The Honourable Steven Guilbeault
Minister of the Environment
c/o Christina Paradiso
Executive Director Chemicals Management, Environmental Protection Branch
Department of the Environment
351 Saint-Joseph Boulevard, Gatineau, Quebec K1A 0H3
Email: ec.interdiction-prohibition.ec@ec.gc.ca

Re: Notice of Objection and Request for Board of Review in relation to proposed regulations prohibiting the manufacture, use, sale and import of decabromodiphenyl ethane (DBDPE, CAS Registry Number 84852-53-9) while providing exemptions to the prohibitions, Canada Gazette, Part I, Volume 156, Number 20 – May 14, 2022: Prohibition of Certain Toxic Substances Regulations, 2022.

Dear Minister Guilbeault:

As President of Phantom Plastics, I am writing to state my formal objection to the above-referenced ECCC regulatory proposal.

As provided for by section 332(2) of CEPA 1999, I am filing this Notice of Objection and respectfully request that a Board of Review be established, pursuant to section 333 of CEPA 1999, to "inquire into the nature and extent of danger" posed by DBDPE for the reasons set out below.

Executive Summary

Phantom Plastics has conducted an extensive review of the scientific peer-reviewed literature on DBDPE and consulted with commercial users of this specific flame retardant additive to assess the potential impact of the proposed ban.

The proposed ban is based purely on unfounded speculation about the possible degradation products of DBDPE. It was assumed, in a complete absence of supporting experimental evidence, that the degradation pathway and products for DBDPE would be similar to those for the banned substance DecaBDE.

That assumption was not valid; and, in fact, peer-reviewed evidence demonstrates that DBDPE does not behave at all similarly to DecaBDE; and so, using the latter as an analogue for the former is both inappropriate and unscientific. DBDPE does not

degrade under environmental conditions and is therefore safe. Furthermore, DBDPE does not degrade to the toxic substances hypothesized by the ECCC.

Banning a lifesaving additive without evidence would be rash in the extreme; and yet, the present proposal is to ban one safe additive simply because it looks somewhat similar to another, unsafe additive. Just as it would be unjust to incarcerate one innocent person because they look similar to another guilty person, it would be unjust to ban DBDPE because it looks somewhat similar to DecaBDE. Chemistry is a science and determinations cannot be made based on appearances and assumptions – only scientific testing and peer-reviewed data from such testing can be used as the basis for decision making.

As DBDPE saves lives, it would be illogical, unjust and unwise to ban it without overwhelming evidence of harm, and that evidence simply does not exist. In this instance, the precautionary principle has been misapplied. The current proposal will increase harm to human health and mortalities without any evidence of benefit.

Introduction

Phantom Plastics is a leading independent consultant formulating plastics, including flame retardants, for companies including P&G, Apple, HP and hundreds more, both in Canada and globally. My credentials as a recognized expert regarding plastics and the environment include authoring The Plastics Paradox book. (My complete biography, including relevant experience and qualifications on this matter, is attached as an appendix to this filing).

Crucially, Phantom does not sell, distribute market or use brominated flame retardants. Rather, our sole intention is to ensure that beneficial policies are promulgated based purely on scientific facts and logic stemming from those facts.

The goal of government policy should always be to protect the public; and sound policy must always be the result of careful deliberation once those scientific facts have been ascertained. This report summarizes all of the pertinent evidence in order to provide a platform upon which to come to a proper conclusion.

The Safety of Brominated Flame Retardants

Certain low molecular weight brominated flame retardants were found to migrate and bioaccumulate. Scientific evidence led to a justified ban and the public was protected. That initial experience produced a new generation of brominated flame retardants. Lessons were learned, and the new additives were larger molecules to hinder

migration. In the case of DBDPE, the molecule has extremely low solubility which dramatically reduces exposure.

What Evidence is there that DBDPE is a Threat to Human Health?

After a review of the scientific literature, I found extensive testing had been performed but could find no evidence that DBDPE is a threat to human health. This view is the same as that of the many regulatory agencies around the world.

Decabromodiphenyl ethane (DBDPE) brominated flame retardant CAS 84852-53-9

Degradation of DBDPE

The proposed ban is based purely on unfounded speculation about the possible degradation of DBDPE. It was incorrectly assumed that the degradation pathway and products would be similar to those for the banned substance DecaBDE.

"DBDPE testing under longer-term (e.g., greater than 6 month), environmentally relevant conditions to determine the degradation pathways and transformation products is lacking (possibly influenced by analytical challenges). Nevertheless, potential DBDPE transformation products were evaluated on the basis of predictions from photodegradation studies and biodegradation modeling, and by considering analogue decaBDE transformation products."

Screening Assessment Certain Organic Flame Retardants Substance Grouping
Benzene, 1,1'-(1,2-ethanediyl)bis [2,3,4,5,6- pentabromo-Decabromodiphenyl ethane (DBDPE)
Chemical Abstracts Service Registry Number 84852-53-9 Environment and Climate Change Canada Health Canada May 2019

It is the use of "modeling" by the ECCC which is incorrect and misleading. Modeling is just a fancy scientific name for guessing and we should not make decisions affecting the lives of our fellow human beings based on guesswork.

Let us instead examine the peer-reviewed science.

"The current photolytic degradation experiments were performed on DBDPE in solvents and on silica gel. Large differences in the photolytic degradation behaviors of DBDPE may exist between lab matrixes and the natural environmental media such as atmospheric particles, soil, and water as suggested previously for deca-BDEs (Raff and Hites, 2007). Additional evidence is therefore needed to understand the potential

photolytic degradation kinetics and to examine the occurrence of degradation intermediates of DBDPE in the real environment."

J. Wang et al., Photolytic degradation of decabromodiphenyl ethane (DBDPE), Chemosphere, 89, 844-849, 2012

The study indicated that DBDPE degrades under ultraviolet light in solvents. However, they correctly note that the conditions in the real-world environment are completely different. Any substance can be made to degrade under harsh laboratory conditions. That is not what matters though. What matters is whether or not DBDPE degrades to toxic substances under real environmental conditions.

Another study specifically states that DBDPE does not at all degrade in the same manner as DecaBDE. Whereas the banned molecule debrominates to form toxic substances, DBDPE does not. **This proves that using DecaBDE as an analogue for the behaviour of DBDPE is not valid.**

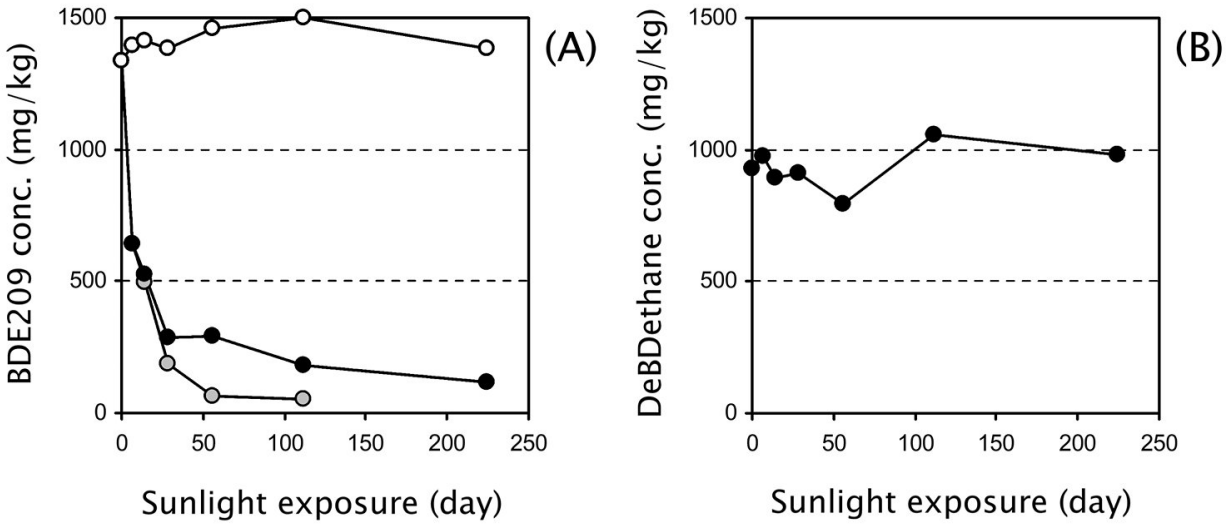
"*The resistance of DeBDethane against debromination compared to DecaBDE might be attributable to differences in molecular structure, i.e. the ether bond in BDE 209 and the aliphatic C-C bridge in DeBDethane.*"

and

"*Photodebromination of technical decabromodiphenyl ether (DecaBDE) incorporated into high-impact polystyrene (HIPS) and TV casings was compared under natural sunlight conditions with that of technical decabromodiphenyl ethane (DeBDethane). BDE 209 in pulverized HIPS+DecaBDE samples degraded with a half-life of 51 days. In contrast,* **no marked loss of DeBDethane occurred throughout the experimental period of 224 days***. During BDE 209 photolysis in HIPS+DecaBDE samples, partly debromination to nona- and octa-BDE was observed, however,* **environmentally relevant polybrominated diphenyl ether (PBDE) congeners such as BDE 47, 99, and 100 were not formed.**"

N. Kajiwara et al., Photolysis Studies of Technical Decabromodiphenyl Ether (DecaBDE) and Ethane (DeBDethane) in Plastics under Natural Sunlight, Environmental Science & Technology, 42, 4404-4409, 2008

The scientists found that when inside plastic, DBDPE does not degrade in UV light. This is more concrete evidence that banning DBDPE is unfounded. The proposed ban is based on an incorrect guess that it would degrade under UV light to form toxic substances, when, in fact, we know that does not happen.



On the left, the scientists show the rapid degradation of the banned DecaBDE under UV light, whereas on the right they show that DBDPE does not degrade. **The proposed ban was based on the statement that no experimental evidence existed on this matter; and so, they thought it appropriate to take a guess at what might happen. Apparently, they did properly consider this peer-reviewed evidence.** There was no need to guess about the degradation of DBDPE, and so the foundation for the proposed ban has been invalidated.

I have seen further work showing that DBDPE does not degrade under real conditions and does not degrade to the toxic substances proposed by the ECCC in their modeling / guesswork.

"…calculated half-lives of more than 200 years vs. minutes in solution. Perhaps more importantly, **there is no subsequent debromination to the octabrominated congeners and lower**. No evidence of debromination is seen in PP, which confirms that matrix effects are important. EBP is much more photolytically stable in resins than decabromodiphenyl ether (DecaBDE), and read-across comparisons between the two are misleading."

R. S. Mathur et al., Photolysis of ethane-bis(pentabromophenyl) (EBP) flame retardant in resins, manuscript in preparation.

I understand that this data has been submitted independently for your consideration. This is categorical proof that the "modeling" used by the ECCC was completely unreliable and should be discarded because experimental data disproves it.

The Use of Modeling

As the ECCC has based the proposed ban entirely on modeling, it is appropriate to discuss what modeling is and whether it is the correct tool for such a recommendation.

Modeling is a tool that chemists and other scientists sometimes use to predict the properties of chemicals. It has been used for decades, and although it has developed a great deal, we still cannot rely on predictions from modeling. For example, drug companies use modeling to find potential molecules to screen as new drugs. The results of the modeling are therefore just used as a hint as to what experiments need to be done. New drugs are never launched based on modeling alone, because it would be unsafe and unscientific to use the guess of a computer program to discover new drugs.

Another example of modeling that the layperson can relate to is weather forecasts. When we are not sure of the weather in the future, we ask a computer program to model the weather and take a guess at the future. We all know that this sometimes works, and sometimes does not work.

It has happened to me that I stood outside in the rain while my weather app, working from a computer model, told me that it was not raining. The sensation was eerie. The computer was convinced that it was not raining; and yet, in the real world, my own senses told me that it was indeed raining.

Now let us discuss the ECCC's use of modeling. They claimed that in the absence of scientific, real world experimental data, they needed to use modeling instead. The model made some guesses about how DBDPE might behave, and then the ECCC made a recommendation to ban the flame retardant. That use of modeling is incorrect and not proper science. As with the case above about the development of drugs, the model should only be used to suggest what experiments to do. It cannot and should not be used to make policy decisions, because it is only a guess.

As we have seen in this report, the experimental evidence does exist. We know that DBDPE does not act like the banned decaBDE, so the model was working from a false assumption. We also know from experimental evidence that DBDPE does not degrade in UV light. Lastly, we know that it does not degrade into the toxic substances that the model predicted.

Many companies have sent objections to the Canadian Government showing them conclusively that the actual scientific data simply does not support the Government's

proposed action. In each case the Minister's response has been to deny the request on the grounds of:

"not raising sufficient uncertainty or doubt in the scientific considerations of the underlying the proposed regulations…"

This response is not appropriate. The Minister is saying that he would prefer to believe a disproven guess over real, peer-reviewed scientific evidence to the contrary. That is unwise, unscientific and not in the best interests of the public.

Let us compare what the Minister has said to the analogy above of the weather forecast. In our analogy, the Minister is standing outside in the pouring rain (real-world data) and insisting that it is not raining because his weather app (computer model guess) says that it is not raining. Believing a guess when the real world evidence says the opposite is unwise to say the least.

Conclusions

Brominated flame retardants including DBDPE are proven to save lives. Alternative flame retardants do not perform as well, and, in many cases, they fail to pass the flame retardancy safety tests, putting lives at risk.

There is no scientific evidence that DBDPE is toxic. It has high molecular weight to prevent migration, and crucially, it is extremely insoluble, which prevents exposure.

The proposed ban in based on pure guesswork. Based on the appearance of the DBDPE molecule, someone has speculated / modeled that it will degrade to form toxic substances. However, there is no scientific experimental evidence to support that speculation. Therefore, banning DBDPE would be as foolhardy and unjust as convicting an innocent person based on hearsay. Sound science and justice both depend upon evidence, and, in this instance, there is no evidence of harm.

Furthermore, the proposed ban was based on an assertion that no scientific evidence existed to show how DBDPE actually degrades. That assertion was incorrect. Peer-reviewed science does exist and was overlooked. The data clearly show that DBDPE does not degrade under environmental conditions, and thus the premise of the proposed ban is invalid. The proposed ban was based on a guess that certain toxic substances would form during degradation of DBDPE when experimental evidence shows that the guess was incorrect and invalid.

In summary, the ECCC proposed a ban based on these invalid assumptions:

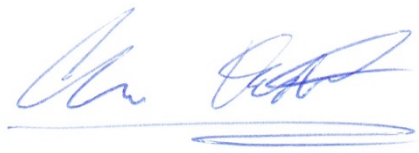
1. That DBDPE degrades rapidly like DecaBDE – disproven by experiment
2. That DBDPE forms toxic substances like DecaBDE – disproven by experiment
3. That a model /guess should be used because experimental data was not available – disproven – models cannot substitute for real data and experimental data does exist

Brominated flame retardants save lives, especially among the vulnerable, including the very young and the elderly. Fires often start in the home when the occupant is asleep, and flame retardant regulations enacted by responsible governments have halved the number of fatalities. Removing one of our most powerful weapons for saving lives would be the exact opposite of applying the "precautionary principle".

As an independent expert, Phantom Plastics implores the Minister to appoint a Board of Review to "inquire into the nature and extent of danger" posed by DBDPE because, at present, there is no scientific justification for a ban.

Your faithfully,

Dr. Chris DeArmitt FIMMM, FRSC, CChem
President
Phantom Plastics



July 12th 2022

Statement of interests: Phantom Plastics was retained by Albemarle to conduct an independent review of the science around brominated flame retardants. Subsequently, Phantom Plastics asked Albemarle for permission to use some of the findings from that review for this objection letter. We wish to express our gratitude for permission to use those findings.

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Expert Witness Resumé – Dr. Chris DeArmitt FIMMM, FRSC, CChem

Qualifications

Dr. Christopher DeArmitt FRSC, CChem, FIMMM
Dr. DeArmitt obtained a BSc (Hons) in Chemistry with Polymer Science from the University of Sussex, United Kingdom. He then obtained his MPhil and PhD from the same establishment, also in the polymer field.

He has over 30 years of industrial experience in plastics and formulation of plastics including additives such as fillers, reinforcements, antioxidants (stabilizers), impact modifiers, pigments and slip aids. Dr. DeArmitt is considered one of the foremost experts on plastic materials and additives for plastics. The Fortune 100 regularly enlist his assistance.

He was elected Fellow of the Royal Society of Chemistry (FRSC) and is a Chartered Chemist (CChem). Dr. DeArmitt is also Fellow of the Institute for Materials, Minerals and Mining (FIMMM).

Dr. DeArmitt was Manager of the Polymeric Materials Group at the Institute for Surface Chemistry in Stockholm. He created multi-national, multi-client projects on the topics of polymers, mineral fillers and antioxidants. During that time, he worked with the KTH Stockholm to create new hyperbranched, high molecular weight antioxidants to provide extraction resistance and long-term performance.

He was Senior Project Manager at Electrolux (known as Frigidaire in the US) in which capacity he led a team to optimize Carboran, a polypropylene material which Electrolux uses in amounts exceeding 55,000 metric tons (over 120 million pounds) per year. Optimization of the fillers and antioxidant package were major topics. Later, Dr. DeArmitt ran a project which identified new natural antioxidants for polypropylene. Work included plastic materials selection formulation and testing for appliances.

As Global Product Development Manager at BASF's headquarters in Germany, Dr. DeArmitt worked on a wide range of styrenic polymers such as polystyrene, HIPS, ABS, ABS/PA and ASA including competitor analysis, new product creation and new additives to give extended durability. Several patents resulted.

As President of Phantom Plastics LLC, Dr. DeArmitt creates new plastic materials, solves problems and provides training to well-known companies like P&G, Apple, Exxon, Disney, Total, Eaton and more.

Publications to date include 3 encyclopedia chapters, 14 book chapters, 2 books over 40 articles and 16 granted patents.

Recent Testimony – Chris DeArmitt PhD FIMMM FRSC CChem

2017 Deposition / trial testimony on behalf of the Plaintiffs against the Defendant Boston Scientific Corporation - Transvaginal Mesh Medical Product Cases – Superior Court of California – County of Los Angeles – Central Civil West, Judicial Council Coordination Proceeding No. 4733

2019 The Independent Medicines and Medical Devices Safety Review of the UK Government regarding the safety of polypropylene vaginal and hernia repair mesh. Dr. DeArmitt gave written evidence free of charge in order to protect the public from harm.

Curriculum Vitae

Conference Chairing and Organizing
Polymer Degradation & Stabilisation Conference (Sweden 1999) – Organizer
Functional Fillers for Plastics, Intertech, (2002, 2007, 2008) – Chairman & Organizer
High Performance Plastics, RAPRA, Cologne (Germany 2011) – Organizer
Minerals in Compounding 2010, AMI, Atlanta Georgia (USA 2010, 2011, 2012) – Chairman / Organizer

Presentations
Conference in Mineral Processing (1999)
Macromolecules '99
Functional Fillers for Plastics (2000, 2002, 2003, 2004, 2005, 2007, 2008)
Nano-structured Materials (2002)
Engineering Thermoplastics (2004)
High Performance Fillers (2005*, 2006, 2007)
Cosmeceuticals Summit 2008
AddCon 2008
Nanopolymers (2008, 2009)
NPE/Antec (2009)
Advanced Materials Symposium (2009)
USM Business School (2009, 2010)
Smart Polymer Systems (2010)

Minerals in Compounding (2010, 2011**, 2012)
Plastics Modification: Additives, Compounding & Coatings (2011, 2012)
Silicone Elastomers 2011
Dragonite – SPE New Jersey Section 2011
Fire Retardants in Plastics 2012
InnoPlast Solutions 2012
BCC 2012
Polymer Foam 2012
Fire Retardants in Plastics 2014
Polymers in Cables 2014**
NPE/Antec (keynote) – USA (2015)
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Sky News Implanted PP Mesh Report with Correspondent Charlotte Lomas-Farley July 29th 2019
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SPE – Plastics & The Environment: Dispelling Popular Myths with Scientific Facts – July 2020
Rotary Club – PLASTICS & THE ENVIRONMENT Facts for a Brighter Future – August 2020
AP Mexico – Plastics & the Environment Interview – August 2020
British Plastics Federation – November 2020 – The Plastics Paradox
Association of Plastic Processors – Russian Federation – February 2021
Global Research and Innovation in Plastics Sustainability (GRIPS) March 17th 2021 – What does the evidence say about plastics in the environment?
AMI Functional Fillers Virtual Summit March 18th 2021
UC Berkeley – Deplastify the Planet 2021
The Plastics Paradox: verità sorprendenti sul materiale che usiamo tanto ma conosciamo poco (~500 registrants)
The Great Plastics Distraction INEOS August 2021
The Plastics Paradox – The Truth about Plastics & the Environment European Plastic Converters October 2021 (>350 participants)

TPO Conference Society of Plastics Engineers October 2021 (typically 900 attendees from 20 countries on 4 continents)
AMI Compounding World EXPO, Cleveland, Ohio, Formulating with Fillers
Competitive Enterprise Institute, November 16th 2021 – The Plastics Paradox feat. Dr. Chris DeArmitt and Angela Logomasini
In-Cosmetics Formulation Summit, November 30th 2021 – The Great Plastics Distraction Part 2
*Voted best presenter
** Voted best presentation and best presenter

Publications (excluding conference papers)
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C. DeArmitt, Compounding World, July / August 2010.

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