ADDENDUM to Testimony of Matt Prindiville, Natural Resources Council of Maine
In Support of
LD 1658, "An Act to Protect Pregnant Women and Children from
Toxic Chemicals Released into the Home Environment"

Before the Joint Committee on Natural Resources

On April 5th, 2007

Good afternoon Senator Martin, Representative Koffman and members of the Natural Resources Committee. My name is Matt Prindiville. I am the Toxics Policy Advocate for the Natural Resources Council of Maine. NRCM strongly supports LD 1658 and urges the committee to vote "Ought to Pass." We thank Representative Pingree for bringing this issue to the attention of the committee and for her continued leadership on children's health issues. LD 1658 is a critical environmental and public health measure that would finish the job that the Maine legislature started when it voted to phase out two toxic PBDE flame retardants three years ago. "Deca-BDE"[1] is the last commercially produced PBDE flame retardant, and the word is out that it's persistent, bioaccumulative and toxic and can be replaced with safer alternatives.

I. PBDEs: An Exponentially Growing Problem

Polybrominated diphenyl ethers (PBDEs) are brominated flame retardants that are used in both commercial and residential textiles and electronics. They work by slowing combustion by releasing hydrogen bromide gas, which interferes with the chemical reaction that spreads fire.[2] PBDEs consist of two benzene rings linked by an oxygen atom and can have up to ten attached bromine atoms. This stable structure causes the molecules to be lipophilic (fat loving) and consequently subject to bioaccumulation.[3] The three primary types of PBDEs are penta-BDE, octa-BDE, and deca-BDE, with deca being the only commercially-used PBDE currently in the market. Penta was primarily applied to polyurethane foam (up to 30% in weight) for use in couches, carpets, and mattresses; octa was used in computer monitor plastics; and deca, which makes up 83% of global PBDE production, is still used in electronic equipment, primarily to flame retard plastic electronic enclosures for television sets.[4] **Deca is an off-white crystalline powder that is usually 10-15% (and up to 30%) of the weight of the host material**

[1] Herein referred to as "deca."
[2] Jessen, S. 2005. Brominated flame retardants: rising levels of concern. Health Care Without Harm, Arlington Virginia. (http://safer-products.org/downloads/ HCWHBF%20Report.pdfa)
[3] Karlsson, M. I. Ericson, B. van Bavel, J-K., Jenson, and M. Dam. 2006. Levels of brominated flame retardants in Northern Fulma (Fulmarus glacialis) eggs from the Faroe Islands. Science of the Total Environment 367: 840-846.
[4] Johnson-Restrepo, R., K. Kannan, R. Addink, and D. H. Adams. 2005. Polybrominated diphenyl ethers and polychlorinated biphenyles in marine foodweb of coastal Florida. Environmental Science and Technology 39: 8243-8250.

and is an additive flame retardant that does not chemically bond to its host material. Consequently, deca migrates into the environment.[5]

There is no doubt that flame retardants make a considerable contribution to fire safety. Their use has helped to stop fires and save lives. However, PBDE flame retardants have provoked a firestorm of controversy since levels in humans, wildlife and the environment were discovered to be increasing exponentially from the time when these chemicals were brought to market during the 1970s.[6] **Deca, it's banned-PBDE cousins, octa and penta and their breakdown products have turned up all over the world, in practically every organism and media examined, including, humans, wildlife, and the environment.** They've been found in whales, Tasmanian devils, fish, and falcons in Australia[7]; terns in San Francisco Bay[8]; guillemots in the Baltic Sea[9]; Peregrine Falcons in Sweden[10], China and at their highest levels in Maine and New Hampshire; marine fish in Florida[11]; seabirds in Norway[12]; harbor seals in Maine's Casco Bay; birds of prey in Belgium[13]; birds of prey in Europe and China[14]; fish in Maine's Penobscot River[15]; and Arctic fox in Greenland and Russia.[16]

Most alarming is that during the past 30 years, PBDE levels in humans have doubled every 3-5 years and continue to increase. Levels in the United States are by far the highest in the world.[17]

The scientific evidence damning PBDEs as health hazards is clear. In laboratory studies, PBDEs permanently damage the brain and impair memory, learning and behavior

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[5] Maine Department of Environmental Protection. 2007. Brominated Flame Retardants: Third annual report to the Maine Legislature. Augusta, Maine.
[6] Ibid.
[7] Symons, R., D. Burniston, N. Piro, G. Stevenson, and A. Yates. 2004. A study of the presence of brominated falme retardants in Austrailian Fuana. Organohalogen Compounds 66: 3959-3965.
[8] She, J. A. Holden, M. Tanner, M. Sharp, T. Adelsbach, and K. Hooper. 2004. Highest PBDE levels (max 63 ppm) yet found in biota measured in seabird eggs from San Francisco Bay. Organohalogen Compounds 66: 3939-3944.
[9] Sellstrom, U., A. Bignert, A. Kierkegaad, L. Haggberg, C. de Wit, M. Olsson, and B. Jansson. 2003. Temporal trend studies on tetra- and pentabrominated diphenyl ethers and hexabromocyclododecane in guillemot egg from the Baltic Sea. Environmental Science and technology 37: 5496-5501.
[10] Sellstrom, U., P. Lindberg, L. Haggberg, and C. de Wit. 2001. Brominated flame retardants (PBDEs) found in eggs of peregrine falcons (Falco peregrinus) breeding in Sweden. Rapport utgiven av Svenska Naturskyddsföreningen I samarbete med TCO-Utveckling AB Stockholm, mars 2001. http://www.snf.se/pdf/rap-pilgrim-brom.pdf
[11] Johnson-Restrepo, R., K. Kannan, R. Addink, and D. H. Adams. 2005. Polybrominated diphenyl ethers and polychlorinated biphenyles in marine foodweb of coastal Florida. Environmental Science and Technology 39: 8243-8250.
[12] Murvoll, K. M. 2006. Levels and effects of persistent organic pollutants (POPs) in seabirds. PhD thesis. Norwegian University of Science and Technology, Trondheim. http://www.diva-portal.org/diva/getDocument?urn_nbn_no_ntnu_diva-712-1__fulltext.pdf
[13] Voorspoels, S., A. Covaci, and P. Schepens. 2004. Brominated flame retardants in birds of prey from Flanders, Belgium. Organohalogen Compounds 66: 3884-3891.
[14] Chen, D., B. Mai, J. Song, Q. Sun, Y. Luo, X. Luo, E. Y. Zeng, and R. C. Hale. 2007. Polybrominated diphenyl ethers in birds of prey from Northern China. Environmental Science and Technology. *In press*.
[15] Anderson, T. and J. MacRae. 2006. Polybromindated diphenyl ethers in fish and wastewater samples from an area of the Penobscot River in Central Maine. Chemosphere 62:1153-1160.
[16] Lefgren, H. 2005. Levels of PCBs, PBDEs, and pesticides in arctic fox (Alopex lagopus) from Greenland and Northern Russia. Orebro University, Sweden. http://www.oru.se/oru-upload/Institutioner/Naturvetenskap/Dokument/%C3%84mnen/Kemi/Examensarbeten/Lifgren_D-uppsats.pdf
[17] Maine Department of Environmental Protection. 2007. Brominated Flame Retardants: Third annual report to the Maine Legislature. Augusta, Maine.

in lab animals[18]. They're also classed as endocrine disruptors, which means they can interfere with normal reproductive and thyroid functions.

Three years ago, when the bromine chemical industry was defending penta, octa and deca before this committee, they claimed that deca was not a problem because it was a large, stable molecule that would pass through an organism and not break down into lower brominated cogeners or bioaccummulate up the food chain. They also claimed it wasn't toxic. Three years have passed and a number of studies have come out to prove them wrong.

The truth is that even low levels of deca have been shown to cause harm in lab animals.[19] **According to the latest research, deca delays brain development and causes adult learning and behavior problems in lab animals exposed early in life.[20] Deca also degrades into other PBDEs that are even more toxic and bioavailable.[21]**

This wouldn't be an issue if deca would just stay where it's put as the industry claims it does. But the fact is deca and its breakdown products don't stay where they're put. Instead, as we've cited, the chemicals are being found all over the place - in household dust, in wildlife species around the world, and in the food we eat[22]. **Most alarmingly, they are found in ever-increasing amounts in breast milk, as well in as the bodies of infants, children and adults.**

The industry would have you believe that in terms of its safety and efficacy as a flame retardant, no other flame retardant has been through such intensive evaluation. And this is true, no other flame retardant has been as studied, and the reason is because **no other flame retardant has caused the same public health outcry and provoked the firestorm of controversy that deca has**. To summarize and cite a small sampling of the studies demonstrating concern:

- Deca is showing up in humans, breast milk, wildlife and the environment[23].
- Deca debrominates into other more toxic PBDE byproducts that are more readily absorbed by humans and wildlife.[24]
- Deca is thought to metabolize and break down in humans and wildlife to other PBDE compounds – that are also rising exponentially – that may be more toxic than deca[25].

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[18] Darnerud, P. O. 2003. Toxic effects of brominated flame retardants in wildlife. Environmental International 29: 841-853.

[19] Viberg, H.,A. Fredriksson and P. Eriksson. 2003. Neurotoxicity of different polybrominated diphenyl ethers, including PBDE 209. Dioxin 2003, Organohalogen Compounds, 60-65, 2003.

[20] Cressey, M.A., E.A. Reeve, D.C. Rice, and V.P Markowski, Behavioral Impairments Produced by Developmental Exposure to the Flame Retardant decaBDE, presented at the annual meeting of the Behavioral Toxicology Society, September 16-17, 2006.

[21] Stapleton, H, Brominated Flame Retardants: Assessing DecaBDE Debromination in the Environment, prepared for the EPHA-EN, May 2006. Heather Stapleton, PhD is an Environmental Chemist at Duke University.

[22] [22] Schecter A, Papke O, Harris RT, Tung KC, Musumba A, Olson J, and Birnbaum L, Polybrominated Diphenyl Ether (PBDE) Levels in an Expanded Market Basket Survey of U.S. Food and Estimated PBDE Dietary Intake by Age and Sex, *Environmental Health Perspectives,* 114:1515–1520 (2006). "Conclusion: Dietary exposure alone does not appear to account for the very high body burdens measured. The indoor environment (dust, air) may play an important role in PBDE body burdens in addition to food."

[23] Maine Department of Environmental Protection. 2007. Brominated Flame Retardants: Third annual report to the Maine Legislature. Augusta, Maine.

[24] Stapleton, H, Brominated Flame Retardants: Assessing DecaBDE Debromination in the Environment, prepared for the EPHA-EN, May 2006. Heather Stapleton, PhD is an Environmental Chemist at Duke University.

- Deca has been proven to be neurotoxic to lab animals. Deca delays brain development and causes adult learning and behavior problems in lab animals exposed early in life. In mice, Deca produced irreversible changes in brain function that worsened with age in adult mice.[26] This is the same health effect seen for other PBDEs already banned in Maine.
- Levels of deca in wildlife are approaching levels shown to cause harm in lab animals.
- The latest research shows toddlers have higher levels of Deca in their blood than older children, who in turn have higher levels than adults[27]. Children pick up deca mostly from eating and breathing contaminated house dust[28].

The verdict is out: deca is toxic; it's getting into humans and wildlife and is breaking down into even more toxic compounds. The good news is we don't have to use it. There are safer, widely-used, commercially-available alternatives for every use covered under LD 1658.

II. Safer Alternatives – We can have Fire Protection without Poisons

Any discussion concerning safer alternatives should focus on the product uses covered by the legislation, namely:

- **Mattresses and home upholstered furniture** which currently do not use deca, and for which there are a wide variety of alternative technologies and flame retardants available to meet the highest fire safety standards, and
- **Electronic enclosures for television sets and computers –** About 80% of the current market for deca is in flame-retardant HIPS plastic for the plastic electronic enclosures for TV sets. The most widely-used, safer alternative to deca is resorcinol bis diphenylphosphate (or RDP) and is employed by the computer industry and many leading television manufacturers to meet the highest fire safety standards without the public health concerns of deca.

A. Mattresses and Home Upholstered Furniture

According to the Lowell Center for Sustainable Production, which produced an internationally acclaimed report on alternatives to deca, "**there are dozens of technologies, fibers, and materials that can be used as decaBDE substitutes in textile applications."** In order to meet the new federal fire safety standards for mattresses, manufacturers can use one or a combination of the following technologies: inherently

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[25] Maine Department of Environmental Protection. 2007. Brominated Flame Retardants: Third annual report to the Maine Legislature. Augusta, Maine.

[26] Cressey, M.A., E.A. Reeve, D.C. Rice, and V.P Markowski, Behavioral Impairments Produced by Developmental Exposure to the Flame Retardant decaBDE, presented at the annual meeting of the Behavioral Toxicology Society, September 16-17, 2006.

[27] Fischer D, Hooper K, Athanasiadou M, Athanassiadis I, and Bergman A, Children Show Highest Levels of Polybrominated Diphenyl Ethers in a California Family of Four: A Case Study, *Environmental Health Perspectives*, 114: 1581-1584 (2006). "This case study suggests that children are at higher risk for PBDE exposures and, accordingly, face higher risks of PBDE-related health effects than adults."

[28] Schecter A, Papke O, Harris RT, Tung KC, Musumba A, Olson J, and Birnbaum L, Polybrominated Diphenyl Ether (PBDE) Levels in an Expanded Market Basket Survey of U.S. Food and Estimated PBDE Dietary Intake by Age and Sex, *Environmental Health Perspectives,* 114:1515–1520 (2006). "Conclusion: Dietary exposure alone does not appear to account for the very high body burdens measured. The indoor environment (dust, air) may play an important role in PBDE body burdens in addition to food."

fire resistant fibers and fabrics, barrier layers, and chemically applied decaBDE-free flame-retardants. The following was paraphrased from the Lowell Center Report, *Decabromodiphenylether: An Investigation of Non-Halogen Substitutes in Electronic Enclosure and Textile Applications:*

- ***"Inherently flame resistant*** fibers and fabrics do not combust and meet the most stringent flame resistance standards. Non-halogen fiber types include melamine, polyaramides, carbonized acrylic, and glass. The most well-known fiber type is Trevia, an inherently flame resistant polyester used for hospital draperies and other places where fire codes require high levels of fire protection.
- ***"Barrier technologies*** are used between the surface fabric and the interior foam core in furniture and mattress construction. In addition to blends of inexpensive fibers and expensive inherently fire resistant fibers, many manufacturers use cotton batting materials treated with boric acid. Manufacturers also bond flame retardant laminates to the back of fabrics. The laminates can be thermally bonded or mechanically joined.
- ***"Chemically applied flame retardants*** include textile fabric coating and exhausting flame retardants into fibers during the dying process. The most common types of non-halogen decaBDE substitutes for cellulosics include dimethylphosphono (N-methylol) propionamide, phosphonic acid, and tetrakis (hydroxymethyl) phosphonium urea ammonium salt.

With mattresses and home upholstered furniture, deca isn't currently used, and it doesn't need to be given the wide array of means to achieve the highest fire safety standards through other technologies and/or safer flame retardants.

B. Electronics

Currently, about 80% of the market for deca is in electronic enclosure applications such as television casings. Many leading firms have actually committed to or have already replaced deca in their products including Sony, Samsung, Panasonic and Phillips (#1, #3, #6 and #6, *Panasonic and Phillips are tied*, respectively in terms of US market share)[29]. However, according the Washington Department of Ecology, about 43% of TVs currently on the market still contain deca. There are several substitutes for decaBDE in electronic enclosures that meet rigorous Underwriters Laboratory fire retardancy standards and are widely available on the market[30]. These substitute systems are commodity resins (plastics) with phosphate-type flame-retardants, the most widely-used being RDP. Essentially, the current substitution process for deca and HIPS plastic is simple: replace deca-HIPS with an RDP treated HIPS-PPO resin or RDP-treated PC/ABS resin. There are also other phosphate-based flame retardants and other compatible resins, and new products are constantly being developed.

Is it possible for the television industry to make this shift in the three years allocated under the bill? According to the Lowell Center, **"if market drivers existed in**

[29] "DecaBDE and BFR Substitution in the Electronics Industry: Leading Manufacturers are Moving Away from Bromine Chemistry in Computers and Televisions." Clean Production Action. November, 2006.
[30] Underwriters Laboratory is the standard-setting entity for fire retarding electronics.

the US, nearly all the global manufacturers have the technology and know-how to meet the demand for decaBDE–free electronic enclosures."[31]

How much will it cost the manufacturers? The Lowell Center found that alternative flame-retardants and resin systems for electronic enclosures are marginally more costly:

> "**To put this into context, we estimate that cost increase for an average 27-inch TV that sells for roughly $300 using PC/ABS rather than decaBDE HIPS in the rear enclosure would be roughly $4.40 to $7.50, or roughly 1.5 to 2.5% of total purchase price.** If industry makes a major switch towards one of the substitutes outlined in our report, we anticipate the raw materials costs would decrease somewhat due to volume-related pricing."[32]

That's about one to three cents more on the dollar to make products that don't harm our kids or wildlife. Where I come from, that's a bargain.

The bromine chemical industry has tried to claim that products in which ignition resistance is an important safety feature may not be available to consumers in Maine, but that's simply not the case. While the current fire safety standards for consumer electronics are voluntary, **you can't sell a TV or computer in this country that doesn't meet fire safety standards.** The reason is that retailers enforce fire safety standards for electronics by refusing to sell products that don't meet the Underwriter Laboratory standards for liability reasons. The same can be said for TV and computer manufacturers selling products in the states. **This effectively ensures that all TVs and computers sold in the United States meet high fire safety standards.**

C. Summary

- **Mattresses do not require Deca to meet the tough new federal fire safety standards that go into effect in July 2007 for home uses.** Many safer options are available, and restricting deca would eliminate one option, that is currently neither used nor preferable[33].
- **Home upholstered furniture manufacturers can employ the same technologies used to flame retard mattresses to make their products flame resistant.**
- **Virtually the entire computer industry and some television makers already use safer alternatives that meet the highest fire safety standards <u>without</u> the use of Deca in the plastic casings.[34] The bill gives the remaining TV**

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[31] Pure Strategies Inc., Decabromodiphenylether: An Investigation of Non-Halogen Substitutes in Electronic Enclosure and Textile Applications, prepared for Lowell Center for Sustainable Production, University of Massachusetts Lowell, April 2005.

[32] Ibid.

[33] *Mattress manufacturers do not currently use deca. As an anecdote, I canvassed several mattress manufacturers and each technical representative I spoke with was adamant that they do not, nor ever plan to use PBDE flame retardants to meet fire safety standards.

[34] Pure Strategies Inc., Decabromodiphenylether: An Investigation of Non-Halogen Substitutes in Electronic Enclosure and Textile Applications, prepared for Lowell Center for Sustainable Production, University of Massachusetts Lowell, April 2005. "… nearly all (electronic) manufacturers have the technology and know-how to meet the demand for decaBDE-free products that meet strict fire safety standards."

manufacturers ample time to switch to alternative flame-retardant resins with minimal costs associated.

III. Conclusion

In conclusion, I would like you take note of who's not in the room. In 2004, you considered a ban on deca, and at that time, nobody from the electronics industry showed up to defend it. Neither did any of the mattress manufacturers. We also didn't see any furniture manufacturers or any of their trade associations. And I have reason to be confident that you won't find any of these parties in the room today either.

The reason that they're not here defending deca is because **every one of them knows they can cost-effectively flame retard their products without the use of deca, and without the public health concerns associated with using it**, and that's the bottom line.

The only defenders of the chemical's use are the companies that profit from manufacturing 120 million pounds of it annually. They are the four companies that make up the Bromine Science and Environmental Forum. Chemtura, Albemarle, ICL Industrial Products and Tosoh Corp. are here because they are heavily invested in bromine chemistry and make a substantial amount of money from selling deca-BDE, one of their flagship products. The industry will tell you not to phase out deca because they believe there aren't good substitutes for it. They will go around and around about RDP, even though they themselves also manufacture it. And they will go to great lengths to distort the truth, as well saying that products will be more flammable as a result of this bill.

In Washington State, they handed out videos to legislators and the news media, depicting two televisions, one treated with deca, smoldering slowly, and the other TV – ostensibly ablaze with fire because it wasn't treated with deca. What they didn't tell the public was that the flaming television had no flame retardants in it whatsoever. This is a complete distortion of the issue. As you heard from previous testimony, you cannot buy a non flame-retarded television set in the United States. The marketplace simply won't allow it. This bill is not about banning flame retardants. It's about removing a dangerous chemical from the universe of flame retardant technologies used in the marketplace.

I would also point out that they used these same arguments, to no avail, when the bans on penta and octa were first proposed. I hope you will see from the testimony provided that **it's clear that we can have fire protection without threatening the health of our children and wildlife. There are safer alternatives in use that meet the highest fire safety standards without compromising public health and safety.** We urge you to pass this bill. Thank you for your time.