels.[45] Intervening acts such as burning fossil fuels, including automobile emissions, oil spills, industrial activities, and urban run-off create increased concentrations or "hotspots" of PAH contamination in the environment.

This environmental contamination caused by these intervening acts translates to seafood contaminated with PAHs. PAHs are found at abnormal levels in seafood in large part as a result of intervening acts such as oil spills, industrial activities and urban development.[46] The safety of commercial and recreational fisheries are jeopardized by PAH contamination from these sources, particularly with oil spills in waterbodies that serve as major sources of commercial seafood (such as the Gulf of Mexico).[47] [48] [49] [50]Increased levels of PAHs are routinely detected in seafood

---

[43] U.S. Environmental Protection Agency. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 2: Risk Assessment and Fish Consumption Limits -Third Edition. EPA 823-B-00-008.

[44] *Ibid*.

[45] Agency for Toxic Substances and Disease Registry. 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. U.S. Department of Health And Human Services Atlanta, Georgia

[46] *Id.* at p. 4-45

[47] Law RJ, Kelly C, Baker K, Jones, J, McIntosh, AD, Moffat, CF. 2002. Toxic equivalency factors for PAH and their applicability in shellfish pollution monitoring studies. J. Environ. Monit. 4: 383-388.

[48] Gilroy DJ. 2000. Derivation of Shellfish Harvest Reopening Criteria Following the New Carissa Oil Spill in Coos Bay Oregon. Journal of Toxicology and Environmental Health. 60:317-329

[49] Bolger M and Carrington CD. 1999. Hazard and risk assessment of crude oil in subsistence seafood samples from Prince William Sound: Lessons learned from the Exxon Valdez. In: Evaluating and Communicating Subsistence Safety in a Cross Cultural Context: Lessons Learned from Exxon Valdez Oil Spill. (Field LJ et al. eds). SETAC 195-204.

[50] Wei S, Lau RKF, Fung CN, Zheng GJ, Lam JCW, Connell DW, Fang Z, Richardson BJ, Lam PKS. 2006. Trace Organic Contamination in Biota Collected from the Pearl River Estuary, China: A Preliminary Risk Assessment. Marine Pollution Bulletin. 52:1682-1694.

following oil spills compared to areas not affected by oils spills.[51] [52] In the U.S., commercial and recreational fisheries are routinely closed and assessed for PAH contamination after an oil spill.[53] [54]Following the *Erika* oil spill off the coast of Spain in 1999, a toxicology study documented the bioavailability of PAHs in mussels which were contaminated with PAHs above background levels by the spill.[55] In this study, genotoxic damage was found in rats who consumed mussels contaminated with PAHs at levels previously presumed to be safe for human consumption. Oil spills are not the only source of contamination. The presence of abnormal levels of PAHs in major waterbodies in general causes elevated levels of PAHs in seafood.

Food data routinely show elevated levels of PAHs in seafood, particularly mollusks such as mussels, oysters, and clams.[56] [57] The National Research Council ("NRC") estimate of benzo(a)pyrene intake in our diets[58] further highlights the abnormal levels of PAHs that can occur in food. The NRC study found that the consumption of "oil-contaminated seafood" and a "seafood diet," in general, resulted in an increased intake of the PAH benzo(a)pyrene over a "normal food diet." It estimated the annual intake of benzo(a)pyrene to be 250-500 µg/year for a "normal food diet" and 37-1875 µg/year for a "seafood diet." Of the annual intake of benzo(a)pyrene in the seafood diet, 263-920 µg/year were the result of consuming highly contaminated seafood.[59] Assuming that the entire seafood diet is highly contaminated*,* the annual intake of benzo(a)pyrene associated with oil-contaminated seafood rises to 550-1900 µg/year.[60] People who consume amounts of seafood in the upper end of the diet range had higher intake of benzo(a)pyrene from seafood than from other sources of exposure assessed (air, water, cigarette

[51] Law RJ, Kelly C, Baker K, Jones, J, McIntosh, AD, Moffat, CF. 2002. Toxic equivalency factors for PAH and their applicability in shellfish pollution monitoring studies. J. Environ. Monit. 4: 383-388.

[52] Gilroy DJ. 2000. Derivation of Shellfish Harvest Reopening Criteria Following the New Carissa Oil Spill in Coos Bay Oregon. Journal of Toxicology and Environmental Health. 60:317-329

[53] Law RJ, Kelly C, Baker K, Jones, J, McIntosh, AD, Moffat, CF. 2002. Toxic equivalency factors for PAH and their applicability in shellfish pollution monitoring studies. J. Environ. Monit. 4: 383-388.

[54] Gilroy DJ. 2000. Derivation of Shellfish Harvest Reopening Criteria Following the New Carissa Oil Spill in Coos Bay Oregon. Journal of Toxicology and Environmental Health. 60:317-329

[55] Lemiere S, Cissu-Leguille C, Bispo A, Jourdain M-J, Lanhers MC, Burnel D, Vasseur P. 2004. Genotoxicity Related to Transfer of Oil Spill Pollutants from Mussels to Mammals via Food. Environ Toxicol 19:387-395

[56] European Food Safety Authority. 2008. Findings of the EFSA Data Collection on Polycyclic Aromatic Hydrocarbons in Food.

[57] Agency for Toxic Substances Disease Registry. 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons.

[58] National Research Council. 1985. Oil in the Sea. Inputs, fates, and effects. Washington DC: National Academy Press. p481

[59] *Ibid*.

[60] Bolger and Carrington Bolger et al 1999 in Evaluating and Communicating Subsistence Seafood Safety in a Cross Cultural Context: Lessons Learned from the Exxon Valdez Oil Spill 1999

smoking) with the exception of a "smoked food diet."[61] Because PAHs occur as a mixture of compounds, the data on benzo(a)pyrene levels in food strongly suggests that intake of PAHs in general is higher than normal for people who consume more seafood.

Levels of PAHs elevate to abnormal levels as a result of oil spills and other intervening anthropogenic activities, such as burning fossil fuels, urban run-off and industrial discharges.[62] Whether they are considered naturally occurring or not, PAHs in seafood are added poisonous and deleterious substances.

3. PAHs Are Unavoidable

To set a tolerance for an added poisonous or deleterious substance, the substance must be unavoidable, meaning it "cannot be avoided by good manufacturing practice." 21 C.F.R. § 109.6(b)(1).

Much like PCBs, PAHs are a persistent and ubiquitous contaminant in the environment. Environmental monitoring indicates widespread PAH contamination of major waterways in the U.S. and around the world, particularly near urban areas.[63] Once PAHs are deposited or released, they are retained in the environment and can move from sediments up the food chain.[64] PAHs are persistent in the environment with a half life greater than thirty days.[65] Once they are released into the environment, PAHs can bioaccumulate in the environment (BCF values >300) and in aquatic organisms.[66] [67] [68] [69] [70]

---

[61] National Research Council. 1985. Oil in the Sea. Inputs, fates, and effects. Washington DC: National Academy Press. p481.

[62] Agency for Toxic Substances Disease Registry. 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons.

[63] Law RJ, Kelly C, Baker K, Jones, J, McIntosh, AD, Moffat, CF. 2002. Toxic equivalency factors for PAH and their applicability in shellfish pollution monitoring studies. J. Environ. Monit. 4: 383-388.

[64] U.S. Environmental Protection Agency. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 2: Risk Assessment and Fish Consumption Limits -Third Edition. EPA 823-B-00-008.

[65] *Ibid*.

[66] *Ibid*.

[67] Yender , R. Michel, J. and Lord, C. 2002 Managing Seafood Safety after an Oil Spill. Seattle: Hazardous Materials Response Division, Office of Response and Restoration, National Oceanic and Atmospheric Administration.

[68] Bolger and Carrington Bolger et al 1999 in Evaluating and Communicating Subsistence Seafood Safety in a Cross Cultural Context: Lessons Learned from the Exxon Valdez Oil Spill 1999

[69] Law RJ, Kelly C, Baker K, Jones, J, McIntosh, AD, Moffat, CF. 2002. Toxic equivalency factors for PAH and their applicability in shellfish pollution monitoring studies. J. Environ. Monit. 4: 383-388.

Environmental monitoring of sediments by EPA and of mollusks (oysters and mussels) by the National Oceanic and Atmospheric Administration has documented PAH contamination throughout the United States.[71] EPA testing data of fish and shellfish from U.S. estuaries indicate that PAHs are one of the most common contaminants, with 21 percent of the samples being contaminated at levels exceeding EPA's guidelines for recreational consumers.[72] Internationally, PAH contamination of seafood has been documented in Europe, the Mediterranean, the Middle East, and China.[73] [74]

There are no physical or chemical processes that can remove PAHs once they contaminate seafood. Once PAHs contaminate seafood, they are unavoidable for consumers. There is no evidence of either processing practices for market or home preparation practices that remove PAHs from raw seafood.[75] [76] In fact, studies have shown that processing for market or home preparation practices may in fact increase concentrations of PAHs.[77] [78] Because PAHs are unavoidable through the good manufacturing practices and because PAH contaminated waters and seafood are prevalent, it is essential to establish a tolerance to protect public health.

---

[70] Gilroy DJ. 2000. Derivation of Shellfish Harvest Reopening Criteria Following the New Carissa Oil Spill in Coos Bay Oregon. Journal of Toxicology and Environmental Health. 60:317-329

[71] National Oceanic and Atmospheric Administration. Mussel Watch Program: An Assessment of Two Decades of Contaminant Monitoring in the Nation's Coastal Zone

[72] Harvey J. Harwell. L. and Summers JK. 2008. Contaminant Concentrations in Whole-Body Fish and Shellfish from US Estuaries. Eviron.Monit. Assess. 137

[73] Law RJ, Kelly C, Baker K, Jones, J, McIntosh, AD, Moffat, CF. 2002. Toxic equivalency factors for PAH and their applicability in shellfish pollution monitoring studies. J. Environ. Monit. 4: 383-388.

[74] Wei S, Lau RKF, Fung CN, Zheng GJ, Lam JCW, Connell DW, Fang Z, Richardson BJ, Lam PKS. 2006. Trace Organic Contamination in Biota Collected from the Pearl River Estuary, China: A Preliminary Risk Assessment. Marine Pollution Bulletin. 52:1682-1694.

[75] U.S. Environmental Protection Agency. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. EPA 823-B-00-008

[76] *See e.g.* West Virginia Sport Fish Consumption Advisory Guide, West Virginia Interagency Technical Committee, 2007, page 70, available at http://www.wvdhhr.org/fish/documents/wv_fish_advisory_guide.pdf, last visited September 28, 2011 (showing negligible changes in PAH levels with skin off versus skin on preparations, and no changes in meal restrictions between the two preparation methods).

[77] *See e.g.* Perello, G., R. Marti-Cid, et al. (2009). "Concentrations of polybrominated diphenyl ethers, hexachlorobenzene and polycyclic aromatic hydrocarbons in various foodstuffs before and after cooking." *Food and Chemical Toxicology* 47(4): 709-715 (finding that cooking does not reduce PAH concentrations in food.)

[78] European Food Safety Authority. 2008. Findings of the EFSA Data Collection on Polycyclic Aromatic Hydrocarbons in Food., cf Table 10 and Table 11.

4. Setting Tolerances for PAHs Will Protect Public Health

The FFDCA requires that when a substance cannot be avoided, "the Secretary shall promulgate regulations limiting the quantity therein or thereon to such extent as he finds necessary for the protection of public health, and any quantity exceeding the limits so fixed shall also be deemed to be unsafe" for the purposes of determining whether food is adulterated. 21 U.S.C. § 346. Consequently, a tolerance for an unavoidable substance should be set at a level to protect public health, taking unavoidability and other consumer exposures to the same or related substances into account. *Id*; 21 C.F.R. § 109.6(b)(2). PAHs, and in particular PAHs in seafood, pose a risk to public health. Given the known human health risks associated with exposure to PAHs, FDA should set the tolerance level at a level that will adequately protect public health taking all the risks into account.

Americans regularly consume fish and other types of seafood. Among consumers, the average intake of seafood has been estimated at 89.2 grams per day or 33 kilograms per year. For high end consumers (95th percentile) daily intake has been estimates at 267.1 grams per day or 97 kilograms per year.[79]

The consumption of PAH-contaminated seafood is a public health problem. National seafood monitoring programs have detected PAHs in fish and shellfish samples tested.[80] The EPA recognizes PAHs as a contaminant of concern in fish and other seafood.[81] The European Union has recognized the health threat posed by PAHs in food and established standards for benzo(a)pyrene with specific levels set for fish, crustaceans, and mollusks.[82]

PAH contamination of fish and shellfish has caused various states to issue fish advisories. For example, PAH contamination led the Massachusetts Department of Public Health Regional to advise people against eating fish from the Hocomonco Pond,[83] the Ohio Environmental Protection Agency to advise people not to eat any species of fish from a portion of the Little

[79] National Academy of Sciences. 2007. Seafood Choices: Balancing Benefits and Risks. National Academies Press: Washington DC

[80] Harvey J. Harwell. L. and Summers JK. 2008. Contaminant Concentrations in Whole-Body Fish and Shellfish from US Estuaries. Eviron.Monit. Assess. 137

[81] U.S. Environmental Protection Agency. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume 2 Risk Assessment and Fish Consumption Limits. Third Edition. EPA 823-B-00-008

[82] European Food Safety Authority. 2008. Findings of the EFSA Data Collection on Polycyclic Aromatic Hydrocarbons in Food.

[83] Massachusetts Department of Public Health, Bureau of Environmental Health, Freshwater Fish Consumption Advisory List, October, 2009. Available at http://www.mass.gov/Eeohhs2/docs/dph/environmental/exposure/fish_consumption_advisory_list.pdf, last visited September 28, 2011.

Scioto River[84], and the Duval County Health Department in Florida to advise people not to eat largemouth bass and striped mullet from Hogan Creek.[85]

Crustaceans and mollusks, such as shrimp, crab, and oysters, are of particular concern due to reduced rates of biological clearance in these species.[86] Consumption of PAH-contaminated fish and shellfish represents a significant dietary exposure to PAHs. Setting legal limits of PAHs in seafood will protect the public from consuming dangerous amounts of these toxic chemicals.

Even more problematic, PAHs are often present in the environment as a mixture of chemicals, rather than as an individual chemical; the combined impact of multiple chemicals and interactions can increase health risks.[87] The public is exposed to this mixture of dangerous chemicals not only through eating contaminated seafood, but also through other foods, and through breathing contaminated air, particularly near industrial sources and areas of high vehicular traffic.[88] The fact that the cumulative risk of seafood exposure combined with other exposures supports the need for tolerances to protect public health.

5. There Are No Technological or Other Changes Foreseeable that Might Affect the Appropriateness of Establishing Tolerances for PAHs

There are no foreseeable technological or other changes that would affect the appropriateness of a tolerance. *See* 21 C.F.R. § 109.6(b)(3). As part of its analysis for setting a tolerance level, FDA considers whether there are changes such as "anticipated improvements in good manufacturing practice that would change the extent to which use of the substance is unavoidable and anticipated studies expected to provide significant new toxicological or use data." 21 C.F.R. § 109.6(b)(3).

In the case of PAHs, there are no such technological or other foreseeable changes. First, good manufacturing practices cannot lower the extent to which PAHs are unavoidable. Good seafood manufacturing practices cannot prevent fish and other seafood that live in PAH-contaminated waters from becoming contaminated with PAHs themselves. There also do not seem to be any good manufacturing practices that remove PAHs from contaminated seafood

[84] Ohio Environmental Protection Agency. 2011 Ohio Sport Fish Consumption Advisory – Do Not Eat. Available at http://www.epa.state.oh.us/dsw/fishadvisory/donoteat.aspx, last visited September 28, 2011.

[85] Fish Consumption Advisory for Hogan Creek and Long Branch Announced, Duval County Health Department (Florida), available at http://www.dchd.net/fishadvisoryjuly2011.html, last visited September 28, 2011.

[86] Law RJ, Hellou J. Contamination of Fish and Shellfish following Oil Spill Incidents. Environ Geosci. 1999;6(2): 90-98.

[87] Agency for Toxic Substances Disease Registry. 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons.

[88] *Ibid*.

after it becomes contaminated. In fact, as noted earlier, processing fish and cooking fish have been shown to increase the concentration of PAHs in the food.

Second, there are no anticipated studies expected to change the current scientific understanding that exposure to PAHs can cause significant adverse health effects. There are already considerable toxicological data to establish that PAHs are poisonous and deleterious. The carcinogenicity of PAHs is well established. Newer research has documented developmental and reproductive effects at low doses. Further research exploring cumulative exposures and the toxicity of mixtures and sensitive exposure windows will likely increase the concerns about health risk from PAH exposure, not lower them. Any additional studies that are conducted would flesh out the existing wealth of data. Given the public health impacts of PAH exposure, FDA must establish these tolerances.

Most importantly, the problem of PAH contamination of our waters and seafood will not disappear in the foreseeable future. Industrial practices are not quickly evolving and levels of PAHs in the environment are not expected to change significantly from year to year, meaning those levels are relatively "stable."[89] The U.S. economy is projected to rely on fossil fuels for quite some time. The U.S. Energy Information Administration projects a steady increase in the demand for fuels in the transportation sector. [90] By 2035 consumption in this sector is projected to increase by 2.9 million barrels per day over 2009 consumption.[91] The projections for other sectors indicate that consumption levels will either hold relatively steady or have negligible decreases.

The projected reliance on fossil fuels indicates that off-shore drilling for oil will likely persist.[92] As a result, accidents will likely continue to occur, and oil spills will likely continue to pollute our waters. The continued threat of PAH pollution from off-shore drilling, burning fossil fuels, urban run-off, and industrial releases means that levels of PAHs in seafood are likely to remain a health concern – and even spike during oil spill disasters like the 2010 BP Deepwater Horizon explosion and subsequent oil spill into the Gulf of Mexico (hereinafter referred to as the "BP Oil Spill").[93] [94] The U.S. government will likely again be faced with the question of whether

[89] *See generally* "Poisonous or Deleterious Substances in Food: Notice of Proposed Rulemaking" 39 Fed. Reg. 42743, 42745 (Dec. 6, 1974).

[90] U.S. Energy Information Administration. Annual Energy Outlook 2011: with Projections to 2035. April 2011. Available at http://www.eia.gov/forecasts/aeo/source_oil.cfm

[91] *Ibid.*

[92] *See e.g.* Jeff Mason and Tom Doggett, "Obama seeks more drilling in Alaska and Gulf of Mexico" Reuters, May 14, 2011, available at http://www.msnbc.msn.com/id/42706911/ns/politics/t/obama-seeks-more-drilling-alaska-gulf-mexico/#.TnuBiOy8hPI, last visited Sept. 22, 2011.

[93] Harvey, J. Harwell, L. and Summers JK. 2008. Contaminant concentrations in whole-body fish and shellfish from US estuaries. Enviro., Monit. Assess. 137:403-412.

waters contaminated by an oil spill can be reopened for commercial fishing and whether seafood which has been contaminated by PAHs from oil spill disasters are safe for public health. Until the U.S. transitions fully to an economy not based predominantly on fossil fuels, oil spills and other events that release PAHs into the environment are foreseeable.

Therefore setting tolerances for PAHs in seafood is appropriate.

B. Scientific and Policy Considerations

Risk assessments are used to set legally-allowable levels of pollutants in food. If the testing or assessments are not done right, or are done too slowly, people can be exposed to increased risk of illness because legally allowable levels of chemical exposures may be unsafe, based on outdated or inaccurate science or no data at all.

The 2010 BP Oil Spill is the most recent reminder of why the FDA needs to conduct a proper risk assessment and set tolerances for PAHs in seafood. Ad hoc assessments only open the government's decisions up to criticism and erode public confidence. Instead, assessments that are fully vetted through transparent public processes, which facilitate greater public input and through full consultation with scientific experts, will likely be more health protective and have greater public and scientific support. Setting tolerances that apply to all situations, rather than conducting assessments on a case-by-case basis, will protect public health and will benefit the FDA and localities affected by an oil spill.

Setting tolerances for PAHs will ensure that the FDA and the rest of the federal agencies that are involved with oil spill disasters are better prepared when another oil spill occurs.

1. Setting Tolerances Now Will Improve the Federal Government's Response to Future Oil Spills

In the midst of an oil spill emergency, the FDA's resources are better utilized dealing with the specific emergency. By setting tolerances before the next oil spill, the FDA can focus its limited resources on steps to directly assist the victims of the oil spill immediately to avoid harms from PAHs.

During the 2010 BP Oil Spill, cities and towns waited for FDA to determine whether their waters were safe to re-open to commercial fishing. Had FDA already set a tolerance for PAHs in seafood, the agency could have better allocated its resources. Rather than spending staff time determining what levels of PAHs would be considered safe, the FDA could have better

---

[94] Law, RJ, Kelley, CK, Baker, K., Jones, J., McIntosh, AD, and Moffat, CF. 2002. Toxic equivalency factors for PAH and their applicability in shellfish pollution monitoring studies. J.Environ. Monit. 4:383-388.

addressed the concerns of the local residents, for example, by developing improved sampling and monitoring plans and by conducting more risk communication and public outreach.

2. Setting Consistent and Acceptable Tolerances

In the glare of the immediate aftermath of an oil spill disaster, FDA may have less opportunity to ensure consistency across responses to different oil spills or incidents and to ensure adequately health-protective outcomes. To date, the FDA's response to oil spills has been to conduct an ad hoc risk assessment on a case-by-case basis, utilizing different exposure assumptions between different oil spill events. As such, the assumptions and calculations used for the BP Oil Spill disaster differed from the Agency's prior practice and from the guidance of other expert authorities. These differences give rise to inconsistent responses by the agency to different events, or competing risk assessments between the FDA and other agencies similarly charged with assessing public health threats from contaminants in seafood.

This has inevitably led to inconsistent decision-making, leaving some parts of the U.S. more protected in the aftermath of an oil spill than other parts. For example, the FDA's risk assessment and determination of "safe" levels of PAHs for the BP Oil Spill that reopened the waters to commercial fishing allowed levels of PAHs in seafood were significantly higher than those allowed following the Exxon Valdez oil spill. Specifically, the levels of concern ("LOC") for the highly toxic PAH, benzo(a)pyrene, differed greatly for the two oil spill events. For the Exxon Valdez, the LOC for fish was 5 parts per billion ("ppb") and for crustaceans was 11 ppb.[95] In stark contrast, for the BP Oil Spill, the LOC for fish was 35 ppb and for crustaceans was 132 ppb. [96] FDA offered no credible explanation for the disparity. Conducting quick, ad hoc assessments gives the agency little opportunity to thoroughly evaluate and adjust the analyses in response to outside input.

Setting a tolerance now will allow FDA to have outside experts and scientists from other agencies – such as the EPA – publicly peer review the FDA's assessment and ensure that the assessment is properly vetted. It will also allow for comments from the public and a chance to address information and issues that might have been missed. Opening the assessment up for public comment will also increase transparency and public confidence in the outcomes. In all, these improvements will help ensure that the risk assessment is as robust as possible and provides equal protection to all Americans from PAHs in their seafood.

[95] Gohlke JM, Doke D, Tipre M, Leader M, Fitzgerald T. 2011. A Review of Seafood Safety after the Deepwater Horizon Blowout. Environ Health Persp. 119:1062-1069

[96] U.S. Food and Drug Administration. 2010. Protocol for Interpretation and use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting due to the Deepwater Horizon Oil Spill.

3. Modernizing FDA's Risk Assessments Will Protect Public Health

In contrast to conducting ad hoc risk assessments conducted for each oil spill, the structured and proactive process of setting tolerances will allow FDA a better opportunity to thoughtfully incorporate the most up-to-date and health-protective assumptions into its risk assessment, with input from the public and other affected parties.

To illustrate some of the shortcomings of the current process that could be rectified to ensure more health-protective outcomes, NRDC examined the risk assessment that FDA conducted during the BP Oil Spill. The FDA's methods, assumptions, and decisions were documented in the 2010 *Protocol for Interpretation and Use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting Due to The Deepwater Horizon Oil Spill*. NRDC compared the risk assessment methods used by FDA in response to the BP Oil Spill with current scientific best practices as described in the literature, used by other authoritative bodies, and even incorporated in risk assessments for other oil spills.[97]

NRDC found that, during the BP Oil Spill, FDA used an outdated risk assessment methodology that relied on flawed or outdated assumptions and parameters. The choice of parameters and assumptions can significantly alter the conclusions of a risk assessment, thereby having major effects on resulting policy decisions. For example, NRDC determined that a risk assessment using parameters and methods specifically aimed at protecting vulnerable populations and incorporating the latest risk science (which were not incorporated in FDA's assessment) differs from FDA's assessment by up to four orders of magnitude. [98] The risk assessment therefore resulted in LOCs for PAHs in seafood from the Gulf of Mexico (fish, shrimp, oysters, crab) that did not adequately protect public health.

Shortcomings in FDA's assessment included underestimating seafood consumption (and thus the risk from PAH exposures) in the Gulf region; using a high consumer bodyweight that systematically minimizes the risks to smaller consumers; and using an inappropriately high threshold for acceptable risk that allowed significant risks to persist. In addition, the assessment did not calculate the cumulative risk from consuming different types of seafood, did not consider the increased risks to the fetus and infant, and did not include naphthalene in the cancer risk assessment. These gaps contributed to underestimating the potential health risks that Gulf area residents faced as a result of consuming contaminated seafood from the oil spill.[99]

---

[97] Rotkin-Ellman M, Wong KW, Solomon GM. 2011. Seafood Contamination after the BP Gulf Oil Spill and Risks to Vulnerable Populations: A Critique of the FDA Risk Assessment. Environ Health Perspect http://dx.doi.org/10.1289/ehp.1103695

[98] *Ibid*.

[99] *Ibid*.

Importantly, during the development of the safe levels, FDA considered a wide range of assumptions for seafood consumption rates and individual body weight. [100] However, in the final calculation, FDA did not choose the most health protective values and did not justify its deviation from prior practice or its failure to protect health. The public vetting of a notice-and-comment rulemaking to set tolerances would be more likely to identify and help rectify such flaws in a risk assessment.

For instance, public comment likely would have drawn attention to examples of chemical assessments where new data and approaches have repeatedly demonstrated significantly greater risks than initially believed,[101] [102] thus highlighting a need for more health-protective assumptions, such as those incorporated in the latest National Academy of Science ("NAS") review of risk assessment science. The recommendations from the NAS report *Science and Decisions: Advancing Risk Assessment* (hereinafter referred to as the "NAS Report") address some of the very shortcomings reflected in FDA's assessments of the BP Oil Spill risks.[103]

In setting tolerances for PAHs in seafood, FDA has an opportunity to take the NAS Report's recommendations as a starting point and to incorporate any further advances in the science and risk assessment methodology. Four specific recommendations would address the shortcomings in FDA's parameters and assumptions that are identified above and should serve as a starting point in any risk assessment that forms the basis for a tolerance level. Specifically, the risk assessments that will serve as the foundation for setting tolerances for PAHs in seafood should incorporate the NAS Report's recommendations to: improve assessment of cumulative and aggregate exposures in risk assessments; fully account for vulnerable subpopulations and vulnerable lifestages; use health-protective default assumptions including a linear dose-response curve for both carcinogens and non-carcinogens; and better quantify uncertainty in the risk assessment process.[104] FDA should also pay heed to the NAS Report's strong recommendations on increasing transparency and public access to information.[105]

[100] NRDC 2011. FDA documents provided to NRDC part C. http://docs.nrdc.org/energy/files/ene_11101101c.pdf

[101] Grandjean P, Satoh H, Murata K, Eto K.2010. Adverse effects of methylmercury: environmental health research implications. Environ Health Perspect 118:1137–1145.

[102] Castorina R, Woodruff TJ. 2003. Assessment of potential risk levels associated with U.S. Environmental Protection Agency reference values. Environ Health Perspect 111:1318–1325.

[103] National Academy of Sciences – Committee on Improving Risk Analysis Approaches Used by the US EPA, National Research Council. 2009. Science and Decisions: Advancing Risk Assessment. The National Academies Press. Washington DC

[104] *Ibid*.

[105] *Ibid* pages 12 and 121

a) Vulnerable Sub-populations

The NAS Report concluded that the new science documenting inter-individual variability and the vulnerability of the developing fetus and child to chemical contaminants warrants specific changes to risk assessment practices.[106] It recommended that the types, sources, extent and magnitude of vulnerability be explained for each step. In addition to fully characterizing the population at risk, special attention should be directed to vulnerable individuals and populations that may be particularly susceptible and/or more highly exposed.

These changes were not reflected in the FDA assessment.[107] For the risk assessment used to set tolerances for PAHs in seafood, the vulnerabilities of subsets of the population that are likely to be particularly affected by PAH exposure should include consideration of early life vulnerability to PAH exposure and important differences in seafood consumption.

(1) Early Life Vulnerability

PAH exposure is particularly detrimental to the developing fetus and young children,[108] and this increased susceptibility should be incorporated in a risk assessment of PAHs.

FDA's past practice did not include consideration of these vulnerable subpopulations. For example, in calculating the levels of concerns during the BP Oil Spill, FDA's risk assessment solely considered risks to an adult. FDA assumed that the consumer weighs 80 kilograms (176 pounds), rather than evaluating the risk for the average body weight of a 4 to 6 year old child, which is 21.6 kilograms.[109]

In contrast, the NAS, the EPA, and the broader scientific community, have recognized that children are not just small adults and that calculation of life-stage specific doses are the most health protective method to ensure public health protection.[110] [111] [112] EPA's 2005 cancer risk

---

[106] *Ibid*.

[107] Rotkin-Ellman M, Wong KW, Solomon GM. 2011. Seafood Contamination after the BP Gulf Oil Spill and Risks to Vulnerable Populations: A Critique of the FDA Risk Assessment. Environ Health Perspect http://dx.doi.org/10.1289/ehp.1103695

[108] Most PAHs are lipid soluble and therefore cross the placenta (Calabrese E. 1978; Shendrikova and Aleksandrov 1974). Animal studies have found that ingestion of PAHs during pregnancy results in much greater genetic damage in the fetus compared to the mother (Harper et al. 1989).

[109] McDowell MA, Fryer CD, Ogden CL, Flegal KM. 2008. Anthropometric Reference Data for Children and Adults: United States, 2003-2006. National Health Statistics Reports; no 10, Hyattsville, MD: National Center for Health Statistics.

[110] National Academy of Sciences – Committee on Improving Risk Analysis Approaches Used by the US EPA, National Research Council. 2009. *Science and Decisions: Advancing Risk Assessment.* The National Academies Press. Washington DC

[111] U.S. Environmental Protection Agency. 2005. Supplemental guidance for assessing susceptibility from early-life exposure to carcinogens. EPA/630/R-03/003F.

assessment guidelines include age-dependent adjustment factors (ADAFs) to account for differences in carcinogen potency by age groups based on data from animal studies comparing cancer potency in early life stages compared to adult animals.[113] The EPA methods also use different rates of exposure according to age, accounting for the relative difference in intake of pollutants between children and adults. In fact, although EPA did not recommend the prenatal exposure be incorporated, it acknowledged that prenatal susceptibility is a risk.[114] California's Office of Environmental Health Hazard Assessment (OEHHA) accounts for childhood exposures in its risk assessment methods and provides an adjustment factor for prenatal exposures.[115]

Accordingly, in setting tolerances for PAHs in seafood, the FDA should incorporate the widely recognized increased vulnerability of the developing fetus and child to environmental contaminants.

(2) Differences in Rates of Seafood Consumption

Different rates of seafood consumption lead to different levels of PAH exposure from the contaminated seafood. To protect the consumers who eat the most amount of seafood, a risk assessment should incorporate those consumers' rates of consumption. In particular, because the residents of a coastal area affected by an oil spill typically consume more seafood compared to the national population, their consumption rates should be incorporated into the risk assessment.

In its response to the BP Oil Spill, the FDA did not localize its data about seafood consumption to the relevant population in the Gulf. Instead, it relied on a 2005-2006 report of nationwide seafood consumption[116] and assumed that the consumer eats, at most (90th percentile), a daily average of 49 grams of fish, 12 grams of oysters, or 13 grams of shrimp. To the contrary, residents of the Gulf region have a significantly higher rate of seafood consumption compared to the rest of the nation. For example, surveys of New Orleans residents and recreational anglers in Louisiana found consumers at the high end of the distribution reporting

---

[112] American Academy of Pediatrics (AAP).2011. Policy Statement—Chemical-Management Policy: Prioritizing Children's Health. Pediatrics. 127:983-990

[113] *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens* (EPA, March 2005).

[114] U.S. Environmental Protection Agency. 2005. Supplemental guidance for assessing susceptibility from early-life exposure to carcinogens. EPA/630/R-03/003F.

[115] California Office of Environmental Health Hazard Assessment. 2009. In utero and early life susceptibility to carcinogens: The derivation of age-at-exposure sensitivity measures. California: California Environmental Protection Agency.

[116] U.S. Food and Drug Administration. 2010. Protocol for Interpretation and use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting due to the Deepwater Horizon Oil Spill.

shrimp intakes of 65.1 grams per day and 55.5 grams per day respectively[117] [118] – at least 42 daily grams higher than FDA's estimate of 13 grams.[119] Also, the EPA recommends using fish consumption rates in risk assessments ranging from 142.4 grams per day (for the non-native-American subsistence population) to 170 grams per day (for Native Americans subsistence population) to protect subsistence adult consumers, which is 2.9 to 3.5 times higher than the FDA estimate of 49 grams per day.[120]

The World Health Organization (WHO) and the EPA, recognize the extremely skewed nature of food consumption curves, and the resulting increased health risk to high-end consumers. They recommend using local studies and/or the 95th to 97th percentile of consumption surveys, as opposed to the 90th percentile used by FDA.[121] [122] From a statistical perspective, the 90th percentile values used by FDA cannot be characterized as biased towards safety. In fact, the EPA directly criticized the FDA's use of the 90th percentile and highlighted that the proposed standards would be insufficient to protect vulnerable Gulf Coast populations.[123]

Accordingly, the risk assessment for PAHs in seafood should specifically incorporate the high consumption of seafood in coastal regions that will be affected by oil spills.

b) Reliance on Authoritative Bodies

FDA should improve its risk assessments by relying on the research of authoritative research programs. These programs provide for comprehensive and up-to-date literature reviews and draw upon the expertise of key researchers and agency representatives. As discussed earlier,

---

[117] Anderson AC, Rice JC. 1993. Survey of fish and shellfish consumption by residents of the greater New Orleans area. Bull Environ Contam Toxicol 51(4):508-514.

[118] Lincoln RA, Shine JP, Chesney EJ, Vorhees DJ, Grandjean P, Senn DB. 2011. Fish consumption and mercury exposure among Louisiana recreational anglers. Environ Health Perspect. 119:245-251.

[119] U.S. Food and Drug Administration. 2010. Protocol for Interpretation and use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting due to the Deepwater Horizon Oil Spill.

[120] U.S. Environmental Protection Agency. 2002. *See also, Seafood Choices: Balancing Benefits and Risks*, (95th percentile fish consumption rate reported in the NAS report is equal to 155 grams/day – 3.2 times higher than the FDA assumption (NAS 2007).

[121] U.S. Environmental Protection Agency. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 2: Risk Assessment and Fish Consumption Limits -Third Edition. EPA 823-B-00-008.

[122] World Health Organization. 2008. Highest Reported 97.5th Percentile Consumption Figures (Eaters Only) for Various Commodities by the General Population and Children Ages 6 and Under. GEMS/Food for the Codex Committee on Pesticide Residues and the Joint FAO/WHO Meetings on Pesticide Residues.

[123] NRDC 2011. FDA documents provided to NRDC part A. http://docs.nrdc.org/energy/files/ene_11101101a.pdf

the EPA and California OEHHA both account for early life vulnerability in their risk assessments. The National Toxicology Program ("NTP") provides information on health risks from chemicals that are essential for agency risk assessments. The WHO and EPA both recommend how to characterize the difference in rates of seafood consumption among the population to achieve more health-protective results.

In the past, FDA has ignored the findings of authoritative research programs when setting LOCs that are not health protective. For example, during the BP Oil Spill, naphthalene was one of the most frequently detected PAHs in the Gulf seafood tested following the spill and was the most prevalent PAH in the oil.[124] As noted earlier, naphthalene is listed in the NTP's 12th Report on Carcinogens (which FDA has endorsed) as reasonably anticipated to be a human carcinogen and by the State of California as known to cause cancer.[125] [126] Despite the fact that exposure to naphthalene poses a health risk due to both carcinogenic and non-carcinogenic health effects, the FDA established the level of concern for naphthalene in Gulf seafood solely based on non-cancer impacts.[127] FDA ignored the science both on naphthalene's health risks and on whether exposures in Gulf seafood could pose an increased risk of cancer. Further, PAHs are a mixture of multiple compounds, small exposures of which can result in significant cancer risks. By leaving naphthalene out of its cancer risk assessment, the FDA ignored the potential cumulative effect of low level exposures to multiple carcinogens.

c) Use Health-Protective "Acceptable Risk Levels"

FDA should set a more health protective standard to protect against carcinogens in seafood. In risk assessments performed following oil spills, FDA's development of acceptable levels of cancer risk has been inconsistent. In the response to the BP Oil Spill, FDA set levels of concern based on an acceptable risk of 1 in 100,000 people. FDA risk assessments conducted for prior oil spills, such as the Exxon Valdez, utilized more conservative and health protective values for this parameter of 1 in 1,000,000 people.[128] In light of uncertainties in our understanding of the relationship between PAH exposure and cancer risk, FDA should set standards that err on the

[124] [124] U.S. Food and Drug Administration. 2010. Protocol for Interpretation and use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting due to the Deepwater Horizon Oil Spill and FDA unpublished data.

[125] National Toxicology Program. 2005. 12th Report on Carcinogens.

[126] Office of Environmental Health Hazard Assessment. 2005. No significant risk level (NSRL) for the Proposition 65 carcinogen naphthalene. Naphthalene NSRL. California: California Environmental Protection Agency.

[127] U.S. Food and Drug Administration. 2010. Protocol for Interpretation and use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting due to the Deepwater Horizon Oil Spill.

[128] Bolger and Carrington Bolger et al 1999 in Evaluating and Communicating Subsistence Seafood Safety in a Cross Cultural Context: Lessons Learned from the Exxon Valdez Oil Spill 1999

side of protecting public health by ensuring that exposures would not be expected to result in more than 1 in a million excess cancer risk.

C. Summary of Information that May Be Unfavorable

FDA's regulations require inclusion in this petition of representative information known to NRDC that may not support the actions requested herein. 21 C.F.R. § 10.30(b). To the extent that there is any information unfavorable to this petition, it is raised in FDA's protocol for re-opening the Gulf waters which enumerated the methods and assumptions that FDA used. As such, the 2010 *Protocol for Interpretation and Use of Sensory Testing and Analytical Chemistry Results for Re-Opening Oil-Impacted Areas Closed to Seafood Harvesting Due to The Deepwater Horizon Oil Spill*, published June, 2010 and updated November 2010 provides the most relevant information related to the methodology used by the FDA.[129] This protocol identifies the criteria upon which the federal agencies relied in determining whether to re-open waters in the Gulf to commercial seafood harvesting, based on, among other things, the levels of PAH contamination in seafood samples taken in affected areas.

NRDC addresses that methodology and the arguments against the steps taken in response to the BP Oil Spill above in the petition.

III. ENVIRONMENTAL IMPACT

Under 21 C.F.R. § 25.40, the preparation of an Environmental Assessment is not required of actions categorically excluded under 21 C.F.R. §§ 25.30, 25.31, 25.32, 25.33, or 25.34. In this instance, NRDC requests that the Commissioner of the FDA issue tolerances for PAHs in seafood. This action falls under 21 C.F.R. § 25.31(h), which excludes "[i]ssuance, revocation, or amendment of a standard for a biologic product."

IV. CONCLUSION

For the reasons presented above, as supported by the attached studies and reports, NRDC requests that the FDA publish regulations that establish health protective tolerances for 18 PAHs (enumerated above) in seafood based on the latest, best practice in risk assessment methodologies.

---

[129] Accessed from the FDA website, available at <http://www.fda.gov/Food/ucm217601.htm>, last visited September 19, 2011.

V. CERTIFICATION

This petition includes all information and views on which the petition relies, and it includes representative data and information known to NRDC which may be unfavorable to the petition. NRDC attaches and incorporates by reference copies of all studies cited in this petition. As required by 21 C.F.R. § 10.20(a), NRDC is submitting the original and four copies of this petition to the FDA Division of Dockets Management. NRDC reserves the right to supplement this petition pursuant to 21 C.F.R. § 10.30(g).

Respectfully submitted,

__/s Miriam Rotkin-Ellman____________

Miriam Rotkin-Ellman, MPH
Scientist, Health Program
Natural Resources Defense Council
111 Sutter St., 20th floor
San Francisco, CA 94104
(415) 875-6100

___/s Mae C Wu_____________________

Mae Wu
Attorney, Health Program
Natural Resources Defense Council
1152 15th Street, NW
Washington, DC 20005
(202) 289-6868