

# UECAP™

The Voluntary Emissions  
Control Action Program

## BENCHMARKING FOR SUCCESS

NORTH AMERICAN ANNUAL PROGRESS REPORT 2010





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# HIGHLIGHTS

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- 1 Overall trend demonstrates a reduction in the potential emissions of flame retardants (Deca-BDE, HBCD and TBBPA<sup>1</sup>) due to the application of VECAP principles
- 2 Increase in VECAP certification from 3 to 5 sites, representing the highest possible level of commitment to the program's objectives
- 3 High level of implementation of best practices by TBBPA users, leading to 89% controlled packaging waste disposal
- 4 Research to date indicates that users are following best practice recommendations by disposing of waste packaging using chemically secure landfills or incineration

This report is designed to provide transparent and concise information on the progress of the Voluntary Emissions Control Action Program (VECAP) in North America. Feedback or comments are welcome and those submitted will be considered for inclusion in future reporting publications.

All information acquired from the companies that participate in VECAP is managed in full compliance with anti-trust regulations. All informational data is managed by an independent third party. Only data that has been aggregated by the independent third party is shared among the companies. The VECAP independent third party is the only entity with access to the confidential potential emissions data of all participants.

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# Responsible Care<sup>®</sup> and VECAP<sup>™</sup>

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VECAP is an example of Responsible Care in action. Responsible Care was launched in 1985 by the Canadian Chemical Producers' Association (CCPA). It is a unique initiative for the safe and environmentally sound management of chemicals that has spread to more than 50 countries around the world and has taken firm root in the United States. Based upon the Canadian program, the American Chemistry Council<sup>2</sup> (ACC – formerly the Chemical Manufacturers Association) launched the U.S Responsible Care initiative more than twenty years ago to ensure that health, safety, security and protection of the environment are top priorities of the chemical industry. Participation in the Responsible Care initiative is mandatory for members of the ACC. Widely recognized as one of the largest and most successful voluntary performance initiatives advanced by any industry, Responsible Care helps North America's leading chemical companies go above and beyond government requirements, and collectively share their progress with the public.

VECAP aligns well with the tenets of Responsible Care as it offers a structured approach to meet the program's desire for the safe and environmentally sound management of chemicals. Application of VECAP principles is a tangible and visible demonstration of a company's commitment to Responsible Care.

<sup>1</sup> Deca-BDE, HBCD and TBBPA refer to Decabromodiphenyl ether, Hexabromocyclododecane and Tetrabromobisphenol A respectively

<sup>2</sup> [www.americanchemistry.com](http://www.americanchemistry.com)

# I. INTRODUCTION TO VECAP



**The Voluntary Emissions Control Action Program (VECAP) is an innovative and excellence-driven way of managing chemicals. It demonstrates the proactive involvement of companies committed to acting in the best interests of society and the environment. VECAP aims to reduce emissions of polymer additives through the promotion of environmental and process best practices throughout the value chain, from producers to downstream users.**

In North America, VECAP aspires to set new standards for chemicals management in the workplace, both at manufacturing sites and within the value chain. It offers all companies – small, medium and large – equal access to industry expertise in environmental best practices, while setting benchmarks for other industries to apply similar principles. VECAP represents a voluntary and proactive effort to reduce emissions to the environment that exceeds present North American regulatory standards. VECAP is now implemented in all manufacturing plants for Deca-BDE, HBCD and TBBPA by the three main producers of flame retardants globally.

The VECAP program focuses on both producers and downstream users of flame retardants. However, in principle, the VECAP methodology can be applied to encourage emissions reductions of any type of solid or liquid chemical. In fact, member companies have started to apply the methodology to other flame retardants and chemicals substances beyond Brominated Flame Retardants (BFRs).

**VECAP is a tool for reducing environmental emissions by:**

- Increasing understanding of chemicals management in the value chain beyond existing legislation

- Promoting and facilitating open and constructive dialogue with all interested parties, such as industry, regulators and other stakeholders
- Raising awareness among all those involved in the process, from the shop floor to the boardroom
- Implementing best practices identified through the development of the program

**BACKGROUND AND EVOLUTION**

The origins of the VECAP lie with three member companies of the European Flame Retardant Association (EFRA)<sup>3</sup>, who, in 2004 and in partnership with the UK textile industry,

developed a code of good practice for Deca-BDE. The code of practices was then used by the textile industry to assess their processes and take actions to reduce emissions. Subsequently, over the following 6 years, VECAP was extended to include HBCD and TBBPA and at that same time, was expanded to North America and to flame retardant manufacturing plants worldwide.

The program was launched in North America in 2006. Since then, a significant number of Deca-BDE, HBCD and TBBPA users in the United States and Canada have committed to implementing VECAP. This is the third North America progress report published by the North American VECAP team, following reports published in 2007 and 2009<sup>4</sup>.

## HOW DOES VECAP WORK?

The VECAP process is driven by the principle of continuous improvement by seeking opportunities to update the program methodology to better address any new issues that may arise.

In general, flame retardants are derived from naturally occurring elements that are incorporated into materials such as plastics, foams and textiles. They fulfill a vital function: they delay the start of a flame, slow down the combustion process, or even make the material self-extinguishing. Since they reduce the risk of a fire spreading, the use of flame retardants is critical in providing people with more time to escape from fires, and extending a firefighter's time to respond. Flame retardants are commonly used in many domestic and industrial appliances such as computers, TVs, mobile phones and insulation boards in order to comply with fire safety standards. They are also incorporated into a wide range of materials and textiles for mattresses and upholstered furniture. Three flame retardants are covered by this report: Deca-BDE, TBBPA and HBCD. Their specific uses are described in subsequent sections of the report that present the survey results.

VECAP does not physically measure emissions from chemical processes, but rather estimates potential emissions through practical experience, modeling and studies. These estimates are obtained through users responses to

questionnaires. Though it is possible for users to insert their own values whenever they have measured data available, the questionnaires utilize 'default values' for estimating the emissions from processes where actual values are not determined. Default values are based on values measured during operating processes and through modeling.

The traditional means of controlling emissions focuses on the use of end-of-pipe systems, i.e. treatment of waste streams. However, this approach can miss significant steps in the waste generation process. The VECAP methodology allows companies to identify possible sources of emissions throughout their use cycle of a product, and implement measures to reduce or avoid them.

## VECAP CERTIFICATION

Companies are participating in VECAP by working to reduce emissions of flame retardants in their manufacturing plants. The next step in the evolution of VECAP at a use site is to work towards incorporating VECAP into management systems to aid its long term success. In 2009, a certification scheme was launched based upon ISO 9001/14001 principles. This scheme was developed in association with Bureau Veritas<sup>5</sup>, with environmental audits carried out by independent auditors. Since the inception of VECAP, independent certification has been the final step in demonstrating a commitment to a continuous improvement process inherent in VECAP. The certification process is designed to be easy to follow. The certification scheme for Small and Medium Enterprises (SMEs) incorporates only the VECAP process and use of best practices, while larger companies can also include VECAP principles in their written management systems to align with other standards like ISO 14001 or Responsible Care® management systems.

By the end of 2010, five sites had received certification: two in Europe (one producer and one downstream user), two US-based production sites and one production site in Israel. Looking ahead, we believe that increasing the number of certifications, including user sites, is important for the program's long-term development.

## THE VECAP TEAM AND EMISSIONS SURVEY TOOL

VECAP's success in addressing emissions is due to the combined efforts of a team of professionals with knowledge of polymer additives production and application processes. Members of the product stewardship team include a North American representative from each company, European oversight representatives from each company, and an independent third party for data management. The product stewardship team develops the tools needed for the methodology, including the questionnaires, which focus on potential emissions from processes and packaging to air, water and land.

Once the user has completed the questionnaire, a survey report is issued by the VECAP team highlighting potential emissions. Consequently, the user receives recommendations on how best to achieve emission reductions. If these recommendations are implemented, an updated emissions report is issued and sent to the user. In some cases, further recommendations are made, since continuous improvement is key to the success of this voluntary program.

A full survey of every user is not undertaken each year, as the VECAP team focuses on 'new' participants and areas where the greatest emission reductions may be expected, based on analysis of the previous year's survey.

<sup>3</sup> Albemarle Corporation, Chemtura Corporation and ICL Industrial Products

<sup>4</sup> To access the reports please go to [www.vecap.info/publications-2](http://www.vecap.info/publications-2)

<sup>5</sup> [www.bureauveritas.be](http://www.bureauveritas.be)



**EMISSIONS DATA COLLECTION & REPORTING**

To ensure full compliance with anti-trust regulations, no customer data or volumes are directly shared among the companies that participate in VECAP. Consequently, survey results are consolidated under the oversight of an independent third party. When more than one producer is supplying the same user, the volume supplied is aggregated by the third party data management team. Only the aggregated data is shared among the companies. Data are then assessed to obtain estimated potential emissions in grams/tonne. The VECAP independent third party is the only entity with access to the confidential potential emissions data of all participants. The consolidated results of the surveys from 2010 are presented in this report.

<sup>6</sup> For more information, visit: [www.vecap.info/europe/user-documentation](http://www.vecap.info/europe/user-documentation)

**PROVIDING SUPPORT FOR VECAP USERS**

VECAP helps companies implement best practices and make continuous improvements. The VECAP system begins with user commitment to the program, adopting the code of good practice and applying these principles to procedures and work instructions related to

daily operations. As an annex to the code, best available technique (BAT)<sup>6</sup> guidance documents have been developed for emptying packaging and intermediate bulk containers (IBC), drums or containers efficiently.



**FIGURE 2: Process of Handling and Treating Chemicals**

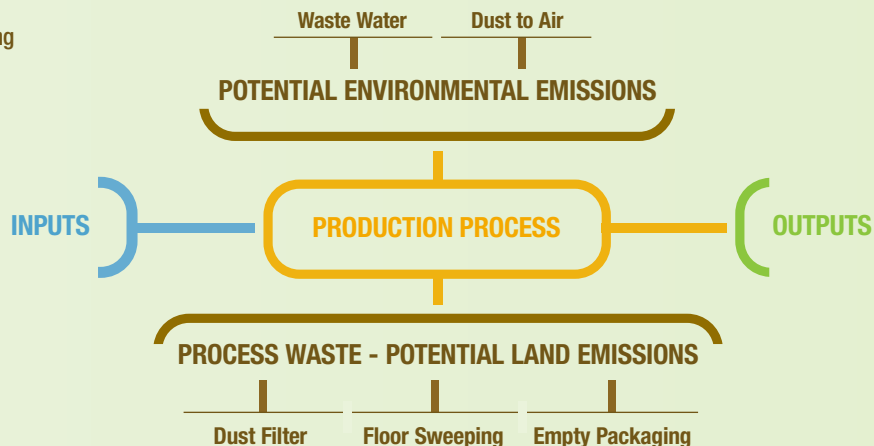
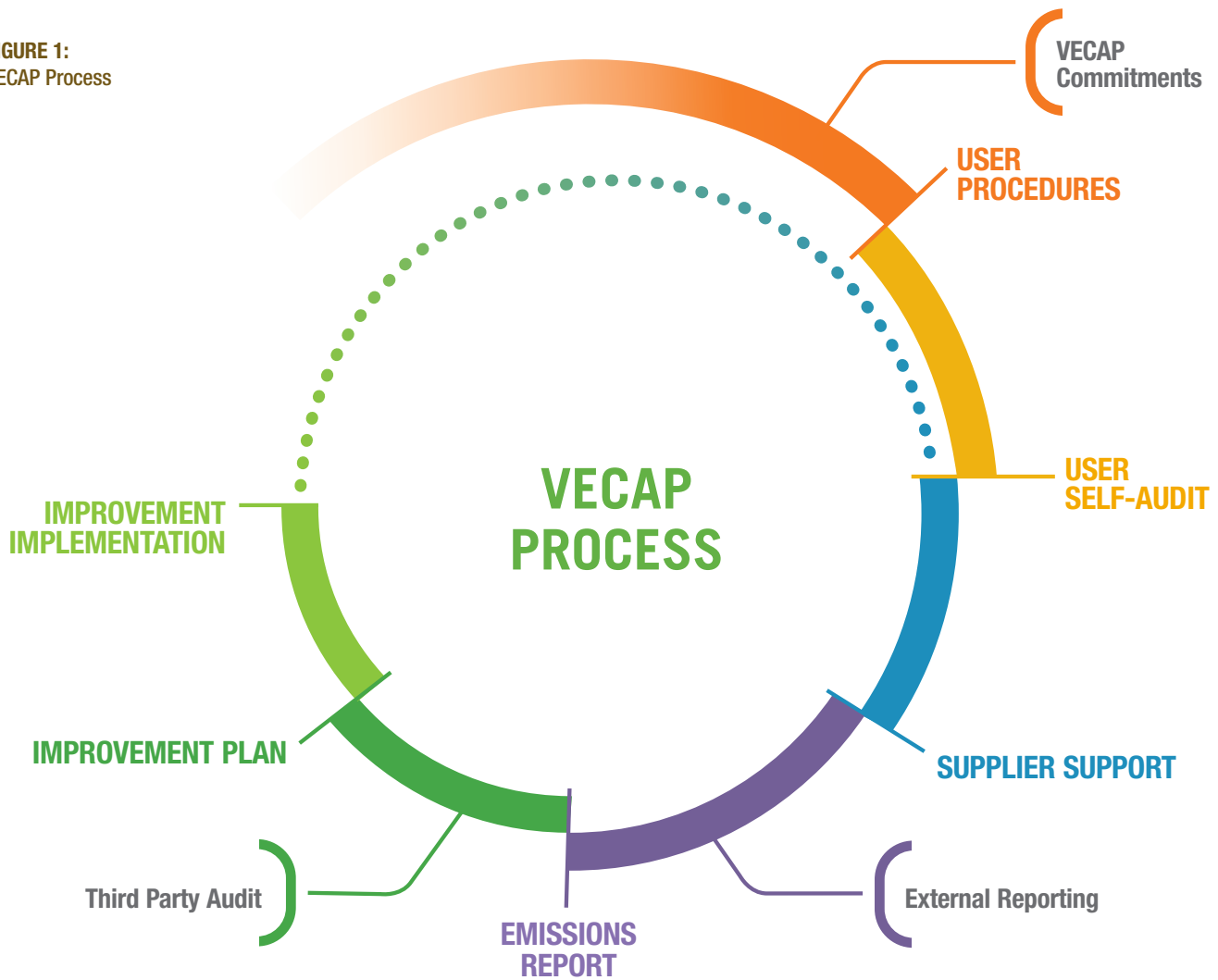




FIGURE 1:  
VECAP Process



## HANDLING AND TREATING CHEMICALS

Listed below are examples of where flame retardant emissions can occur, highlighting critical points in the process of handling and treating chemicals:

### MANUFACTURING

- 1 Production
- 2 Packaging
- 3 Shipping

### PROCESSING

- 1 Dust from unloading and feed operations
- 2 Leaks in feed equipment on production lines
- 3 Inadequate or missing air filters
- 4 Improper clean-up of spills

### WASTE DISPOSAL

- 1 Residues in packaging
- 2 Poorly treated wastewater from system wash-outs
- 3 Waste not reprocessed
- 4 Use of landfills that are not chemically secure
- 5 Unintended emissions, for instance, those associated with the recycle of waste packaging.

## II. VECAP PROGRESS REPORT 2010



### OVERVIEW OF THE 2010 SURVEY

In 2010, 69% of the total volume of Deca-BDE, HBCD, and TBBPA sold by BSEF member companies (Albemarle, Chemtura, and ICL-IP) was covered by the survey.

Survey participants that sign up to the code of good practice and take all necessary steps to reduce levels of potential emissions. Participation in the program dropped slightly between 2009 and 2010 primarily due to user sites changing their source of supply from VECAP participating companies to non-VECAP participating companies.

It should be noted that these participation figures relate only to users and volumes supplied by BSEF member companies. While volumes supplied by non-BSEF members are not included, we believe that the handling of

products by these users will not be significantly different from volumes supplied by BSEF members, provided they are implementing VECAP practices.

### KEY FINDING

Currently, the majority of identified potential emissions are due to unknown packaging waste disposal routes or disposal to a landfill which is not chemically secure (defined as a landfill without liners and leachate control associated with modern facilities). VECAP continues to address this issue very carefully and is in the process of gaining a better understanding of the impact of certain practices, such as the technical capabilities and regulatory requirements of landfills used to dispose of packaging waste.

FIGURE 3: Deca-BDE 2010 total potential emissions

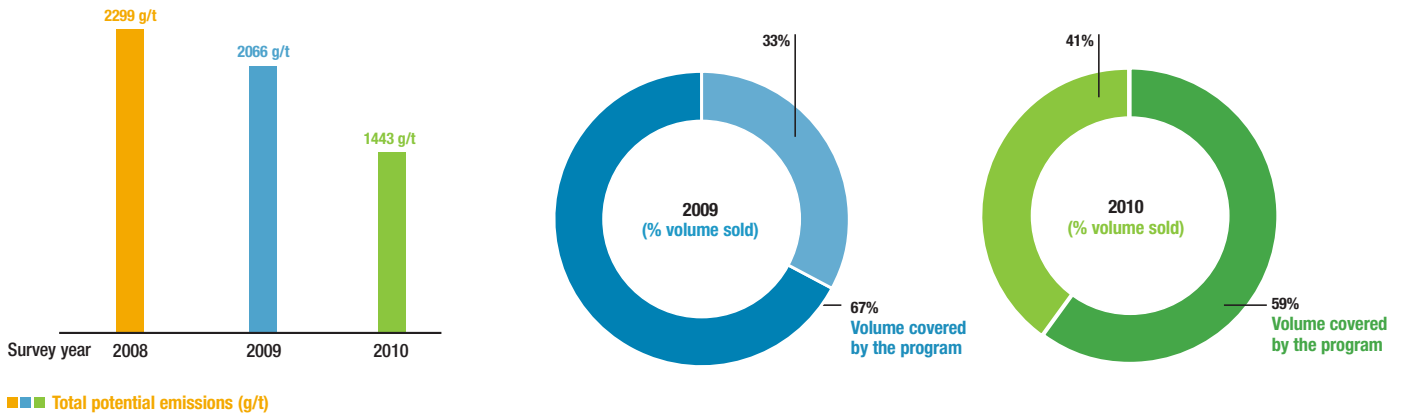


FIGURE 4: HBCD 2010 total potential emissions

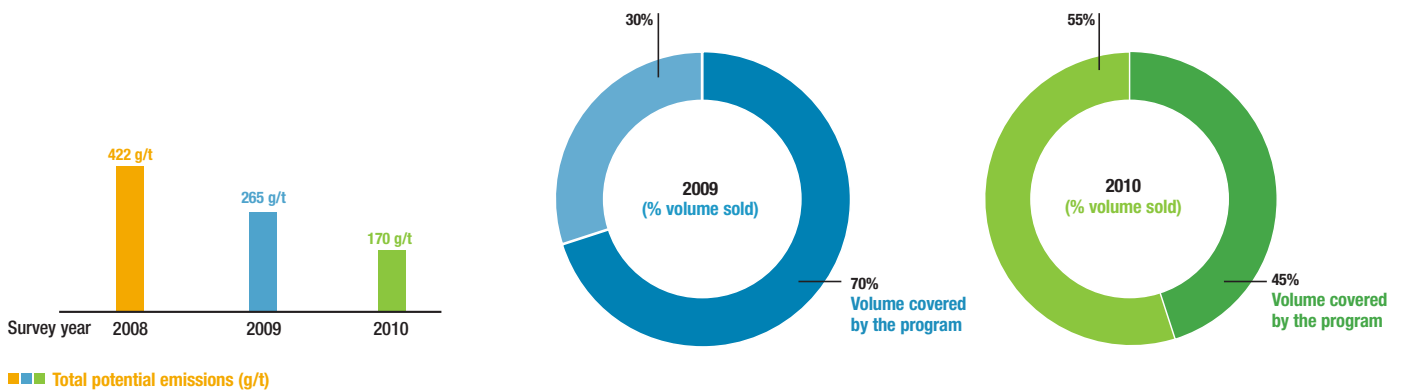
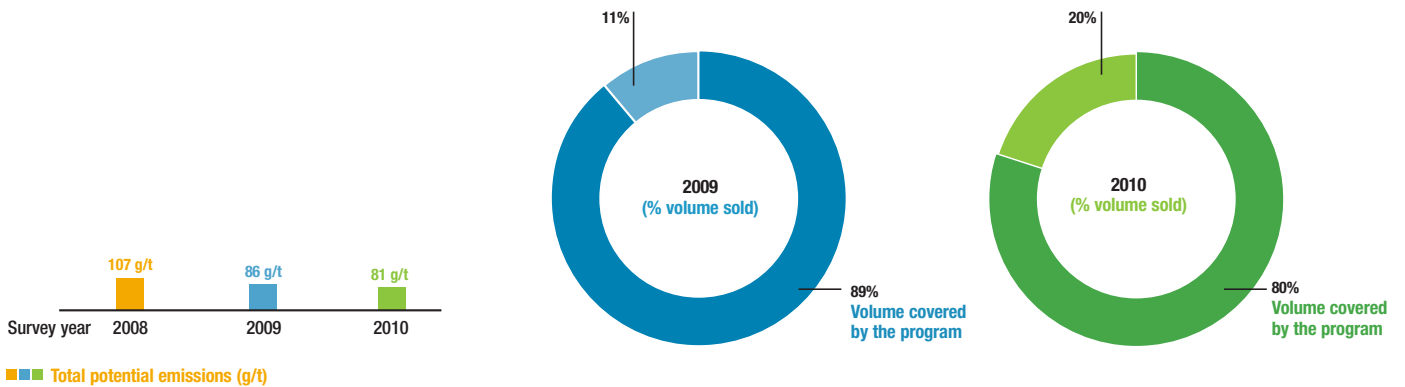


FIGURE 5: TBBPA 2010 total potential emissions



# DECA-BDE

**Decabromodiphenyl ether (Deca-BDE) is a highly effective flame retardant which increases a products resistance to ignition and can dramatically increase escape time in the event a fire does occur. It is used to prevent fires in textiles, in the transportation sector (e.g. automotive and aviation industries), in construction and buildings (e.g. wires, cables, pipes) and in electronic devices.**

## 2010 SURVEY RESULTS FOR DECA-BDE

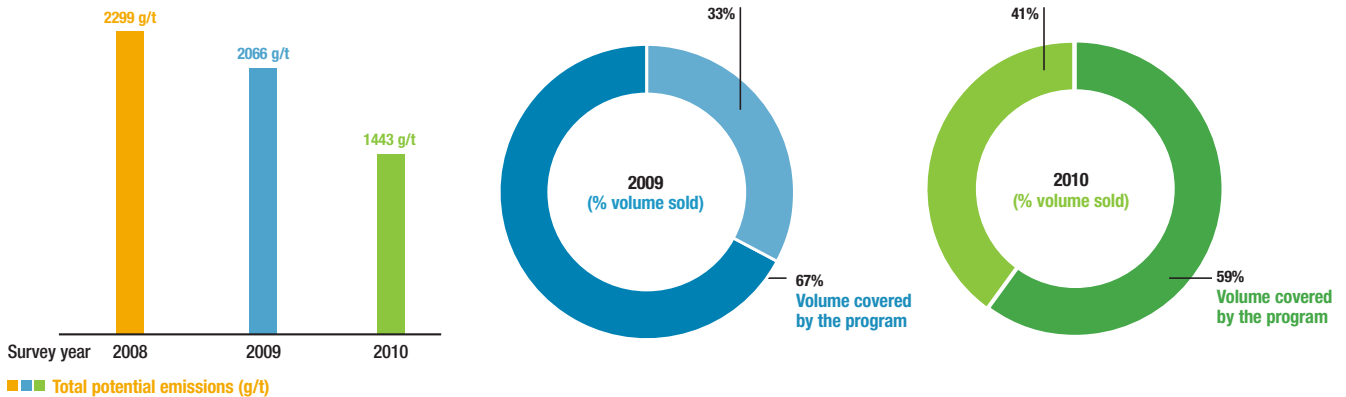
In 2010 the VECAP survey covered 27 out of 68 user sites in North America, which represents 59% of the volume sold by BSEF member companies.

For Deca-BDE, total potential emissions reported in 2010 are 1,417 grams/tonne representing less than 0.1% of the total volume sold to participating companies by BSEF member companies in 2009. Overall, total potential emissions have been reduced by 27% in

relation to the 2009 survey for volumes surveyed at VECAP participating companies.

Participation in VECAP remained good between 2009 and 2010. The slight decrease from 67% to 60% is believed to be due to fluctuations in user production locations.

**FIGURE 6: Deca-BDE 2010 survey results**

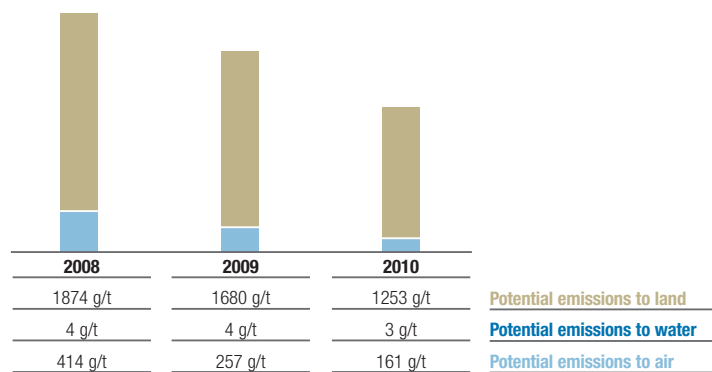


## 2010 POTENTIAL EMISSIONS TO AIR AND WATER

2010 findings show potential yearly emissions to air to be 161 grams/tonne for volumes surveyed, which represents a 37% decrease compared to 2009 figures. This was due to the introduction of best available technique practices.

Potential water emissions decreased by 25% from 4 grams/tonne to 3 grams/tonne for volumes surveyed.

**FIGURE 7: Potential Deca-BDE emissions by emission type (g/t)**

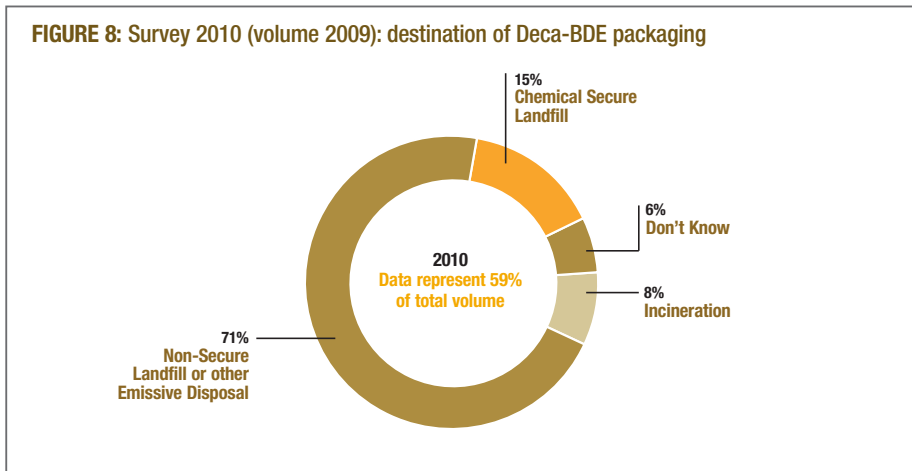


**POTENTIAL EMISSIONS TO LAND AND DESTINATION OF PACKAGING WASTE**

2010 data show a 25% reduction in potential land emissions from packaging waste, from 1680 grams/tonne to 1253 grams/tonne. This can be attributed to a better understanding of user’s packaging waste disposal practices.

The 2010 survey demonstrated that only 23% of Deca-BDE used packaging material was known to be handled according to best practices such as incineration or disposal in chemically secure landfill sites. In our data collection we assume the worst when data is unavailable. For example, we assume that packaging waste is ending up in

landfills that are not chemically secure when the users themselves were uncertain of the capabilities of the landfill utilized. However, when the product stewardship team verified the actual capabilities of the landfills used for packaging waste, it became apparent that it was being disposed of according to best practices and that our initial estimates were overstated. Future confirmation that landfills in use are indeed chemically secure, using liners and with leachate control, are expected to lower the total potential emissions to land in the future. The North American VECAP team has made it a priority to verify the capabilities of the landfills in use to dispose of waste packaging going forward.



**CASE STUDY: EAGLE PERFORMANCE PRODUCTS**

Eagle Performance Products is a company that manufactures latex back coatings and additives for use in automobiles, aircraft, military, construction, and health care applications. They have committed to VECAP at their plant to reduce emissions of flame retardant additives to the environment. By utilizing VECAP, Eagle was not only able to impressively reduce waste in packaging, reuse material formerly discarded as waste, and reduce polymer additive emissions to air at its own production facilities, but was able to transfer this product stewardship knowledge throughout the supply chain to assist its customers in dramatically reducing their product waste.

Eagle’s participation in VECAP helps demonstrate its position as an industry leader in environmental stewardship. Eagle’s president, John Friddle, states that, “Eagle will continue to be an advocate for VECAP and other waste reduction programs. We will persuade our customers and competitors to join in to protect the environment while continuing to use safe chemistry.”

Eagle Performance Products has implemented 5 initiatives that have reduced waste both in-house and with customers. These initiatives have resulted in savings of approximately 6,000 kilograms/year of formulated material and 11,500 kilograms/ year of polymer additives at the Eagle Performance Products plant, and approximately 36,000 kilograms/year of formulated product at its customer’s facilities.

# HBCD

**Hexabromocyclododecane (HBCD) is a flame retardant used mainly in thermal insulation foams to protect human lives and property from fire. Its main application is in expanded and extruded polystyrene (EPS and XPS) insulation foam boards widely employed by the construction sector. HBCD also has minor application in electrical boxes (high impact polystyrene) and in the back coating of textiles, mainly for upholstered furniture.**

## 2010 SURVEY RESULTS FOR HBCD

In 2010 the VECAP survey covered 9 out of 28 user sites in North America which represents 45% of total volume sold by BSEF members companies in 2009.

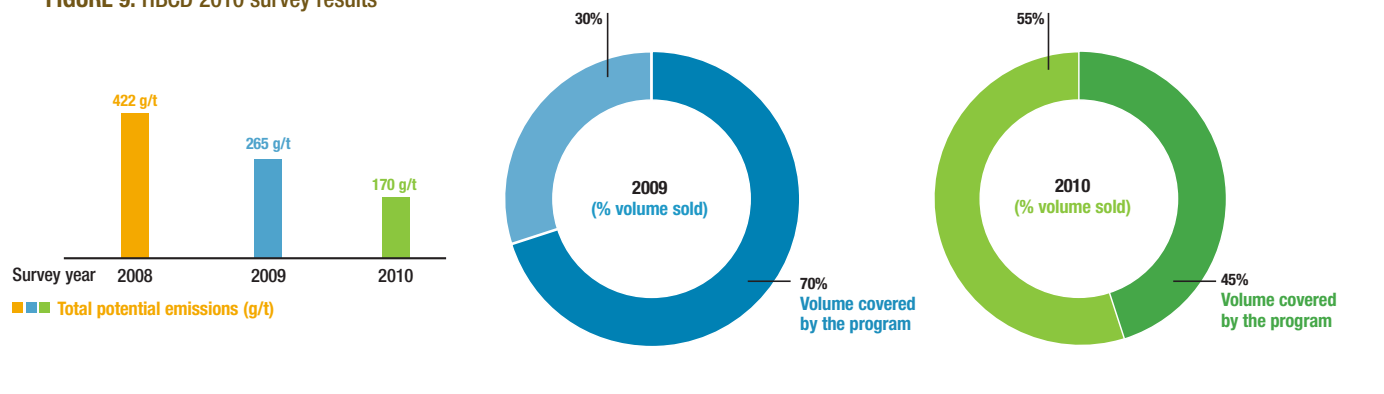
Participation has dropped by 25% in relation to the 2009 survey largely due to user sites

changing their source of supply to non-VECAP participating companies. A major emphasis on integrating more users into the program is planned for 2011.

For HBCD, total potential emissions reported in 2010 are 172 grams/tonnes representing less than 0.02% of the total volume sold by BSEF member companies in 2009. Overall, total

potential emissions have been reduced by 54% in relation to the 2009 survey for VECAP participating companies.

**FIGURE 9: HBCD 2010 survey results**

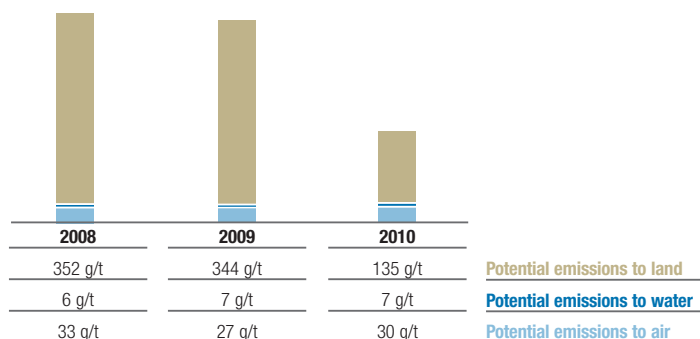


## 2010 POTENTIAL EMISSIONS TO AIR AND WATER

Potential air emissions in 2010 are at 30 grams/tonne for volumes surveyed, which is aligned with previous survey results. It should also be taken into account that these values are probably overestimated, due to the fact that low-dust granular material is increasingly being used, while the methodology for air emissions applies to HBCD in its powder form.

Potential emissions to water in 2010 remained flat at 7 grams/tonne for volumes surveyed.

**FIGURE 10: Potential HBCD emissions by emission type (g/t)**



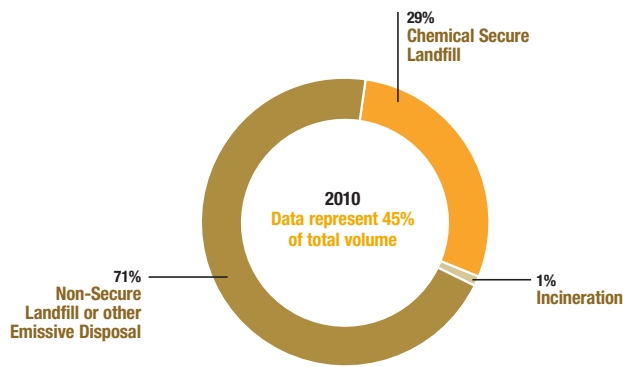
**POTENTIAL EMISSIONS TO LAND AND DESTINATION OF PACKAGING WASTE**

Potential land emissions are presently 135 grams/tonne, representing a reduction of 61% in relation to 2009. This reduction can be attributed to a better understanding of user’s disposal of packaging waste practices. Previous estimates of uncontrolled potential emissions of HBCD due to packaging waste residues were overstated due to the fact that if users were uncertain of their disposal practices then, in accordance with VECAP principles, calculations were made using the potential worst case scenario, that all

emissions were uncontrolled. Therefore, packaging waste was assumed to be going to non-secure landfill. However, when the product stewardship team inquired into to the destination of waste, it became apparent that it was being disposed of according to best practices (chemically secure landfill or incineration).

The 2010 survey shows that 30% of HBCD was known to be handled according to best practices. This figure is expected to increase as the users provide information on the destination of packaging waste.

**FIGURE 11: Survey 2010 (Volume 2009) destination of HBCD packaging**



# TBBPA

**Tetrabromobisphenol-A is the brominated flame retardant used mainly in the manufacture of printed wiring boards for use in electrical and electronic equipment. More than 90% of FR-4 printed circuit boards are believed to be produced using TBBPA.**

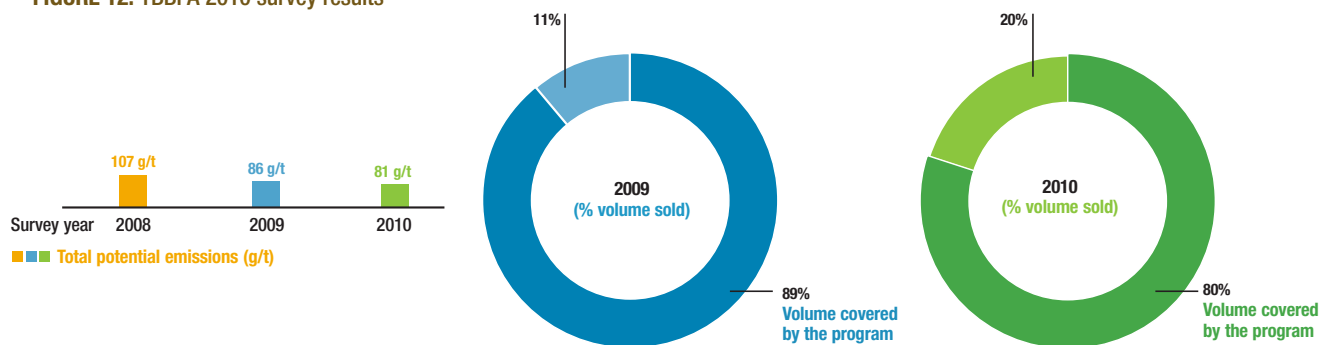
## 2010 SURVEY RESULTS FOR TBBPA

The VECAP survey covers 6 out of 23 TBBPA user sites in North America, representing 80% of total volume sold by BSEF member companies in 2009. For TBBPA, total potential emissions

reported in 2010 are 105 grams/tonne, which is less than 0.1% of the total volume sold by BSEF member companies in 2009. Overall, total potential emissions have slightly increased by 7% in relation to the 2009 survey for VECAP participating companies.

Participation in VECAP between 2009 and 2010 remained strong. A decrease from 89% to 80% shows that a reasonable participation was maintained.

**FIGURE 12: TBBPA 2010 survey results**

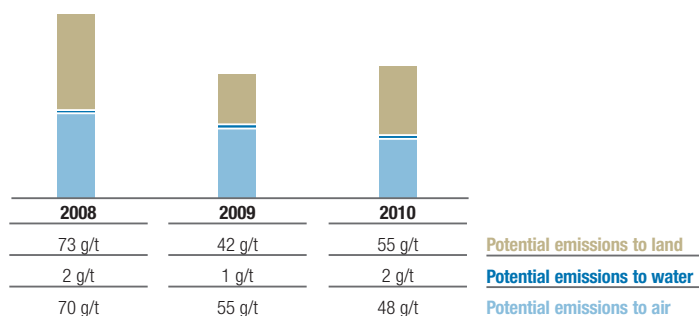


## 2010 POTENTIAL EMISSIONS TO AIR AND WATER

For 2010, potential emissions to air are 48 grams/tonne for volumes surveyed, representing a 13% reduction over 2009 potential emissions and demonstrating the uptake of best available technique practices.

Potential emissions to water remained stable at 2 grams/tonne for volumes surveyed.

**FIGURE 13: Potential TBBPA emissions by emission type (g/t)**





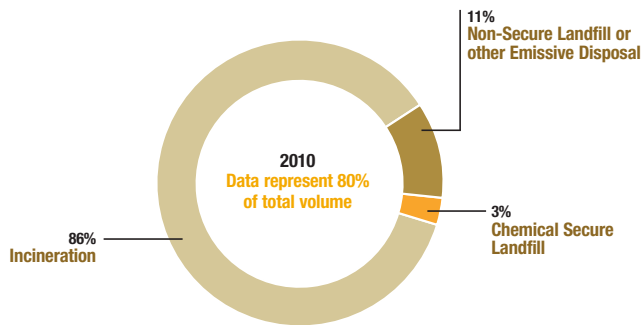
**POTENTIAL EMISSIONS TO LAND AND DESTINATION OF PACKAGING WASTE**

Potential land emissions were found to be 55 grams/tonne for volumes surveyed; 31% higher in relation to 2009 survey.

However, when compared to Deca-BDE and HBCD results on a grams/tonne basis, the overall emissions for TBBPA are lower. This is due to the wide spread implementation of VECAP best practices among TBBPA users, which is further supported by the high level of incineration of packaging waste, a preferred disposal practice utilized by TBBPA users.

Disposal of 89% of packaging waste is now handled using VECAP best practices, such as incineration and chemically secured landfill. For the rest of the volume covered by the survey, there is some uncertainty regarding the quality of landfills in use or actual disposal practices. The VECAP team has made it a priority going forward to verify the capabilities of the landfills used for disposal of TBBPA waste packaging.

**FIGURE 14: Survey 2010 (Volume 2009) destination of TBBPA packaging**



# III. OUR VISION FOR THE FUTURE



**Building on the most recent results and taking into account the latest lessons learned, the VECAP team would like to outline its vision for future development of the program. On the basis of continuous improvement, the VECAP team will work to ensure further progress over the next few years by:**

## **Understanding emissions associated with waste packaging**

A major accomplishment of VECAP has been to identify the main potential sources of emissions. In the 2010 survey, packaging waste was confirmed as the leading source of potential land emissions. Further understanding the disposal practices and the capabilities of landfills utilized for packaging waste will be a priority for the coming year.

## **Increasing VECAP coverage**

Our industry will continue to promote the use and benefits of VECAP with a view to increasing program participation. In particular, the VECAP

team will seek to not only enhance the participation of our direct customers, but also, on the participation of second-line users and our distribution networks.

## **Implementing VECAP best practices where potential emissions have been identified**

VECAP aims to promote the implementation of best practices among users who have not yet implemented recommendations to reduce their potential emissions.

## **Encouraging widespread acceptance of VECAP certification**

So far, it is mainly flame retardant manufacturing sites that have been certified. It is important for the program to broaden certification acceptance among users, as this represents the ultimate commitment to the program and assurance that the voluntary emissions reduction scheme is properly implemented.

### **ABBREVIATIONS**

BAT	Best available technique
BFR	Brominated Flame Retardants
BSEF	Bromine Science and Environmental Forum
Deca-BDE	Decabromodiphenyl ether
FR	Flame Retardants
HBCD	Hexabromocyclododecane
HIPS	High Impact Polystyrene
TBBPA	Tetrabromobisphenol-A
TFA	Textile Finishers Association (UK)
VECAP	Voluntary Emissions Control Action Program

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## FOR FURTHER INFORMATION:

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**[www.vecap.info](http://www.vecap.info)**

**VECAP Product Steward**  
[info@vecap.info](mailto:info@vecap.info)

Companies that participate in VECAP are also members of the North American Flame Retardants Alliance (NAFRA). NAFRA is made up of leading companies that manufacture or market flame retardants in North America. NAFRA encompasses all types of flame retardants, including those based on bromine, chlorine, phosphorus, nitrogen and inorganic compounds. NAFRA is a sector group of the American Chemistry Council.

**NAFRA**  
American Chemistry Council  
700 Second Street NE  
Washington, DC 20002  
Tel: 202-249-6712

The Bromine Science and Environmental Forum (BSEF) is the international organization of the bromine chemical industry, whose remit is to inform stakeholders and commission science on brominated chemicals such as flame retardants.

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**[www.bsef.org](http://www.bsef.org)**

# VECAP

VECAP is a voluntary initiative of the member companies of the Bromine Science and Environmental Forum (BSEF).

