BILLING CODE 6560-50-P

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 799

[EPA-HQ-OPPT-2010-0812; FRL-8880-3]

RIN 2070-AJ83

Testing of Bisphenol A

AGENCY: Environmental Protection Agency (EPA).

ACTION: Advance notice of proposed rulemaking (ANPRM).

SUMMARY: Bisphenol A (BPA) (Chemical Abstracts Service Registry Number (CASRN) 80-05-7), a high production volume (HPV) chemical, is a reproductive, developmental, and systemic toxicant in animal studies and is weakly estrogenic. EPA is providing this ANPRM to request comment on requiring toxicity testing to determine the potential for BPA to cause adverse effects, including endocrine-related effects, in environmental organisms at low concentrations. EPA is also seeking comment on requiring environmental testing consisting of sampling and monitoring for BPA in surface water, ground water, drinking water, soil, sediment, sludge, and landfill leachate in the vicinity of expected BPA releases to determine whether environmental organisms may currently be exposed to concentrations of BPA in the environment that are at or above levels of concern for adverse effects, including endocrine-related effects. This ANPRM is directed only toward the environmental presence and environmental effects of BPA. EPA is working with the Department of Health and Human Services (HHS) on potential human health issues, but is not considering any additional testing specifically in regard to human health issues at this time.

11T-0891

DATES: Comments must be received on or before [*insert date 60 days after date of publication in the* **Federal Register**].

ADDRESSES: Submit your comments, identified by docket identification (ID) number EPA-HQ-OPPT-2010-0812, by one of the following methods:

• *Federal eRulemaking Portal*: *http://www.regulations.gov*. Follow the on-line instructions for submitting comments.

• *Mail*: Document Control Office (7407M), Office of Pollution Prevention and Toxics (OPPT), Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460-0001.

• *Hand Delivery*: OPPT Document Control Office (DCO), EPA East Bldg., Rm. 6428, 1201 Constitution Ave., NW., Washington, DC. Attention: Docket ID Number EPA-HQ-OPPT-2010-0812. The DCO is open from 8 a.m. to 4 p.m., Monday through Friday, excluding legal holidays. The telephone number for the DCO is (202) 564-8930. Such deliveries are only accepted during the DCO's normal hours of operation, and special arrangements should be made for deliveries of boxed information.

Instructions: Direct your comments to docket ID number EPA-HQ-OPPT-2010-0812. EPA's policy is that all comments received will be included in the docket without change and may be made available on-line at *http://www.regulations.gov*, including any personal information provided, unless the comment includes information claimed to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through regulations.gov or e-mail. The regulations.gov website is an "anonymous access" system, which means EPA will not know your identity or contact

information unless you provide it in the body of your comment. If you send an e-mail comment directly to EPA without going through regulations.gov, your e-mail address will be automatically captured and included as part of the comment that is placed in the docket and made available on the Internet. If you submit an electronic comment, EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD-ROM you submit. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses.

Docket: All documents in the docket are listed in the docket index available at *http://www.regulations.gov*. Although listed in the index, some information is not publicly available, e.g., CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. Publicly available docket materials are available electronically at *http://www.regulations.gov*, or, if only available in hard copy, at the OPPT Docket. The OPPT Docket is located in the EPA Docket Center (EPA/DC) at Rm. 3334, EPA West Bldg., 1301 Constitution Ave., NW., Washington, DC. The EPA/DC Public Reading Room hours of operation are 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number of the EPA/DC Public Reading Room is (202) 566-1744, and the telephone number for the OPPT Docket is (202) 566-0280. Docket visitors are required to show photographic identification, pass through a metal detector, and sign the EPA visitor log. All visitor bags are processed through an X-ray machine and subject

to search. Visitors will be provided an EPA/DC badge that must be visible at all times in the building and returned upon departure.

FOR FURTHER INFORMATION CONTACT: *For technical information contact*: Mary Dominiak, Chemical Control Division (7405M), Office of Pollution Prevention and Toxics, Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460-0001; telephone number: (202) 564-8104; e-mail address: *dominiak.mary@epa.gov*.

For general information contact: The TSCA-Hotline, ABVI-Goodwill, 422 South Clinton Ave., Rochester, NY 14620; telephone number: (202) 554-1404; e-mail address: *TSCA-Hotline@epa.gov*.

SUPPLEMENTARY INFORMATION:

I. General Information

A. Does this Action Apply to Me?

You may be potentially affected by this action if you manufacture (defined by statute to include import) or process BPA (CASRN 80-05-7). BPA is listed on the Toxic Substances Control Act (TSCA) Chemical Substance Inventory (TSCA Inventory) under the name phenol, 4,4'-(1-methylethylidene)bis-. Potentially affected entities may include, but are not limited to:

• Chemical manufacturers (including importers) (NAICS codes 325, 32411), e.g., chemical manufacturing and petroleum refineries of BPA.

• Plastics material and resin manufacturers (NAICS code 325211), e.g., manufacturers and processors of BPA-based polycarbonate plastics and epoxy resins.

• Foundries (NAICS codes 331512, 331524, 331528), e.g., steel investment foundries, aluminum foundries, and other non-ferrous foundries, except die-casting, using BPA in casting sands.

• Paint and coating manufacturers (NAICS code 325510), e.g., manufacturers of epoxy-based paints and other coating products that may contain BPA.

• Paper recyclers (NAICS codes 322110, 322121, 3222), e.g., pulp mills, paper (except newsprint) mills, and converted paper product manufacturers that may process waste thermal paper containing BPA.

• Materials recovery facilities (NAICS code 562920), e.g., facilities separating and sorting recyclable materials that may handle thermal paper, polycarbonates, or food and beverage cans lined with BPA-based epoxy coatings.

• Custom compounders of purchased resins (NAICS code 325991), e.g., facilities where resins are made from recycled polycarbonate plastics that may contain BPA.

This listing is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be affected by this action. Other types of entities not listed in this unit could also be affected. The North American Industrial Classification System (NAICS) codes have been provided to assist you and others in determining whether this action might apply to certain entities. If you have any questions regarding the applicability of this action to a particular entity, consult the technical person listed under **FOR FURTHER INFORMATION CONTACT**.

B. What Should I Consider as I Prepare My Comments for EPA?

1. *Submitting CBI*. Do not submit this information to EPA through regulations.gov or e-mail. Clearly mark the part or all of the information that you claim

to be CBI. For CBI information in a disk or CD-ROM that you mail to EPA, mark the outside of the disk or CD-ROM as CBI and then identify electronically within the disk or CD-ROM the specific information that is claimed as CBI. In addition to one complete version of the comment that includes information claimed as CBI, a copy of the comment that does not contain the information claimed as CBI must be submitted for inclusion in the public docket. Information so marked will not be disclosed except in accordance with procedures set forth in 40 CFR part 2.

2. *Tips for preparing your comments*. When submitting comments, remember to:

i. Identify the document by docket ID number and other identifying information (subject heading, **Federal Register** date and page number).

ii. Follow directions. The Agency may ask you to respond to specific questions or organize comments by referencing a Code of Federal Regulations (CFR) part or section number.

iii. Explain why you agree or disagree; suggest alternatives and substitute language for your requested changes.

iv. Describe any assumptions and provide any technical information and/or data that you used.

v. If you estimate potential costs or burdens, explain how you arrived at your estimate in sufficient detail to allow for it to be reproduced.

vi. Provide specific examples to illustrate your concerns and suggest alternatives.

vii. Explain your views as clearly as possible, avoiding the use of profanity or personal threats.

viii. Make sure to submit your comments by the comment period deadline identified.

II. Background

A. What Action is the Agency Taking?

As a follow-up to the BPA Action Plan released on March 29, 2010 (Ref. 1), EPA is issuing this ANPRM under TSCA section 4(a) (15 U.S.C. 2603(a)) to solicit public input on the necessity for and best approach to obtain environmental effects, exposure, and pathway information relevant to a determination that BPA either does or does not present an unreasonable risk of injury to the environment. In particular, EPA requests comment on:

1. Whether EPA should propose requiring specific toxicity testing to more fully characterize the effects of BPA on environmental organisms at low concentrations.

2. Whether EPA should propose requiring environmental testing consisting of sampling and monitoring, particularly in the vicinity of reported releases of BPA into the environment, and what design and protocol it should use for such sampling and monitoring, in order to identify potential sources and pathways of exposure and determine the extent to which environmental organisms may be exposed to BPA concentrations of concern as determined by existing data and by additional studies that are either already underway or would be conducted under a test rule.

3. EPA additionally requests comment and supporting information regarding which TSCA section 4(a)(1) finding authority would be most appropriate for the purpose of a BPA test rule proposal, as discussed in Unit II.C. Any proposal would ultimately be based on EPA's assessment of the relevant information available at the time of proposal.

B. What Testing is EPA Considering in this ANPRM?

In this ANPRM, EPA is considering requiring both toxicity testing for environmental organisms exposed to BPA and environmental testing consisting of sampling and monitoring in the vicinity of reported BPA releases to measure its environmental presence. The toxicity testing is being considered to resolve existing uncertainties concerning the potential for BPA to elicit adverse effects in ecologically relevant species, including endocrine-related impacts that could occur at low doses. The environmental testing is being considered to resolve existing uncertainties concerning potential sources of and pathways leading to environmental exposures and to determine whether or not the concentrations to which organisms currently may be exposed in the environment are at or above levels of concern for adverse effects, including endocrine-related effects.

On May 17, 1985, EPA published in the **Federal Register** a proposed rule (50 FR 20691) to require human health and environmental testing in response to the TSCA Interagency Testing Committee's (ITC) 14th report published in the **Federal Register** issue of May 29, 1984 (49 FR 22389), which designated BPA for priority consideration for health and environmental effects. EPA proposed standard freshwater and marine acute fish and aquatic invertebrate toxicity tests, and freshwater aquatic plant toxicity tests. Test results were submitted in response to the proposal for freshwater and marine acute fish, acute aquatic invertebrate, and algal toxicity. EPA's final rule published in the **Federal Register** issue of September 18, 1986 (51 FR 33047) (1986 Final Rule), terminated the test rule process for environmental effects testing for BPA. At the time, EPA determined that the test data were adequate and that chronic freshwater organism

testing was not needed because the LC_{50} values for the standard acute aquatic organism toxicity tests were greater than 1.0 parts per million (ppm) (1 milligram/Liter (mg/L)), and the ratios of 48-hour to 96-hour LC_{50} values were not greater than 2. Since the 1986 Final Rule, however, several studies on BPA have raised concerns about its environmental effects at concentrations less than 1.0 ppm (1 mg/L).

As stated in the BPA Action Plan (Ref. 1), EPA does not intend to initiate regulatory action under TSCA at this time on the basis of human health. EPA remains committed to protecting human health, but notes that most human exposure, including exposure to children, comes through food packaging materials under the jurisdiction of the Food and Drug Administration (FDA) in HHS. FDA, together with the Centers for Disease Control and Prevention (CDC) and the National Institute of Environmental Health Sciences (NIEHS), is investing in important new health studies in both animals and humans to better determine and evaluate the potential health consequences of BPA exposures. EPA will continue to coordinate closely with FDA, CDC, and NIEHS on this activity. To the extent that FDA may identify health concerns from BPA in food contact materials, EPA will work with FDA to identify and assess potential substitutes. Levels of exposure that may be identified by the ongoing review as being of concern to human health, including children's health, will affect the extent to which EPA would take additional action to address potential risks to human health resulting from uses within TSCA jurisdiction.

1. *What is currently known about the environmental hazard of BPA*? The toxicity of BPA has been studied extensively, as indicated in the multiple studies cited in the BPA

Action Plan (Ref. 1).[1] There is general agreement among multiple reviewers, including government regulatory agencies in the United States, Japan, the European Union (EU), and Canada, that BPA is a reproductive and developmental toxicant at doses in animal studies of $\geq$ 50 mg/kilogram-body weight (kg-bw)/day (delayed puberty in male and female rats and male mice; discussed in Refs. 2-9); $\geq$ 235 mg/kg-bw/day (reduced fetal or birth weight or growth early in life, effects on testis of male rats; Ref. 9); and $\geq$ 500 mg/kg-bw/day (possible decreased fertility in mice, altered estrous cycling in female rats, and reduced survival of fetuses; Ref. 9). Systemic effects (reduction in body weight, changes in relative organ weights, and increases in liver toxicity; Refs. 2-8) were observed at doses above 5 mg/kg-bw/day (identified as a no observed adverse effect level (NOAEL); lowest observed adverse effect level (LOAEL) of 50 mg/kg-bw/day). There are reports of endocrine-related low-dose effects on puberty and neurological development (brain, behavior; Ref. 9) at doses in animal studies as low as 2 microgram (µg)/kg-bw/day. There is disagreement in the scientific community at large about whether effects seen at doses in animals less than 1 mg/kg/day are meaningful and relevant to humans. FDA, together with NIEHS and CDC, are engaging in additional research to better determine and evaluate the potential human health consequences of exposures to BPA, including exposures at low doses (Ref. 10). EPA is working with FDA, NIEHS, and CDC on this ongoing research, and is not considering any additional testing specifically in regard to human health issues at this time.

[1] EPA's response to the request for correction of the information provided in the Action Plan that was filed under the "Agency's Information Quality Guidelines" by the American Chemistry Council is available at *http://www.epa.gov/quality/informationguidelines/iqg-list.html.*

Many studies have been conducted to determine potential effects of BPA exposure on invertebrates, fish, amphibians, reptiles, birds, and wild mammals, and a review is provided by Crain et al. (Ref. 11). In general, studies have shown that BPA can affect growth, reproduction, and development in aquatic organisms. Evidence of sub-lethal effects mediated through either endocrine or non-endocrine related mechanisms in fish, amphibians, reptiles, and invertebrate aquatic organisms has been reported at potentially environmentally relevant exposure levels lower than those required for acute toxicity. There is a widespread variation in reported values for these sub-lethal effects, but many fall in the range of 1 µg/L to 1 mg/L (Ref. 6; also, see individual studies noted in Table 2 of Unit II.B.2.).

The ecological hazard for BPA has been evaluated in three different risk assessments performed by the EU, Canada, and Japan (Refs. 7, 6, and 8), as summarized in Table 1 of this unit. The different methodologies, endpoints, and study results used by each country to derive their ecological values highlight the significant uncertainty in the estimated hazard values. Japan concluded that "the current exposure levels of BPA will not pose unacceptable risks to the local populations of aquatic life, particularly fish" (Ref. 8). In contrast, the EU concluded that although the predicted exposure concentrations were significantly below its hazard values, there was a need for further information and/or testing on such organisms as freshwater snails (Ref. 7).

Canada used a study (Ref. 12) that reported reduced sperm quality and delayed ovulation in brown trout at a very low concentration in water (1.75 µg/L). Other effects such as the induction of intersex (or testes-ova in males and females), decreased spermatogenesis, induction of vitellogenin, delayed or ceased ovulation, or histological

liver changes were also reported in other studies referenced in the EU and Japanese hazard evaluations. However, because there were no standardized test guidelines or risk assessment guidance for evaluating some of these endocrine-related effects at the time of these assessments, the EU and Japan set ecotoxicological hazard values based on conventional effects (mortality and reproductive effects) from standardized studies. In contrast, Canada concluded in its hazard characterization that:

> [c]onsidered together, the data provide strong evidence that bisphenol A is capable of eliciting adverse effects: (1) following prolonged exposure at levels below those usually seen to elicit effects in standard toxicity tests (i.e., tests based on recognized methods which evaluate endpoints such as survival, reproduction and growth); (2) following brief low-dose exposure, particularly at sensitive developmental stages, with effects apparent later in the life cycle; (3) on filial generations following parental exposure; and (4) using more than one mode of action.
> (Ref. 6)

Canada concluded that BPA concentrations in water have the potential to cause adverse effects on populations of pelagic organisms in Canada and concentrations in biota have the potential to cause adverse effects in populations of wildlife in Canada, but that there is a low risk of direct adverse effects to sediment organisms and to avian wildlife species in Canada. In the conclusion of its risk assessment, Canada stated that it is considered appropriate to apply a precautionary approach when characterizing risk, observing "it is concluded that bisphenol A is entering the environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity" (Ref. 6).

Table 1.--Summary of Bisphenol A Ecological Values

Country	Predicted No Effect Concentrations (microgram/Liter (µg/L))[1]	Endpoints
European Union	1.5	The predicted no effect concentration (PNEC) for aquatic organisms (derived by using a statistical analysis of data from available data on freshwater and marine aquatic organisms (in this case, 16 different studies, unpublished and published, from 10 different taxonomic groups)) to arrive at a value of 7.5 µg/L, which is divided by an uncertainty factor of 5, resulting in a PNEC of 1.5 µg/L (Ref. 7).
Canada	0.175	This PNEC was derived by using a lowest observed effect concentration (LOEC) of 1.75 µg/L for reduced semen quality and delayed ovulation in a brown trout study (Lahnsteiner et al, 2005) and applying an uncertainty factor of 10 (Ref. 6).
Japan	1.6	The PNEC was derived by using the 16 µg/L no effect concentration (NOEC) for egg hatchability in fathead minnows from the unpublished 3-generation study by Sumpter, et al. (2001) multi-generation fish study and dividing by an uncertainty factor of 10 (Ref. 8).

[1] In the European Union, Canada, and Japan, a predicted no effect concentration (PNEC) is compared directly with an exposure value to evaluate risk. If the ratio of environmental concentration to PNEC is less than one, the risk is generally considered acceptable. As noted in the table, countries use different approaches for generating PNECs, and the precise values may differ even when based on the same studies.

EPA considers that the uncertainty demonstrated by these divergent opinions concerning interpretation of the results of existing environmental toxicity studies, particularly studies addressing potential effects at low levels of exposure, may indicate further testing is necessary to resolve the question of whether or not BPA presents an unreasonable risk of injury to the environment on the basis of those effects. This is due to the combination of the existence of measured values, as discussed in Unit II.B.4. and as shown in that unit's Table 3, for BPA in U.S. surface waters at a mean-concentration range of up to 1.78 µg/L (parts per billion (ppb)) and a single-maximum concentration of 12 µg/L (ppb); in ground water at a mean-concentration range of up to 1.9 µg/L (ppb)

and a maximum concentration of 2.55 µg/L (ppb); and in freshwater sediments at a median concentration of 0.6 µg/kg (ppb) dry weight and a maximum concentration of 140 µg/kg (ppb) (see Table 3 in Unit II.B.4.), and the existence of many hazard studies describing a variety of effects in aquatic organisms at some of these concentrations (see Table 2 in Unit II.B.2.), leaving little or no room for a reasonable or acceptable margin of exposure.

In order to assess the potential for BPA to harm the environment in the United States, EPA considers it important to address two basic areas of inquiry relevant to identifying the hazard and exposure components of a risk analysis:

a. What additional hazard information is needed to fully characterize the effects of BPA in environmental organisms at low doses and potentially environmentally relevant concentrations?

b. What levels of BPA are present in the environment, particularly in areas where environmental exposures are likely to be highest (e.g., near BPA manufacturing facilities, polycarbonate and epoxy resin manufacturing and processing facilities, foundries, landfills, wastewater treatment plants (WWTPs), and other locations associated with uses and/or releases of BPA)?

2. *What additional hazard information is needed on the effects of BPA on environmental organisms*? EPA performed a literature search to identify relevant scientific information to assess the acute and chronic toxicity of BPA to environmental organisms from 2007 [2] to the present. A total of 468 articles were found (Ref. 13), of which 30 were found to be of some relevance (Ref. 14). Since thorough analyses of acute

[2] The starting date of 2007 was used to allow for some overlap between the thorough searches done by Canada, the EU, and Japan.

and chronic toxicity for "conventional endpoints" (which generally address immediate effects on survival or reproduction) had already been conducted for BPA by Canada, the EU, and Japan (Refs. 6-8), EPA performed a more detailed evaluation of the scientific literature for sub-lethal effects at lower concentrations (< 100 µg/L). These sub-lethal effects in both vertebrates and invertebrates could be mediated either through endocrine or non-endocrine-related mechanisms. There are many studies indicating such sub-lethal effects from BPA exposures at levels that, based on the information discussed in Unit II.B.4., appear to be potentially environmentally relevant concentrations because they may occur in the environment. Some of these studies are included in Table 2 of this unit.

Table 2.--Summary of Reported Hazard Effects of Bisphenol A at Potentially Environmentally Relevant Concentrations

Test Organism	Endpoint	Effect Concentrations (microgram/Liter (µg/L))	References (Listed in Ref. 14)
Amphibians			
Xenopus laevis (African clawed frog)	Inhibited metamorphosis via T3 pathways	22.8	Heimeier et al., 2009
Xenopus laevis	High ratio of females to males-1st study	23	Levy et al., 2004
Xenopus laevis	High ratio of females to males-2nd study	only at 23	Levy et al., 2004
Avian			
Gallus domesticus (chicken)	Delayed development of wattle, comb, and testes	2	Furuya et al., 2006
Gallus domesticus	Inhibited development of seminiferous tubuli and spermatogenesis	20	Furuya et al., 2006
Fish			
Dicentrarchus labrax (seabass)	Increased vitellogenin production	10	Correia et al., 2007
Misgurnus anguillicaudatus (Chinese loach)	Increased vitellogenin production	10	Lv et al., 2007
Orizias latipes	Egg hatchability delayed	13 only	Yokota et al.,

(medaka)			2000
Orizias latipes	Loss of testicular structure, increased fibrotic tissue; decreased sperm cells	50	Metcalfe et al., 2001
Orizias latipes	Vitellogenin production	10	Kashiwada et al., 2002
Orizias latipes	Increased female proteins (i.e., vitellogenin)	10	Tabata et al., 2001
Orizias latipes	Decreased egg hatching in 2nd generation	2 only	Japanese Ministry of the Environment, 2006
Orizias latipes	Increased male hepatosomatic index	49.7	Japanese Ministry of the Environment, 2006
Pimephales promelas (fathead minnow)	Increased vitellogenin production	52.8	Rhodes et al., 2007 (unpublished)
Xiphophorus helleri (swordtail fish)	Reduced sword tail length	20	Kwak et al., 2001
Cyprinus carpio (carp)	Oviduct formation in males	32	Bowmer & Gimeno, 2001 (unpublished)
Cyprinus carpio	Altered sex steroid levels; alterations in testes structure; oocyte atresia	1	Mandich et al., 2007
Invertebrates			
Bellamya purificata (snail)	Enzyme activities in gills and digestive glands	1	Li et al., 2008
Marisa cornuarietis (ramshorn snail)	Superfeminization	1	Oehlmann et al., 2000
Marisa cornuarietis	Increased egg and clutch production per female	0.25 at 20 °C	Oehlmann et al., 2006
Marisa cornuarietis	Increased egg production	0.25 at 27 °C	Oehlmann et al., 2006
Marisa cornuarietis	Increased clutch production	5 at 27 °C	Oehlmann et al., 2006
Potamopyrgus antipodarum	Increased growth/embryo	5 only	Jobling et al., 2004

(snail)	production		
Potamopyrgus antipodarum	Unshelled embryos	30	Duft et al., 2003
Potamopyrgus antipodarum	Increased embryo production	1	Duft et al., 2003
Nucella lapillus (marine snail)	Superfeminization; reduced sperm/penis length/prostrate gland in males	1	Oehlmann et al., 2000
Acartia tonsa (copepod)	Increased egg production	20 (day 10 only)	Andersen et al., 1999
Tigriopus japonicus (intertidal copepod)	Delayed development (Parent)	0.1	Marcial et al., 2003
Tigriopus japonicus	Delayed development (F1)	0.01	Marcial et al., 2003
Chironomus riparius	Delayed emergence (2^{nd} generation)	0.078	Watts et al., 2001
Chironomus riparius	Mouthpart deformities	0.01	Watts et al., 2003

There is debate in the scientific literature on how best to interpret these low-dose, sub-lethal effects of BPA and other chemicals on environmental organisms. EPA is concerned that these sub-lethal effects may be having a detrimental effect on populations of aquatic organisms over time based on the reported increased susceptibility of subsequent generations exposed to BPA in multi-generation invertebrate and fish studies. For example, in the intertidal copepod (*Tigriopus japonicus*), delayed development was reported in the first generation at 0.1 µg/L, but at a 10-fold lower concentration of 0.01 µg/L in the next generation (Ref. 15). In the freshwater midge (*Chironomus riparius*), the first generation did not have a significant delay in emergence time from the egg, but in the second generation emergence was delayed at 0.08 µg/L (Ref. 16). Egg hatchability decreased in fathead minnows (*Pimephales promelas*) at 640 µg/L in the first (F1) generation, then at 160 µg/L in the second (F2) generation (Ref. 17). Although the

mechanisms of action leading to effects may be different for vertebrate and invertebrate organisms, this suggests the potential for increasing developmental and reproductive effects in populations of aquatic organisms that have repeated exposures to BPA for generations, even at very low concentrations.

Testing with BPA has been extensive at sub-lethal concentrations, but the studies with effects across multiple species generally have flaws associated with them, including lack of analytical monitoring, small sample size, inadequate replication, or use of inappropriate statistical analyses leading to incorrect conclusions of study results. Studies in ramshorn snails, for example, resulted in superfeminization (e.g., the formation of additional female organs, enlarged accessory sex glands, gross malformations of the pallial oviduct, and a stimulation of egg and clutch production) at very low concentrations in one lab (Ref. 18), but those results were not found in studies by other researchers (Refs. 19-21).

In addition, in some studies, BPA demonstrated effects at very low concentrations, but no effects were observed at the higher test concentrations. For example, tadpoles exposed to 2.3, 23, and 230 µg/L of BPA (Ref. 22) before metamorphosis had an increased female to male ratio at 23 µg/L only. These types of anomalous responses have been reported across multiple species of fish and invertebrates for BPA and are characteristic of endocrine-active chemicals. They suggest inhibition of reproduction and development at low concentrations and overcompensation by the organism at higher concentrations in response to a toxicant (Ref. 23).

It is difficult to interpret this information in a regulatory context, because the scientific methods employed in individual academic settings to test a hypothesis are not

necessarily geared toward meeting or establishing generally applicable guidelines for evaluating ecotoxicity and setting corresponding regulatory limits or controls. In terms of environmental toxicity, EPA considers the currently available research as evidence that BPA has the potential to interact with the estrogen hormone system. There is some evidence that BPA is also active via the thyroid hormone pathway in amphibians and fish (Refs. 24 and 25). More recent evidence indicates that BPA also acts as an androgen receptor antagonist in both mammals and fish (Ref. 26). There are currently efforts underway by EPA's Office of Science Coordination and Policy (OSCP) through the Endocrine Disruptor Screening Program (EDSP) and the Organization for Economic Cooperation and Development (OECD) Endocrine Disrupter Testing and Assessment Work Group (EDTAWG), among others, to determine the best approach to evaluate and assess such effects (Refs. 27-29).

EPA is inviting comment on the need to further determine the hazard of BPA to various ecological species. The purpose of further testing would be to produce high quality data that could be used for risk assessment purposes for any adverse reproductive or developmental effects in different species that might result from the interactions identified through the available research.

3. *What are the issues for comment concerning toxicity testing*? EPA invites comment on whether and what testing should be required to further describe the hazard of BPA to various ecological species to resolve the low dose effects issue. EPA particularly invites comment on the following, for which little or no clarifying hazard information appears to be currently available or for which much of the available data have been derived from studies of questionable quality or uncertain interpretation:

a. Effects of BPA on fish in long-term tests, including those that encompass multiple generations.

b. Effects of BPA on amphibians at sensitive life stages, specifically metamorphosis (thyroid effects) and sexual development/differentiation (hypothalamic-pituitary-gonadal axis effects).

c. Effects of BPA on birds over multiple generations.

d. Effects of BPA on aquatic invertebrate species.

EPA further invites comment on the availability of current test guidelines that could help address these issues. This may include, for example, considering the draft recommendations concerning aquatic life criteria for contaminants of emerging concern (Ref. 30). Additionally, EPA is inviting the public to describe and define where they believe there are data gaps concerning the environmental toxicity of BPA, especially at low concentrations, or whether and on what basis they believe the current data are sufficient to determine whether BPA does or does not present an unreasonable risk of injury to the environment.

4. *What levels of BPA are present in the U.S. environment*? BPA is present in the environment as a result of direct releases from manufacturing or processing facilities (Ref. 31). BPA also may be present in the environment as a result of fugitive emissions during processing and handling, release of unreacted monomer from products (Ref. 9), or possibly from degradation of products under certain conditions. In addition, although no environmental studies on thermal paper have been done in the United States, based on information from EPA's review of European and Japanese studies, the use of unconjugated BPA in thermal paper also may contribute to environmental releases of

BPA from paper manufacturing and recycling plants and to the presence of BPA in the stream of recycled paper used in toilet paper, paper tableware, and other products, and may contribute to the presence of BPA in landfills because paper products are a major contributor to the U.S. solid waste stream (Refs. 7, 32-36).[3]

Significant research has been done to document widespread human population exposures to BPA in the United States using biomonitoring (Refs. 37-41). Although these studies and reports indicate that most people in the United States have measurable levels of BPA in their bodies, these data do not identify the relative source contributions to BPA exposure. Researchers generally accept that food contact uses of materials containing BPA, such as polycarbonate bottles or epoxy linings in food and beverage cans, are a likely major source of human exposure, but the relative contributions of food contact uses, potential TSCA uses, or other environmental sources cannot be extrapolated reliably from these existing data. For information about the multi-agency effort to evaluate the potential human health consequences of BPA exposures, see the discussion in Unit II.B.

According to the Toxics Release Inventory (TRI) Database, total release of BPA in the United States in 2007 was 1,132,062 pounds (lbs), with releases of 122,965 lbs to air, 6,246 lbs to water, 14,972 lbs released on-site to land, and 684,638 lbs transferred off-site to land. An additional 32,928 lbs were reported as off-site water transfer to Publicly Owned Treatment Works (POTWs), with another 2,759,705 lbs transferred to incineration (Ref. 31).

---

[3] Recent studies also indicate thermal paper may contribute directly to human exposure to BPA through dermal contact. In one U.S. study, for example, pregnant women who worked as cashiers, who presumably had frequent contact with thermal paper used in cash register receipts, had the highest urinary BPA concentrations compared with pregnant women in other occupations (Ref. 37).

Some information is available for BPA concentrations in U.S. water and other environmental media (see Table 3 in Unit II.B.4., providing values from the U.S. studies cited in this discussion). Most environmental monitoring results show that the concentrations of BPA in surface water bodies are lower than 1 µg/L (ppb), mainly due to its partitioning and biodegradability properties (Ref. 42). BPA was detected at a median concentration of 0.14 µg/L (ppb) and a maximum concentration of 12 µg/L (ppb) in 41.2% of 85 samples collected from U.S. streams in 1999 and 2000 (Ref. 43). The maximum concentration of 12 µg/L (ppb) was much higher than any of the other samples reported in the study; the next highest concentration reported was 5.2 µg/L (ppb), and as indicated by the median concentration of 0.14 µg/L (ppb), BPA concentration in other U.S. waters was much lower. A recent review of reports of BPA in surface water found that BPA was reported in 26 studies in North America (2 in Canada and 24 in the United States) with detection in 80% (852 of 1,068) of surface water samples. The median concentration reported was 0.081 µg/L (ppb) and the 95th percentile concentration was 0.47 µg/L (ppb) (Ref. 44).

Two studies have addressed individual WWTPs in two different parts of the United States. In 2001 and 2002, BPA was not detected above the detection limit of 0.0001 µg/L (ppb) in Louisiana in effluent from a WWTP, in samples collected from surface waters in Louisiana, or in drinking water at various stages of treatment at plants in Louisiana (Ref. 45). A 2008 study sampled BPA in treated wastewater from the East Bay Municipal Utilities WWTP in Oakland, California, and in a variety of locations that discharge to this WWTP (Ref. 46). This study reported detecting (limit of detection = 0.25 µg/L (ppb)) BPA in two of three treated wastewater samples at 0.38 and 0.31 µg/L

(ppb). It also reported detecting BPA in wastewater generated by a pharmaceutical manufacturer (0.295 µg/L (ppb)), an industrial laundry (21.5 µg/L (ppb)), and a paper products manufacturer (0.753 µg/L (ppb)).

While U.S. studies on wastewater are limited to only two State locations, a Canadian study published in 2000 reported BPA concentrations ranging from 49.9 to 0.031 µg/L (ppb) in sewage influent and effluent (generally < 1 µg/L (ppb) in the influent and < 0.3 µg/L (ppb) in the effluent) and from 36.7 to 0.104 µg/g (ppm) in raw and digested sewage sludge from multiple WWTPs in Canada (Ref. 47). The same authors reported that BPA contamination was detected in 100% of sewage samples from 31 WWTPs across Canada with concentrations ranging from 0.080 to 4.98 µg/L (ppb) (median 0.329 µg/L (ppb)) for the influent and from 0.010 to 1.08 µg/L (ppb)(median 0.136 µg/L (ppb)) for the effluent (Ref. 48). Based on comparison of influent and effluent levels, they estimated that BPA in the influent was removed by the sewage treatment process with a median reduction rate of 68%. BPA was detected in sludge samples at concentrations ranging from 0.033 to 36.7 µg/g (ppm), on a dry weight basis. The authors also reported a wide range of BPA in wastewater discharges from industrial facilities in the Toronto, Canada, area, with concentrations ranging from 0.23 to 149.2 µg/L (ppb). Higher BPA levels in wastewater were associated with facilities producing chemicals and chemical products and packaging and paper products, and with commercial dry cleaning establishments. BPA concentrations in pulp and paper mill sludge ranged from < 0.02 (below detection limit) to 3.33 µg/g (ppm), with a median value of 0.076 µg/g (ppm), on a dry weight basis (Ref. 48). EPA notes that U.S. wastewater treatment conditions and

industrial and commercial discharges may differ from what was found in Canada, but considers this Canadian study to be informative.

Municipal wastewater treatment produces solid byproducts, commonly referred to as sewage sludge. After additional treatment to meet regulatory standards for pathogen, nutrient, and metal content, this treated sewage sludge, now classified as biosolids, may be disposed of by land application; biosolids may also be incinerated or disposed of in landfills. A U.S. study published in 2006 measured BPA in 9 treated biosolids products from WWTPs in 7 States and found that all contained between 1,090 and 14,400 µg/kg (ppb) (median 4,690 µg/kg (ppb)) (Ref. 49). A 2008 study reported BPA in treated biosolids from a municipal U.S. WWTP at 4,600 µg/kg (ppb) and reported 81 µg/kg (ppb) in soil that received the land-applied biosolids (Ref. 50). That study detected BPA at 81 µg/kg (ppb) in earthworms living in treated soil. The authors also reported detecting 147 µg/kg (ppb) in a nearby "control" soil that did not receive treatment with biosolids. That anomalous result was not explained.

In 2000, the U.S. Geological Survey (USGS) collected samples from 47 ambient ground water sites (not drinking water wells) in 18 States and analyzed them for 65 organic wastewater contaminants. BPA was detected in 29.8% of the sampled ground water sites, with a mean detected concentration of 1.78 µg/L (ppb) and a range of 1.06 to 2.55 µg/L (ppb). BPA was among the top 5 most frequently detected organic compounds in this study (Refs. 51 and 52).

In the summer of 2001, the USGS collected samples from 74 sources of raw, untreated, drinking water in 25 States and Puerto Rico, in areas that were known or suspected to have at least some human and/or animal wastewater sources in upstream or

upgradient areas. These sources comprise 25 ground water and 49 surface water sources of drinking water serving populations ranging from one family to more than 8 million people. BPA was detected in 9.5% of these samples at a reporting level of 1 μg/L (ppb). The maximum concentration measured in these samples was 1.9 μg/L (ppb) (Refs. 51 and 53).

Landfill leachate from one U.S. study reported maximum BPA concentrations of 1.7 μg/L (ppb) in landfill leachate and 1.4 μg/L (ppb) in the receiving ground water plume at a landfill on Cape Cod, Massachusetts, that was known to be leaking (Ref. 54). Data for other landfill sites in the United States were not available, and this single point is not representative of the country. Landfill leachate from other countries contained more than 500 μg/L (ppb) of BPA (Ref. 42). Studies conducted at Japanese landfills resulted in maximum untreated leachate concentrations of 17,200 μg/L (ppb) and treated leachate concentrations of 5.1 μg/L (ppb) (Ref. 11).

Wilson et al. (Ref. 55) reported that BPA concentrations in soil samples taken from outdoor play areas of homes and daycare centers ranged from 4-14 ppb dry weight, with means of 6-7 ppb dry weight. Klecka et al. (Ref. 44) reported a median concentration of 0.6 ppb BPA in North American freshwater sediments, including non-detected samples; BPA concentrations in samples from the United States ranged from 1.4 to 140 ppb dry weight. Levels in U.S. marine sediments were reported to have a median of 3.5 ppb of BPA and to range from 1.5 to 5 ppb dry weight (Ref. 56).

Table 3.--U.S. Reported Environmental Concentrations of Bisphenol A

Location	Mean or Range of Means (parts per billion (ppb))	Range (ppb)	References
Surface Water	<0.0001 to 0.14*	<0.0001 to 12	Barnes et al., 2008a (Ref. 51)

			Boyd et al., 2003 (Ref. 45) Boyd et al., 2004 (Ref. 57) Focazio et al., 2008 (Ref. 53) Klecka et al., 2009 (Ref. 44) Kolpin et al., 2002 (Ref. 43) Staples et al., 2000 (Ref. 58) Zhang et al., 2007 (Ref. 59)
Ground Water	NR** to 1.78[†]	<0.003 to 2.55	Barnes et al., 2008a (Ref. 51) Barnes et al., 2008b (Ref. 52) Focazio et al., 2008 (Ref. 53) Rudel et al., 1998 (Ref. 54)
Drinking Water	<0.0001	<0.0001 to 0.42	Boyd et al., 2003 (Ref. 45) Stackelberg et al., 2004 (Ref. 60)
Wastewater	<0.0001	<0.0001 to 25	Boyd et al., 2003 (Ref. 45) Drewes et al., 2005 (Ref. 61) Jackson and Sutton, 2008 (Ref. 46) Rudel et al., 1998 (Ref. 54) Tsai, 2006 (Ref. 42)
Soils	6 to 7	4 to 147	Kinney et al., 2008 (Ref. 50) Wilson et al., 2003 (Ref. 55)
Sediment, Fresh	0.6*[††]	1.4 to 140[††]	Klecka et al., 2009 (Ref. 44)
Sediment, Marine	3.5*	1.5 to 5.0	Stuart et al., 2005 (Ref. 56)
Biosolids	4,600 to 4,690*	1,090-14,400	Kinney et al., 2006 (Ref. 49) Kinney et al., 2008 (Ref. 50)

* Value is median.
** Not reported (NR).
[†] Mean of values above reporting limit (1 ppb).
[††] Median value includes non-detected values below the minimum detection limit, while the reported range includes only detected values.

Although there is disagreement in interpreting some of the effects observed in studies performed to date with BPA, as described in Unit II.B.1. and 2., a comparison of the range of the effect levels observed in many studies and the predicted no effect concentration (PNEC) values used in three international regulatory risk assessments (0.175 to 1.6 µg/L, Table 1 of Unit II.B.1.) with measured concentrations in some U.S. waters and sediments, which included values as high as 12 µg/L (ppb) (surface water), 2.55 µg/L (ppb) (ground water), and 140 ppb sediment (freshwater sediment) (Table 2 of

Unit II.B.2.), indicate possible risk of injury to aquatic organisms. The single available measurement of BPA in leachate from one U.S. landfill site is not sufficient to represent or characterize the United States as a whole, and landfill leachate data from other countries suggest that BPA concentrations in leachate may be significantly higher than concentrations in surface water bodies. The direct exposure pathway from wastewater to environmental organisms, along with the widespread detection of BPA in WWTP sludges, further suggest that land application of WWTP sludges may be a significant environmental exposure pathway that needs to be better understood.[4]

Although most currently available environmental monitoring results show that the concentrations of BPA in U.S. water bodies are lower than 1 µg/L (ppb) (median concentration of 0.14 µg/L (ppb)), these environmental measurements represent isolated snapshots in time. Because these results come from a variety of studies designed for very different purposes and conditions (for example, laboratory analytical development contrasted with field monitoring), the data are not readily comparable and cannot be assembled into a nationally or regionally representative picture. Particularly in light of the corresponding uncertainties described in Unit II.B.1. and 2., concerning potential BPA hazards at low doses, the existing data do not allow EPA to determine how many areas may exceed potential concentrations of concern, how often or how long such concentrations may be exceeded, or the sources or pathways leading to BPA presence in the environment from manufacturing, processing, distribution in commerce, use, or disposal that may result in human and environmental exposures. EPA considers that these

[4] EPA's response to the request for correction of the information provided in the Action Plan that was filed under the "Agency's Information Quality Guidelines" by the American Chemistry Council is available at *http://www.epa.gov/quality/informationguidelines/iqg-list.html.*

existing data would not be sufficient to determine whether or not an unreasonable risk to the environment exists. To help resolve these uncertainties, EPA is considering requiring that manufacturers and processors of BPA conduct environmental testing consisting of targeted sampling and monitoring of surface water, ground water, sediment, soil, landfill leachate, and drinking water on and adjacent to their properties, specifically in the vicinity of manufacturing facilities and such processing facilities as foundries, WWTPs, paper and plastics recycling facilities, and other sources of BPA releases as identified through TRI reporting and other information. These test data could also help guide development of effective risk management actions if it should be determined that activities involving BPA present an unreasonable risk of injury to aquatic or other environmental systems.

Fully understanding exposure pathways and in particular the magnitude, frequency, and duration of exposure could require a nationwide survey of the occurrence of the chemical in environmental media associated with production, processing, use, disposal, and recycling facilities. However, at this time, EPA is proposing that selected monitoring of a more limited scope be conducted to help identify the most likely locations of high exposure and the sources and pathways of exposure, to determine whether BPA may be present in those locations at concentrations that pose a risk of concern to aquatic or other systems. Monitoring of aquatic sites and sediments near releases (effluents and sludge) from manufacturing and processing sites (including on-site WWTPs) reporting high releases under TRI or associated with high releases identified from other information, as well as monitoring of sites that receive runoff from landfills, would be included.

EPA believes these targeted monitoring data may provide information relevant both to the characterization of environmental risk and to the potential focus of future risk management activities such as those under TSCA section 6, if the data indicate such activities are warranted. EPA also considers these data would further inform the issue of potential human exposure levels attributable to sources other than the direct food contact uses believed to be the principal source of human exposure, which are regulated by the FDA. As noted earlier in Unit II.B., EPA is working with FDA, NIEHS, and CDC on additional research to better determine and evaluate the potential human health consequences of exposures to BPA, including exposures at low doses. Levels of exposure that may be identified by FDA as being of concern to human health, including children's health, would affect the extent to which EPA would take additional action to address potential risks to human health resulting from uses within TSCA jurisdiction, but EPA is not considering any additional testing specifically in regard to human health issues at this time.[5]

In order to be useful to an investigation of potential environmental risks posed by BPA, environmental testing must be representative and of known quality. To accomplish this, data should be collected using approved or recognized sampling, preparation, and analytical techniques. Appropriate quality assurance and quality controls also should be incorporated in the protocols for collection and analyses.

A further complicating factor in the assessment of potential environmental risks posed by BPA is that organisms in the environment, rather than being exposed to a single chemical at a time, are likely to be exposed simultaneously to multiple chemicals. The

[5] EPA notes, however, that information obtained on the environmental presence of BPA would be relevant to understanding the environmental component of human exposures.

presence of other endocrine-active chemicals, including other estrogenic chemicals, for example, could affect the potential for effects on environmental organisms. It may be useful, when monitoring for BPA, to identify the total estrogenicity of a sample along with the amount of BPA present.

Potential methodologies and protocols for use in monitoring programs may include ASTM D7574-09 Standard Test Method for Determination of Bisphenol A in Environmental Waters by Liquid Chromatography/Tandem Mass Spectrometry (Ref. 62); ASTM D5730-04 Standard Guide for Site Characterization for Environmental Purposes With Emphasis on Soil, Rock, the Vadose Zone and Ground Water (Ref. 63); EPA Method 8270D (SW-846), Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Revision 4 (Ref. 64); and other methods cited and described in such publications as Barnes et al. (2008) (Ref. 51) and Focazio et al. (2008) (Ref. 53).

5. *What are the issues for comment concerning environmental testing consisting of sampling and monitoring*? EPA particularly invites comment on:

a. The extent and type of environmental testing that may be sufficient to characterize the environmental presence of BPA.

b. The extent and type of environmental testing that may be sufficient to understand sources of and exposure from the high concentrations of BPA found in treated biosolids from WWTPs.

c. Whether environmental testing should be conducted now, or should be tiered to occur after the uncertainties associated with the hazards of BPA at low concentrations in the environment have been resolved.

d. The locations where such environmental testing should be undertaken, such as manufacturing, processing, recycling, foundry, and other use, treatment, and disposal sites identified with BPA releases reported under TRI or other information.

e. The media (e.g., soil, sediment, sludge, WWTP influent and effluent, landfill leachate, drinking water, surface water, ground water) to be sampled at each such site.

f. Which parties should be required to conduct the testing and/or be potentially responsible for providing reimbursement to those who conduct specific tests.

g. The appropriate methods and protocols to use in such a environmental testing program.

h. Whether such an environmental testing program should include measurements for the total estrogenicity of samples collected as well as for the concentration of BPA, and what methods and protocols may be suitable for generating and interpreting such data.

i. Whether and what additional environmental testing activities may be necessary to understand and characterize non-food-contact uses, sources, and environmental pathways that may contribute to exposure to BPA. Though, as indicated in Unit II.B., the current focus of this ANPRM is on environmental effects, this information would inform the multi-agency effort to evaluate the potential human health consequences of BPA exposures.

j. Other information that may provide insight into sources and pathways of environmental and human exposure to BPA released into the environment. Though, as indicated in Unit II.B., the current focus of this ANPRM is on environmental effects, this

information would inform the multi-agency effort to evaluate the potential human health consequences of BPA exposures.

k. The cost and economic feasibility of such environmental testing, for the different types of sites.

C. What is the Agency's Authority for Taking this Action?

EPA is issuing this ANPRM on certain toxicity testing and on certain environmental testing consisting of sampling and monitoring for the chemical substance BPA under TSCA section 4(a) (15 U.S.C. 2603(a)).

Section 2(b)(1) of TSCA (15 U.S.C. 2601(b)) states that it is the policy of the United States that "adequate data should be developed with respect to the effect of chemical substances and mixtures on health and the environment and that the development of such data should be the responsibility of those who manufacture [which is defined by statue to include import] and those who process such chemical substances and mixtures[.]" To implement this policy, TSCA section 4(a)(1) provides that EPA shall require by rule that manufacturers or processors or both of chemical substances and mixtures conduct testing, if the Administrator finds in a final rule that:

> (A)(i) the manufacture, distribution in commerce, processing, use, or disposal of a chemical substance or mixture, or that any combination of such activities, may present an unreasonable risk of injury to health or the environment,
>
> (ii) there are insufficient data and experience upon which the effects of such manufacture, distribution in commerce, processing, use, or disposal of such substance or mixture or any combination of such activities on health or the environment can reasonably be determined or predicted, and
>
> (iii) testing of such substances or mixture with respect to such effects is necessary to develop such data; or
>
> (B)(i) a chemical substance or mixture is or will be produced in substantial quantities, and (I) it enters or may reasonably be anticipated to enter the environment in substantial quantities or (II) there is or may be significant or substantial human exposure to such substance or mixture,
>
> (ii) there are insufficient data and experience upon which the effects of the manufacture, distribution in commerce, processing, use, or disposal of such

> substance or mixture or of any combination of such activities on health or the environment can reasonably be determined or predicted, and
>
> (iii) testing of such substance or mixture with respect to such effects is necessary to develop such data and
>
> (C) in the case of a mixture, the effects which the mixture's manufacture, distribution in commerce, processing, use or disposal or any combination of such activities may have on health or the environment may not be reasonably and more efficiently determined or predicted by testing the chemical substances which comprise the mixture[.]
>
> (15 U.S.C. 2603(a))

If EPA in a final rule makes an appropriate finding under TSCA section 4(a)(1)(A) or (B) for a chemical substance or mixture, the Administrator shall require that testing be conducted on that chemical substance or mixture. The purpose of the testing would be to develop data with respect to the health and environmental effects for which there is an insufficiency of data and experience, and which are relevant to a determination that the manufacture, distribution in commerce, processing, use, or disposal of the substance or mixture, or any combination of such activities, does or does not present an unreasonable risk of injury to health or the environment. As indicated in Unit II.A.3., EPA requests comment and supporting information regarding which TSCA section 4(a)(1) finding authority would be most appropriate for the purpose of a BPA test rule proposal. Any proposal would ultimately be based on EPA's assessment of the relevant information available at the time of proposal.

Once the Administrator has made the relevant findings under TSCA section 4(a), EPA may require any health or environmental effects testing for which data are insufficient and which are necessary to develop the data. EPA need not limit the scope of testing required to the factual basis for the TSCA section 4(a)(1)(A)(i) or (B)(i) findings as long as EPA also finds that there are insufficient data and experience upon which the effects of the manufacture, distribution in commerce, processing, use, or disposal of such

substance or mixture or of any combination of such activities on health or the environment can reasonably be determined or predicted, and that testing is necessary to develop such data. This approach is explained in more detail in EPA's TSCA section 4(a)(1)(B) Final Statement of Policy (B Policy) published in the **Federal Register** issue of May 14, 1993 (58 FR 28736, 28738-28739).

Authority for requiring sampling and monitoring for a chemical substance or mixture can be found within TSCA section 4. Section 4(a) of TSCA authorizes EPA to require the development of data "which are relevant to a determination that the manufacture, distribution in commerce, processing, use, or disposal of such substance or mixture, or that any combination of such activities, does or does not present an unreasonable risk of injury to health and the environment." The extent to which such activities may affect health or the environment is dependent in part upon the human and environmental exposures to the chemical substance occasioned by those activities. As an example, TSCA section 4(a)(2)(A) specifically addresses testing for persistence of a substance. Testing to identify where and in what concentrations a chemical substance or mixture may become present in the environment contributes to an understanding of human and environmental exposures resulting from those activities. As stated in Unit II.B., EPA does not intend to initiate regulatory action under TSCA at this time on the basis of human health.

III. References

1. EPA. 2010. Bisphenol A Action Plan. Available on-line at *http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2010-0348-0002*.

2. EPA. 1993. Bisphenol A (CASRN 80-05-7) Reference Dose for Chronic Oral Exposure (RfD). July 1, 1993. Integrated Risk Information System (IRIS). Available on-line at *http://www.epa.gov/ncea/iris/subst/0356.htm*.

3. FDA. 2008. Draft Assessment of Bisphenol A for Use in Food Contact Applications. Available on-line at *http://www.fda.gov/ohrms/dockets/AC/08/briefing/2008-0038b1_01_02_FDA%20BPA%20Draft%20Assessment.pdf*. Peer review report and additional information available on-line at *http://www.fda.gov/Food/FoodIngredientsPackaging/ucm166145.htm*.

4. European Food and Safety Authority (EFSA). 2006. Opinion of the Scientific Panel on Food Additives, Flavourings, Processing Aids and Materials in Contact with Food on a Request from the Commission Related to 2,2-BIS(4-HYDROXYPHENYL) PROPANE. Question number EFSA-Q-2005-100. *The EFSA Journal*. Vol. 428:1-75.

5. EFSA. 2008. Scientific Opinion of the Panel on Food additives, Flavourings, Processing aids and Materials in Contact with Food (AFC) on a request from the Commission on the toxicokinetics of Bisphenol A. *The EFSA Journal*. Vol. 759:1-10.

6. Canada. 2008. Environment Canada, Health Canada. Screening Assessment for the Challenge Phenol, 4,4' (1-methylethylidene)bis- (Bisphenol A) Chemical Abstracts Service Registry Number 80-05-7. October 2008. Available on-line at *http://www.ec.gc.ca/substances/ese/eng/challenge/batch2/batch2_80-05-7_en.pdf*.

7. EU. 2010. European Union Risk Assessment Report. CAS: 80-05-7. EINECS No.: 201-245-8. Environment Addendum of April 2008 and Human Health Addendum of April 2008 (to be read in conjunction with published EU RAR of BPA, 2003).

4,4'-ISOPROPYLIDENEDIPHENOL (Bisphenol A). Institute for Health and Consumer Protection, Joint Research Centre, European Commission. Luxembourg: Publications Office of the European Union.

8. Japan's National Institute of Advanced Industrial Science and Technology (AIST). 2007. AIST Risk Assessment Document Series 4. Bisphenol A. AIST07-A00001-4.

9. National Toxicology Program, Center for the Evaluation of Risks to Human Reproduction (NTP/CERHR), HHS. 2008. NTP-CERHR Monograph on the Potential Human Reproductive and Developmental Effects of Bisphenol A. Available on-line at *http://cerhr.niehs.nih.gov/evals/bisphenol/bisphenol.pdf*.

10. FDA. 2010. U.S. Food and Drug Administration. Update on Bisphenol A for Use in Food Contact Applications: January 2010. Available on-line at *http://www.fda.gov/NewsEvents/PublicHealthFocus/ucm197739.htm*.

11. Crain, D.A.; Eriksen, M.; Iguchi, T.; Jobling, S.; Laufer, H.; LeBlanc, G.A.; and Guillette, Jr., L.J. 2007. An ecological assessment of Bisphenol A: evidence from comparative biology. *Reproductive Toxicology*. Vol. 24:225-239.

12. Lahnsteiner, F.; Berger, B.; Kletzl, M.; and Weismann, T. 2005. Effect of Bisphenol A on Maturation and Quality of Semen and Eggs in the Brown Trout, *Salmo trutta f. fario*. *Aquatic Toxicology*. Vol. 75:213-224.

13. EPA. 2010. List of References to BPA-Related Environmental Studies Published from 2007 through 2010.

14. EPA. 2010. List of References Published from 2007 through 2010 of Some Relevance to the Environmental Toxicity of BPA, and Older Studies of Sub-Lethal Effects Also Cited in Table 2.

15. Marcial, H.S.; Hagiwara, A.; and Snell, T.W. 2003. Estrogenic compounds affect development of harpacticoid copepod *Tigriopus Japonicus*. *Environmental Toxicology and Chemistry*. Vol. 22:3025-3030.

16. Watts, M.M.; Pascoe, D.; and Carroll, K. 2001. Chronic exposure to 17α-ethinylestradiol and bisphenol A-effects on development and reproduction in the freshwater invertebrate *Chironomus riparius* (Diptera: Chironomidae). *Aquatic Toxicology*. Vol. 55:113-124.

17. Sumpter, J.P.; Tyler, C.R.; Sherazi, A. 2001. Bisphenol-A: Multigeneration study with the fathead minnow (*Pimephales promelas*). Brunel University (unpublished; part of study published as Sohoni *et al*, 2001).

18. Oehlmann, J.; Schulte-Oehlmann, U.; Werner, K.; Jagnytsch, O.; Lutz, I.; Kresten, K.; Wollenberger, L.; Santos, E.M.; Paull, G.C.; Van Look, K.J.W.; and Tyler, C.R. 2008. A Critical Analysis of the Biological Impacts of Plasticizers on Wildlife. *Philosophical Transactions of The Royal Society*, *B*: *Biological Sciences.* Vol. 364:2047-2062.

19. Forbes, V.E.; Selck, H.; Palmqvist, A.; Aufderheide, J.; Warbritton, R.; Pounds, N.; Thompson, R.; van der Hoeven, N.; and Caspers, N. 2007. Does bisphenol A induce superfeminization in *Marisa cornuarietis*? Part I: Intra- and inter-laboratory variability in test endpoints. *Ecotoxicology and Environmental Safety*. Vol. 66:309-318.

20. Forbes, V.E.; Aufderheide, J.; Warbritton, R.; Thompson, R.; van der Hoeven, N.; and Caspers, N. 2007. Does bisphenol A induce superfeminization in *Marisa cornuarietis*? Part II: Toxicity test results and requirements for statistical power analyses. *Ecotoxicology and Environmental Safety*. Vol. 66:319-325.

21. Forbes, V.E; Aufderheide, J.; Warbritton, R.; Thompson, R.; van der Hoeven, N.; and Caspers, N. 2008. Effects of bisphenol A on fecundity, egg hatchability, and juvenile growth of *Maris Cornuarietis*. *Environmental Toxicology and Chemistry.* Vol. 27:2332-2340.

22. Levy, G.; Lutz, I.; Krüger, A.; and Kloas, W. 2004. Bisphenol A induces feminization in *Xenopus laevis* tadpoles. *Environmental Research*. Vol. 94:102-111.

23. Calabrese, E.J. and Baldwin, L.A. 2003. Hormesis at the National Toxicology Program (NTP): evidence of hormetic dose responses in NTP dose-range studies. *Nonlinearity in Biology, Toxicology, and Medicine*. Vol. 1:455-467.

24. Heimeier, R.A.; Das, B.; Buchholz, D.R.; and Shi, Y. 2009. The Xenoestrogen Bisphenol A inhibits postembryonic vertebrate development by antagonizing gene regulation by thyroid hormone. *Endocrinology*. Vol. 150:2964-2973.

25. Ramakrishnan, S. and Wayne, N.L. 2008. Impact of bisphenol-A on early embryonic development and reproductive maturation. *Reproductive Toxicology*. Vol. 25:177-183.

26. Ankley, G.T.; Jensen, K.M.; Kahl, M.D.; Durhan, E.J.; Makynen, E.A.; Cavallin, J.E.; Martinovic, D.; Wehmas, L.C.; Mueller, N.D.; and Villeneuve, D.L. 2010. Use of chemical mixtures to differentiate mechanisms of endocrine action in a small fish model. *Aquatic Toxicology*. Vol. 99:389-396.

27. EPA. Endocrine Disruptor Screening Program; Policies and Procedures for Initial Screening; Notice. **Federal Register** (74 FR 17560, April 15, 2009) (FRL-8399-9).

28. EPA. Endocrine Disruptor Screening Program website. Available on-line at *http://www.epa.gov/scipoly/oscpendo*.

29. Organization for Economic Co-operation and Development Environment Directorate. Endocrine Disruptor Testing and Assessment. Available on-line at *http://www.oecd.org/document/62/0,3343,en_2649_34377_2348606_1_1_1_1,00.html*.

30. EPA. 2008. White Paper. Aquatic Life Criteria for Contaminants of Emerging Concern. Draft Document. EPA, Office of Water. Washington, DC.

31. EPA. 2009a. Toxics Release Inventory. 2007 Public Data Release, Released March 14, 2009. Available on-line at *http://www.epa.gov/tri/tridata/index.html*.

32. Vinggaard, A.M.: Körner, W.; Lund, K.H.; Bolz, U.; and Petersen, J.H. 2000. Identification and quantification of estrogenic compounds in recycled and virgin paper for household use as determined by an in vitro yeast estrogen screen and chemical analysis. *Chemical Research in Toxicology*. Vol. 13:1214-1222.

33. Gehring, M.; Tennhardt, L.; Vogel, D.; Weltin, D.; and Bilitewski, B. 2004. Bisphenol A contamination of wastepaper, cellulose and recycled paper products. In: Brebbia, C.A.; Kungulos, S.; Popov, V.; and Itoh, H. (eds.): Waste Management and the Environment II. WIT Transactions on Ecology and the Environment. Vol. 78:294-300. Southampton, Boston: WIT Press. Available on-line at *http://rcswww.urz.tu-dresden.de/~gehring/deutsch/dt/vortr/040929ge.pdf*.

34. Ozaki, A.; Yamaguchi, Y.; Fujita, T.; Kuroda, K.; and Endo, G. 2004. Chemical analysis and genotoxicological safety assessment of paper and paperboard used for food packaging. *Food and Chemical Toxicology*. Vol. 42:1323-1337.

35. Fukazawa, H.; Hoshino, K.; Shiozawa, T.; Matsushita, H.; and Terao, Y. 2001. Identification and quantification of chlorinated bisphenol A in wastewater from wastepaper recycling plants. *Chemosphere*. Vol. 44:973-979.

36. Terasaki, M.; Shiraishi, F.; Fukazawa, H.; and Makino, M. 2007. Occurrence and estrogenicity of phenolics in paper-recycling process water: pollutants originating from thermal paper in waste paper. *Environmental Toxicology and Chemistry*. Vol. 26:2356-2366.

37. Braun, J.M.; Kalkbrenner, A.E.; Calafat, A.M.; Bernert, J.T.; and Ye, X., et al. 2011 Variability and Predictors of Urinary Bisphenol A Concentrations during Pregnancy. *Environmental Health Perspectives.* Vol. 119:131-137.

38. Calafat, A.M.; Kuklenyik, Z.; and Reidy, J.A., et al 2005. Urinary

concentrations of bisphenol A and 4-nonylphenol in a human reference population.

Environmental Health Perspectives. Vol. 113:391-395.

39. Calafat, A.M.; Ye, S; and Wong, L.Y., et al 2008. Exposure of the US population to bisphenol A and 4-tertiarty-octylphenol: 2003-2004. *Environmental Health Perspectives.* Vol. 116:39-44.

40. Calafat, A.M.; Weuve, J.; Ye, X., et al 2009. Exposure to bisphenol A and other phenols in neonatal intensive care unit premature infants. *Environmental Health Perspectives.* Vol. 117:639-644.

41. CDC, HHS. Fourth National Report on Human Exposure to Environmental Chemicals, Update Tables. July 2010. Available on-line at *http://www.cdc.gov/exposurereport/pdf/Update_Tables.pdf*.

42. Tsai, W. 2006. Human Health Risk on Environmental Exposure to Bisphenol-A: A Review. *Journal of Environmental Science and Health.* Part C, Vol. 24:225-255.

43. Kolpin, D.W.; Furlong, E.T.; Meyer, M.T.; Thurman, E.M.; Zaugg, S.D.; Barber, L.B.; and Buxton, H.T. 2002. Pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams, 1999-2000: a national survey. *Environmental Science & Technology*. Vol. 36:1202-1211.

44. Klecka, G.M.; Staples, C.A.; Clark, K.E.; van der Hoeven, N.; Thomas, D.E.; and Hentges, S.G. 2009. Exposure Analysis of Bisphenol A in Surface Water Systems in North America and Europe. *Environmental Science & Technology.* Vol. 43:6145-6150.

45. Boyd, G.R.; Reemtsma, H.; Grimm, D.A.; and Mitra, S. (2003). Pharmaceuticals and personal care products (PPCPs) in surface and treated waters of Louisiana, U.S.A. and Ontario, Canada. *The Science of the Total Environment*. Vol. 311:135-149.

46. Jackson, J. and Sutton, R. 2008. Sources of endocrine-disrupting chemicals in an urban wastewater, Oakland, CA. *The Science of the Total Environment*. Vol. 405:153-160.

47. Lee, H-B. and Peart, T.E. 2000a. Determination of bisphenol A in sewage effluent and sludge by solid-phase and supercritical fluid extraction and gas chromatography/mass spectrometry. *Journal of the Association of Analytical Communities (AOAC) International.* Vol. 83:290-297.

48. Lee, H-B. and Peart, T.E. 2000b. Bisphenol A contamination in Canadian municipal and industrial wastewater and sludge samples. *Water Quality Research Journal of Canada*. Vol. 35:283-298.

49. Kinney, C.A.; Furlong, E.T.; Zaugg, S.D.; Burkhardt, M.R.; Werner, S.L.; Cahill, J.D.; and Jorgensen, G.R. 2006. Survey of Organic Wastewater Contaminants in Biosolids Destined for Land Application. *Environmental Science & Technology.* Vol. 40:7207-7215.

50. Kinney, C.A; Furlong, E.T.; Kolpin, D.W.; Burkhardt, M.R.; Zaugg, S.D.; Werner, S.L.; Bossio, J.P.; and Benotti, M.J. 2008. Bioaccumulation of pharmaceuticals and other anthropogenic waste indicators in earthworms from agricultural soil amended with biosolid or swine manure. *Environmental Science & Technology.* Vol. 42:1863-1870.

51. Barnes, K.K.; Kolpin, D.W.; Focazio, M.J.; Furlong, E.T.; Meyer, M.T.; Zaugg, S.D.; Haack, S.K.; Barber, L.B.; and Thurman, E.M. 2008a. U. S. Geological Survey. Water-Quality Data for Pharmaceuticals and Other Organic Wastewater

Contaminants in Ground Water and in Untreated Drinking Water Sources in the United States, 2000-01. Available on-line at *http://pubs.usgs.gov/of/2008/1293*.

52. Barnes, K.K.; Kolpin, D.W.; Furlong, E.T.; Zaugg, S.D.; Meyer, M.T.; and Barber, L.B. 2008b. A National Reconnaissance of Pharmaceuticals and Other Organic Wastewater Contaminants in the United States: (I) Groundwater. *The Science of the Total Environment*. Vol. 402:192-200.

53. Focazio, M.J.; Kolpin, D.W.; Barnes, K.K.; Furlong, E.T.; Meyer, M.T.; Zaugg, S.D.; Barber, L.B.; and Thurman, E.M. 2008. A National Reconnaissance for Pharmaceuticals and Other Organic Wastewater Contaminants in the United States--(II) Untreated Drinking Water Sources. *The Science of the Total Environment*. Vol. 402:201-216.

54. Rudel, R.A.; Melly, S.J.; Geno, P.W.; Sun, G.; and Brody, J.G. 1998. Identification of Alkylphenols and Other Estrogenic Phenolic Compounds in Wastewater, Septage, and Groundwater on Cape Cod, MA. *Environmental Science & Technology.* Vol. 32:861-869.

55. Wilson, N.K.; Chuang, J.C.; Lyu, C.; Menton, R.; and Morgan, M.K. 2003. Aggregate exposures of nine preschool children to persistent organic pollutants at day care and home. *Journal of Exposure Analysis and Environmental Epidemiology.* Vol. 13:187-202.

56. Stuart, J.D.; Capulong, C.P.; Launer, K.D.; and Pan, X. 2005. Analyses of phenolic endocrine disrupting chemicals in marine samples by both gas and liquid chromatography-mass spectrometry. *Journal of Chromatography A.* Vol. 1079:136-145.

57. Boyd, G.R.; Palmerib, J.M.; and Grimm, D.A. 2004. Pharmaceuticals and Personal Care Products (PPCPs) and Endocrine Disrupting Chemicals (EDCs) in Stormwater Canals and Bayou St. John in New Orleans, Louisiana, USA. *The Science of the Total Environment*. Vol. 333:137-48.

58. Staples, C.A.; Dorn, P.B.; Klecka, G.M.; O'Block, S.T.; Branson, D.R.; and Harris, L.R. 2000. Bisphenol A Concentrations in Receiving Waters Near U.S. Manufacturing and Processing Facilities. *Chemosphere*. Vol. 40:521-525.

59. Zhang, S.; Zhang, Q.; Darisaw, S.; Ehie, O.; and Wang, G. 2007. Simultaneous Quantification of Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs), and Pharmaceuticals and Personal Care Products (PPCPs) in Mississippi River Water, in New Orleans, Louisiana, USA. *Chemosphere*. Vol. 66:1057-1069.

60. Stackelberg, P.E.; Furlong, E.T.; Meyer, M.T.; Zaugg, S.D.; Henderson, A.K.; and Reissman, D.B. 2004. Persistence of Pharmaceutical Compounds and Other Organic Wastewater Contaminants in a Conventional Drinking-Water-Treatment Plant. *The Science of the Total Environment*. Vol. 329:99-113.

61. Drewes, J.E.; Hemming, J.; Ladenburger, S.J.; Schauer, J.; and Sonzogni, W. 2005. An Assessment of Endocrine Disrupting Activity Changes during Wastewater Treatment through the Use of Bioassays and Chemical Measurements. *Water Environment Research*. Vol. 77:12-23.

62. ASTM International (ASTM). 2009. ASTM D7574-09 Standard Test Method for Determination of Bisphenol A in Environmental Waters by Liquid

Chromatography/Tandem Mass Spectrometry. Available on-line at *http://www.astm.org/Standards/D7574.htm*.

63. ASTM. 2004. ASTM D5730-04 Standard Guide for Site Characterization for Environmental Purposes With Emphasis on Soil, Rock, the Vadose Zone and Ground Water. Available on-line at *http://www.astm.org/Standards/D5730.htm*.

64. EPA. 1998. Method 8270D (SW-846), Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Revision 4. Available on-line at *http://www.epa.gov/sam/pdfs/EPA-8270d.pdf*.

IV. Statutory and Executive Order Reviews

Under Executive Order 12866, entitled "Regulatory Planning and Review" (58 FR 51735, October 4, 1993), this action was submitted to the Office of Management and Budget (OMB) for review. Any changes made to this document in response to OMB comments received by EPA during that review have been documented in the docket as required by the Executive Order.

Since this document does not impose or propose any requirements, and instead seeks comments and suggestions for the Agency to consider in possibly developing a subsequent proposed rule, the various other review requirements that apply when an agency imposes requirements do not apply to this action. Nevertheless, as part of your comments on this ANPRM, you may include any comments or information that you have regarding this action.

In particular, any comments or information that would help the Agency to assess the potential impact of a rule on small entities pursuant to the Regulatory Flexibility Act (RFA) (5 U.S.C. 601 *et seq*.); to consider voluntary consensus standards pursuant to

section 12(d) of the National Technology Transfer and Advancement Act of 1995 (NTTAA) (15 U.S.C. 272 note); to consider environmental health or safety effects on children pursuant to Executive Order 13045, entitled “Protection of Children from Environmental Health Risks and Safety Risks” (62 FR 19885, April 23, 1997); or to consider human health or environmental effects on minority or low-income populations pursuant to Executive Order 12898, entitled “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” (59 FR 7629, February 16, 1994).

The Agency will consider such comments during the development of any subsequent proposed rule as it takes appropriate steps to address any applicable requirements.

List of Subjects in 40 CFR Part 799

Environmental protection, Bisphenol A, BPA, Chemicals, Hazardous substances, Reporting and recordkeeping requirements.

Dated: July 20, 2011.

Stephen. A. Owens,

Assistant Administrator, Office of Chemical Safety and Pollution Prevention.

[FR Doc. 2011-18842 Filed 07/25/2011 at 8:45 am; Publication Date: 07/26/2011]