

UECAP TM U

The Voluntary Emissions
Control Action Programme

STRIVING FOR EXCELLENCE

ANNUAL PROGRESS REPORT 2010



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HIGHLIGHTS

- ① Continued growth in participation in the VECAP programme, representing 95% of total volume sold by EFRA member companies
- ② Successful implementation of best practices for packaging waste management, as reflected in a significant decrease in potential emissions from residues in empty bags for HBCD and Deca-BDE
- ③ Increase in VECAP certification from three to five sites, representing the highest possible level of commitment to the programme's objectives
- ④ Overall trend towards a reduction of potential emissions for the three brominated flame retardants, according to survey results from the last three years
- ⑤ Introduction of a new precautionary-based methodology for calculating potential emissions, resulting in an apparent increase in potential air emissions for all products, as opposed to an actual increase

This report is designed to provide transparent and concise information on the progress of the Voluntary Emissions Control Action Programme (VECAP) on an annual basis. Any feedback or comments are welcome and will be considered for future editions.

FOREWORD



IYC 2011
International Year of
CHEMISTRY

This year we celebrate the International Year of Chemistry, a worldwide celebration that highlights the achievements of chemistry and how the chemical industry has made positive contributions to the well-being of society.

An important way that we serve society is by continuously improving the environmental, health, safety and security performance of chemical operations under our global industry's unique voluntary initiative – Responsible Care. One of the hallmarks of the work done under Responsible Care is VECAP (The Voluntary Emissions Control Programme), which has received recognition from external stakeholders as a successful, sustainable approach to chemicals safety.

Since its inception in 2004, the number of VECAP participants has grown, which means an increasingly large number of companies in the chemical industry have adopted the initiative to address waste management via concrete measures that go beyond compliance with legislation.

VECAP is an excellent example of how joining up manufacturers and downstream users can raise awareness of better ways to handle waste, work together to identify the real issues that must be addressed, and ensure successful implementation of best practices.

We offer you this report that provides a summary of results which highlight the efforts made continuously to improve the VECAP methodology and shed light on new areas to be tackled. This year's report also provides a first look at some encouraging trends, which will be used in years to come to assess programme success.

Dr. Hubert Mandery
Cefic Director General

I. INTRODUCTION TO VECAP



The Voluntary Emissions Control Action Programme (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 brominated flame retardants (BFRs) through the promotion of environmental and process best practices throughout the value chain, from producers to downstream users. Although this programme does not deal with potential emissions during the service life of products or after their disposal, the flame retardant industry has pledged to address these issues in the future.

VECAP was developed and first implemented in 2004 by three producers of flame retardants¹ in partnership with user industries². The programme was previously run by the European Brominated Flame Retardant Industry Panel (EBFRIP), which was dissolved in January 2011.

Now operating under the European Flame Retardants Association, a sector group of Cefic³ (EFRA), VECAP aims 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, whilst setting benchmarks for other industries to apply similar principles. The programme has been educating stakeholders by organising

workshops to introduce VECAP to regulators, trade groups and others interested in chemicals management. VECAP is now implemented by the three main producers of BFRs in all manufacturing plants for Deca-BDE, HBCD and TBBPA globally, as well as at 92 user sites.

In addition, producers of HBCD and polystyrene foams set up a similar voluntary product stewardship programme, SECURE⁴, to control and reduce potential emissions of HBCD to the environment, focusing specifically on the polystyrene foams value chain. This programme is operated jointly by Plastics Europe⁵, Exiba⁶ and producers of BFRs. VECAP and SECURE have currently combined forces and share a common methodology.

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 programme

BACKGROUND AND EVOLUTION

The origins of the programme lie with member companies of EFRA, who in 2004 initiated a code of good practice calling on the UK textiles industry to audit their processes and take action to reduce Deca-BDE emissions. Subsequently, over the following 6 years VECAP extended its coverage to include HBCD and TBBPA, also produced by some members of EFRA. Moreover, VECAP expansion was also geographical, as the programme now targets all European users of BFRs. It is worth noting that, following the disbandment of the UK Textile Finishers Association (TFA), representing formulators and finishers, the VECAP team in 2009 took on the task of promoting the programme directly within the UK textiles industry.

During the early years of the programme, there was an exclusive focus on emissions to air and water, mainly following a request from EU regulators to the producers of BFRs to monitor and report progress in these areas of concern. However, the 2008 annual report highlighted an emerging issue of potential emissions to land from residues in packaging waste, which is now addressed through the implementation of VECAP best practices by the majority of users.

During the completion of the 2010 annual survey, estimates for potential air emissions had to be adjusted due to the finding that some key questions related to the use of air filters had not been included in the initial surveys. Indeed, the surveys had been conducted on the assumption that all users operated with a ventilation system equipped with a filter. As it was found that this was not always the case, the VECAP team decided to adapt the questionnaire to ensure that these practices were documented and taken into account in estimates of potential air emissions. The adaptation of the questionnaire led to a *prima facie* increase in potential air emissions for all products compared to previous surveys. However, through recalculation of potential emissions from previous surveys using the new adjustments, it was established that such “increases” were attributable to the change in

assumptions, as opposed to actual air emission increases.

The above example demonstrates that the “learning by doing” principle of the programme makes year-on-year comparisons somewhat difficult. However, the VECAP team believes that, in order to take advantage of experience gained, the principle of continuous improvement must remain at the core of the programme.

HOW DOES VECAP WORK?

The VECAP process is driven by the principle of continuous improvement, namely, adapting the methodology to better address any new issues that may arise.

The VECAP programme focuses on producers and downstream users of BFRs. However, in principle, the VECAP methodology can be applied to encourage emissions reductions of any type of solid or liquid chemical. While some individual EFRA member companies are applying the methodology to other substances, including flame retardants, this is beyond the scope of this report.

In general, flame retardants are derived from naturally occurring elements that are incorporated into materials such as plastics, foams and textiles. They fulfil 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 firefighters with extended time to respond. They are commonly used in many domestic and industrial appliances such as computers, TVs, mobile phones, mattresses and insulation boards in order to comply with fire safety standards. They are also incorporated into a wide range of materials and textiles for upholstered furniture. Three major BFRs are covered in this report: Deca-BDE, TBBPA and HBCD. Their specific uses are described with the survey results.

VECAP does not physically measure emissions from chemical processes, but rather calculates or estimates, based on practical experience

and studies, potential emissions associated with user and producer processes and practices. This ensures that a precautionary worst case scenario is considered with regard to controlling emissions. The traditional means of controlling emissions focuses on the use of end-of-pipe systems, i.e. treatment of waste and polluting streams. However, this approach can miss significant steps in the waste generation process. The VECAP methodology allows companies to identify possible sources of emissions and implement measures to reduce or avoid them.

In cases where no measured data are available, the programme uses a worst case scenario and assumes a level of potential emissions, unless the emissions pathway has been demonstrated to be effectively closed. These estimates are formalised by means of questionnaires, which allow potential emissions generated at each stage in the producer or user process to be combined to estimate total potential emissions. The questionnaires have inbuilt ‘default values’ for the emission performance of processes. Nonetheless, it is possible for users to insert their own values whenever they have measured data available. Default values are based on values measured during operating processes. As VECAP is applied in a consistent manner, it identifies the main potential sources of emissions, and allows the impact of any changes in processes to be evaluated and, where appropriate, managed accordingly.

¹ Albemarle, Chemtura and ICL-IP

² The origins of VECAP lie with the UK Textile Finishers Association (TFA), who in 2004 initiated a code of good practice that called on the UK textiles industry to audit their processes.

³ www.flameretardants.eu

⁴ Self Enforced Control of Use to Reduce Emissions (SECURE)

⁵ Plastics Europe www.plasticseurope.org

⁶ European Extruded Polystyrene Insulation Board Association (Exiba) www.exiba.org



ACHIEVEMENTS IN 2010

In the light of commitments included in the 2009 Annual Progress Report, the following points should be emphasised:

- ① The programme continued to focus on addressing empty packaging as the main source of potential emissions.
- ② All BFR importers (non-EFRA members) were approached to join VECAP.
- ③ The programme was expanded in 2010 to cover the UK textiles Industry directly through VECAP (in the past this was handled by the UK Textile Finishers Association).
- ④ Best practices were enhanced, with user application of best available techniques increasing from 84% to 95% of total volumes.
- ⑤ Data handling was refined and is subject to continuous improvement.
- ⑥ In the context of widening the scope to encompass other materials, the global VECAP team (EU and North America) is currently developing generic survey tools that may be used for all polymer additives.

VECAP CERTIFICATION

In 2009, a certification scheme was launched based on ISO 9001/14001 principles. The scheme was developed in association with Bureau Veritas, with environmental audits carried out by independent auditors. Since the programme's inception, independent certification has been the final step in the continuous improvement process. This process is designed to be easy to follow. The certification scheme for SMEs applies only to the process and use of best practices, while for larger companies it can be extended to their management system, in line with other standards like ISO 14001 or Responsible Care® management systems.

Five sites have since received certification: two in Europe (one producer and one downstream user), two US-based production sites and one in Israel. Compared to the 2009 report, two new manufacturing facilities have been certified. Looking ahead, we believe that increasing the number of certifications, including user sites, is important for the programme's long-term development. In 2011, two production sites, one in China and one in Jordan, as well as one user site in the Netherlands, are expected to apply for certification.

THE VECAP TEAM AND EMISSIONS SURVEY TOOL

VECAP's success is due to the combined efforts of a team of professionals with knowledge of BFR production and application processes. Members of the product stewardship team include a product steward, three producer companies, Cefic⁷ representatives and members of the SECURE group. The VECAP product steward, supported by 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.

For each of the two types of flame retardant applications - plastics and textiles - different questionnaires were developed in collaboration with downstream users, considering every step in the user process in order to cover all potential emission points. Each of the three producer companies requests its first-line customers (and second-line users, where possible) to complete and return the questionnaires. These contain sales volume data from the previous year as well as potential emissions data, either based on default values, measured values supplied by the user, or a

combination of both. For air and water emissions, default average values are taken, where possible, from a study by a consultant (GfA[®]), or are based on practical experience of users. For any residual product left in nominally empty packaging, BFR producers have generated default average values for each type of packaging and product form, based on in-house or user measurements, where possible.

Once the user has completed the questionnaire, often with the help of the producer, 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 programme.

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.

EMISSIONS DATA COLLECTION & REPORTING

BFR users are responsible for completing the questionnaire and ensuring the accuracy of the information. The answers are first collated by each supplier, who highlights potential emissions identified, then consolidated by Cefic's statistical services, and finally compiled and analysed by the VECAP product steward. When more than one producer is supplying the same user, the volume supplied is aggregated by Cefic. Data are then treated to obtain estimated potential emissions in g/tonne in the EU. In addition, by using weighted averages, it is also possible to obtain kg/year potential emissions. The consolidated results of the surveys from 2010 are presented in this report.

Although working closely together, both Cefic and the VECAP product steward act independently of manufacturers and users. They are the only parties with access to confidential individual potential emissions data of all participants.

PROVIDING SUPPORT FOR VECAP USERS

VECAP helps companies implement best practices and make continuous improvements. The VECAP system begins with user commitment to the programme, adopting the Industry's code of good practice⁹ and applying these principles to procedures and work instructions related to daily operations. As an annex to the code, best available technique (BAT)¹⁰ guidance documents have been developed for emptying packaging and intermediate bulk containers (IBC), drums or containers efficiently. These documents are regularly updated.

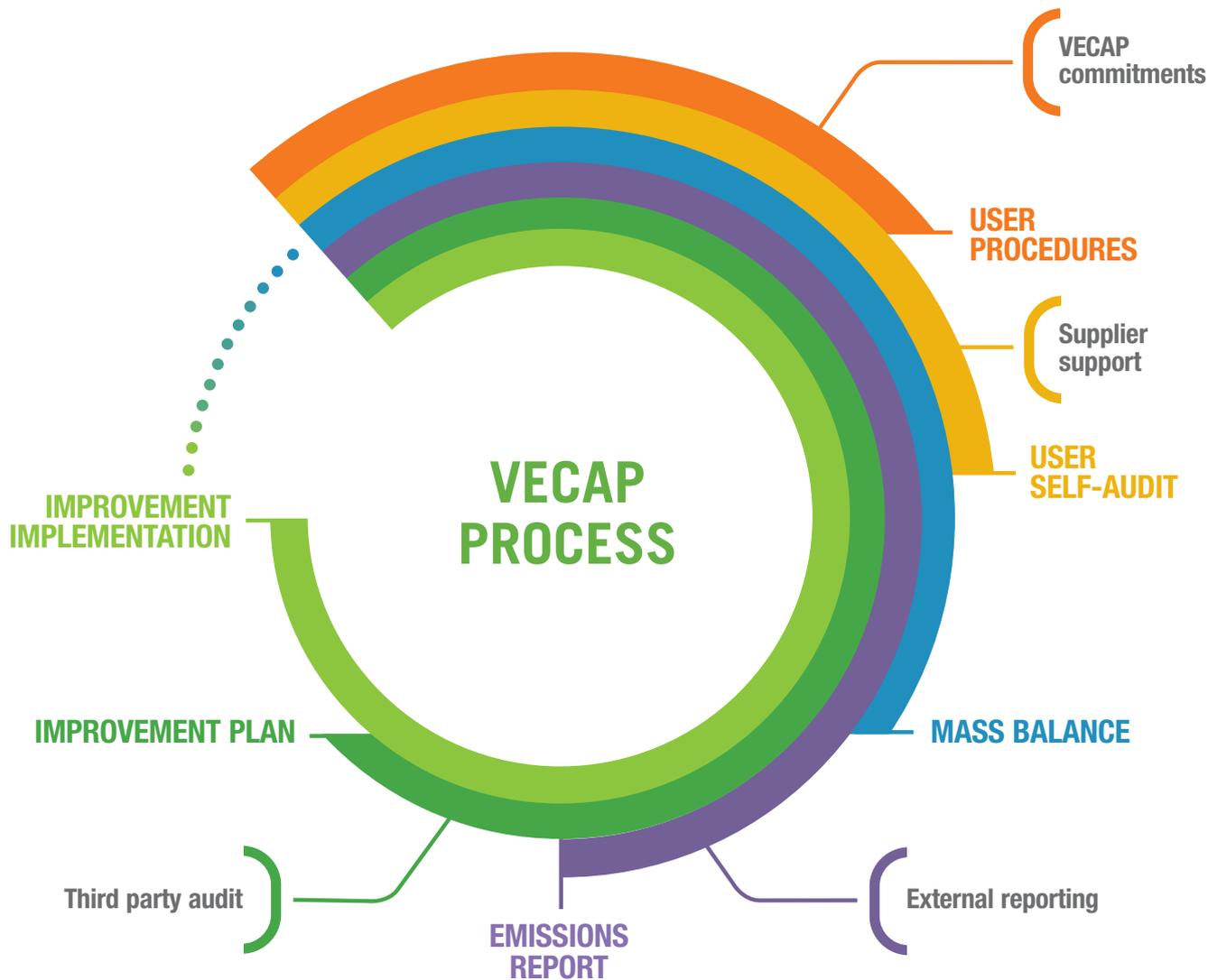


⁷ European Chemical Industry Council (Cefic) www.cefic.org

⁸ GfA reports: 60425-011.B14, 10 September 2003 (Deca-BDE); 60425-011.B13, 21 August 2003 (HBCD)

⁹ To be found at <http://www.vecap.info/europe/user-documentation>

¹⁰ To be found at <http://www.vecap.info/europe/user-documentation>

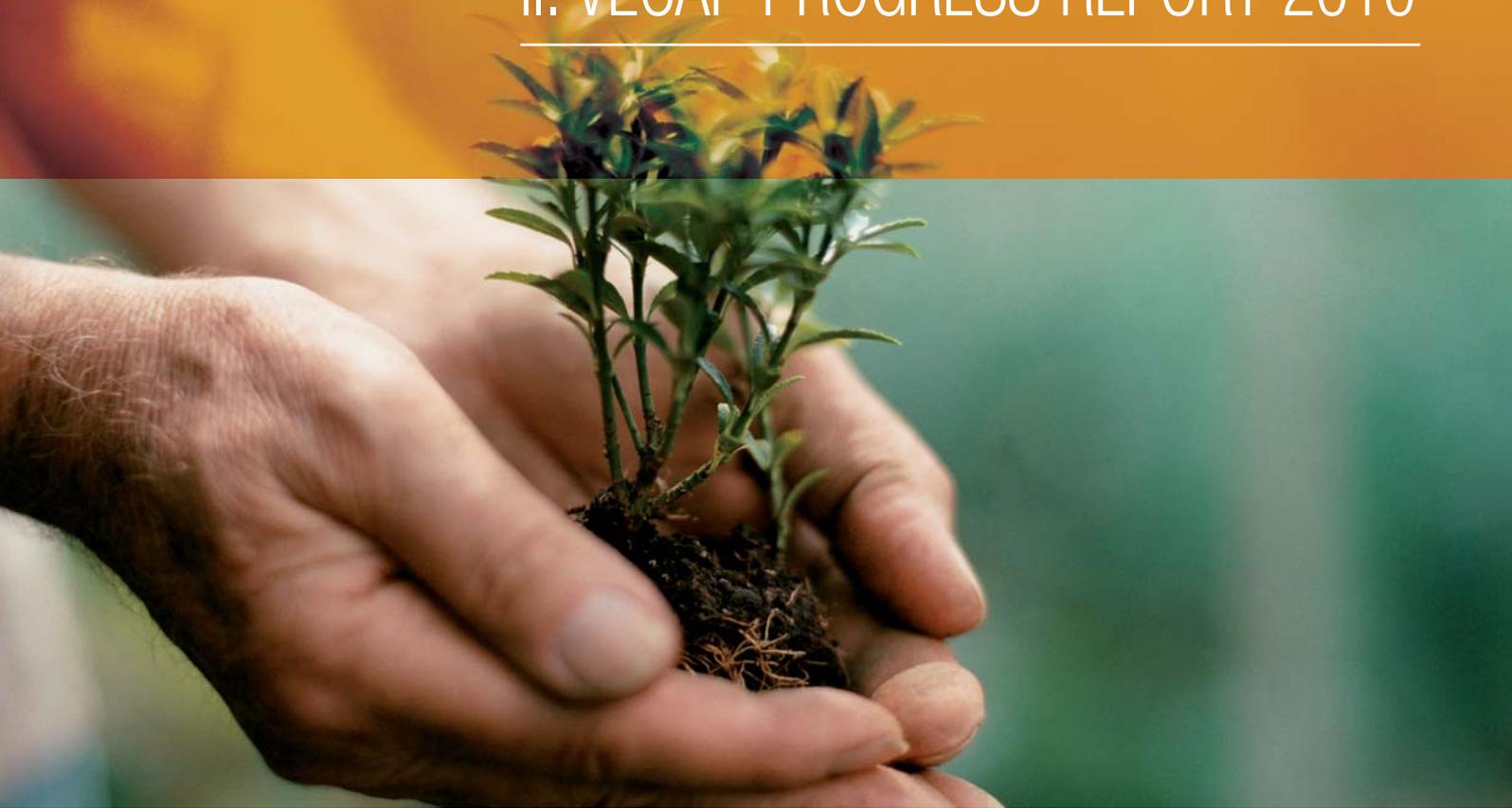


BRIEF HISTORY OF THE METHODOLOGY - CONTINUOUS IMPROVEMENT

Since its creation in 2004, continuous improvement has been key to VECAP's success. Over the years, the product stewardship team has come to realise that in order to control emissions, it is essential to keep an open mind. The programme has improved the way users and producers manage BFRs, and participants have been able to identify critical points in the handling process as potential sources of emissions. Thanks to this approach, producers have developed tools and proposed measures to tackle each potential emissions source and consequently reduce emissions.

In 2008, disposal of used packaging was identified as a major source of land emissions. This is now properly controlled for Deca-BDE and HBCD through the implementation of best available techniques. During this survey year, an improved method to estimate potential air emissions was developed. Initial surveys assumed that all users operated with a ventilation system equipped with a filter. During the course of the 2010 survey, it came to the light that this was not always the case. The decision was therefore made to include a new section in the questionnaires addressing this issue, as well as to recalculate figures from previous years. The new methodology allowed the VECAP team to generate comparable data for the last three survey years and to continue to tackle further sources of emissions in a consistent manner.

II. VECAP PROGRESS REPORT 2010



OVERVIEW OF THE 2010 SURVEY

In 2010, there was increased participation in VECAP. No less than 95% of total volume sold by EFRA member companies is now covered by the survey. One of the main reasons for this is that, in 2010, the current programme was introduced to the UK textile formulators, who were formerly represented by the now disbanded TFA. While adhering to the same principles, the TFA was using a different methodology for its surveys, whereby its members did not estimate their potential emissions in the same way as other BFR users. The current programme is thus somewhat new to ex-TFA members, meaning that their practices are not all VECAP-compliant yet. The VECAP team will be working closely together with new participants on their implementation of measures and best practices.

In addition, 95% of survey participants are also committed to the programme, meaning that they sign up to the code of good practice and

take all necessary steps to reduce levels of potential emissions. A marked increase in commitment to the programme signals an encouraging trend for the VECAP team.

It should be noted that these participation figures relate only to users and volumes supplied by EFRA member companies. While volumes supplied by non-EFRA members cannot be included, we have reason to believe that the handling of products by these users will not be significantly different from volumes supplied by EFRA members, provided they are implementing VECAP practices.

The number of VECAP-certified sites has increased from three to five. VECAP certification by an independent third party (currently Bureau Veritas) represents the highest possible level of commitment to the programme's objectives.

In 2010, the VECAP team continued to update and improve its programme, for example, by

implementing best practices for the handling of empty packaging at sites that were not compliant in 2009. It was also discovered that certain users had not yet started operating with recommended ventilation systems. As a result, potential emissions to air had to be reviewed and adjusted.

Before looking in depth at 2010 survey findings, listed below are examples of where BFR emissions can occur, highlighting critical points in the process of handling and treating chemicals.

Arrival at customer site

From the production site, BFRs are transported to the customer who has ordered them (as seen in Figure 1). When they arrive, the bags or containers are stored in a warehouse until they are needed in the production process. At this stage, the likelihood of potential emissions being released into the environment is low.

Opening and emptying

Once they are needed in the production process, the bags or containers are taken from the warehouse to the filling station, where they are opened. This is one of the most critical points in the process, with the potential for emissions to land, air and water.

Ideally, operators handling the bags should wear appropriate personal protective equipment, such as protective clothing, a respirator and gloves.

They should open the bags under a ventilation system, preferably a tiered system composed of several filters. The use of a well functioning and regularly maintained ventilation system can help to keep air emissions to a minimum.

During the opening and emptying of the bags, chemicals can escape through open windows or through the clothes of the handlers, for example. Ideally, windows should be closed during the emptying of bags, and spilled chemicals should be cleaned immediately after the batch has been emptied. These measures will help to reduce emissions to air and land.

The emptied bags represent another critical point, as any residues left in the bags can lead to emissions to land. After having been properly emptied, the bags should be appropriately stored and sent for disposal in a controlled landfill site or for incineration, in order to avoid emissions to land.

During the production process

BFR chemicals are then ready to be used in the production process. As may be expected, this is a further critical point, particularly where water is used. At the end of the production cycle, the waste water needs to be treated in order to reduce emissions to water.

Critical points which can lead to unwanted emissions to land, air and water can therefore be identified throughout the whole journey of a bag containing BFRs. However, by applying appropriate measures, and following best practices developed by VECAP, emissions can be minimised.

The 2010 survey produced the following results on potential emissions to land, water and air from Deca-BDE, HBCD, and TBBPA.

KEY FINDINGS

Based on information gathered from 92 users, including 12 second-line users surveyed, there are 3 headline findings:

- 1 A comparison of survey results from the last three years indicates an overall trend towards a reduction in estimates of potential emissions for the three substances.
- 2 Best practices for packaging waste have been successfully implemented, as reflected in a significant decrease in potential emissions from empty bag residues for HBCD and Deca-BDE. It should be noted that, for all three products, 97% of packaging volume is stored correctly before disposal.
- 3 A new area requiring clarification was identified with regard to air emissions during the 2010 survey, as it was assumed that all users operated with a ventilation system equipped with a filter. The adjustment in the methodology to estimate emissions led to a prima facie increase in potential air emissions for all products compared to previous surveys. However, through recalculation of potential emissions reported in previous surveys, using the new adjustments, it was established that such 'increases' were attributable to a change in assumptions, as opposed to actual air emission increases.

Currently, the majority of potential emissions from the surveyed flame retardants are still due to uncontrolled packaging waste disposal routes, except for HBCD, where potential air emissions now represent the most significant, albeit low, source. The programme continues to address this very carefully and is in the process of gaining a better understanding of the impact of certain practices, such as the recycling of paper packaging, on potential emissions.

FIGURE 1: Process of handling and treating of chemicals

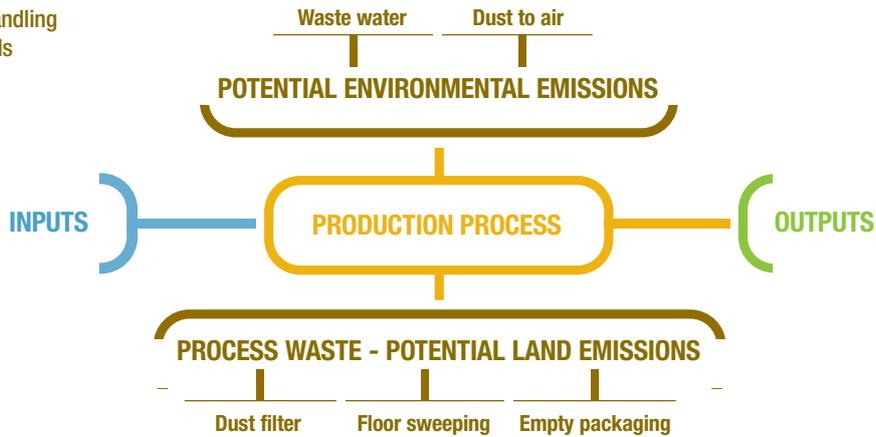


FIGURE 2: Deca-BDE 2010 total potential emissions

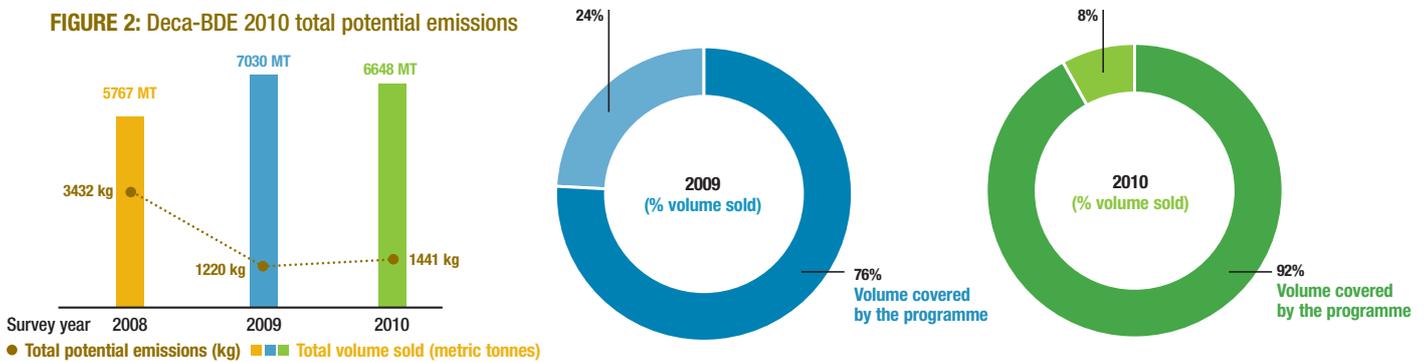


FIGURE 3: HBCD 2010 total potential emissions

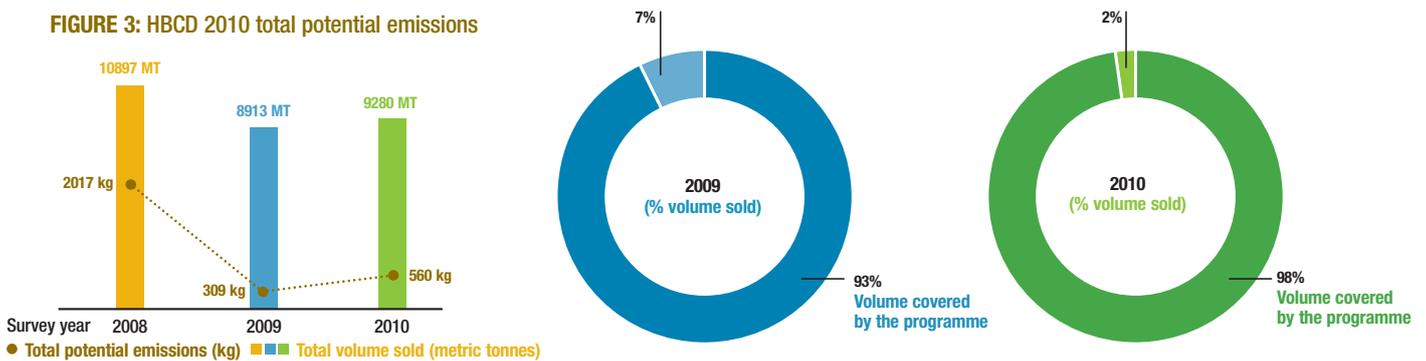
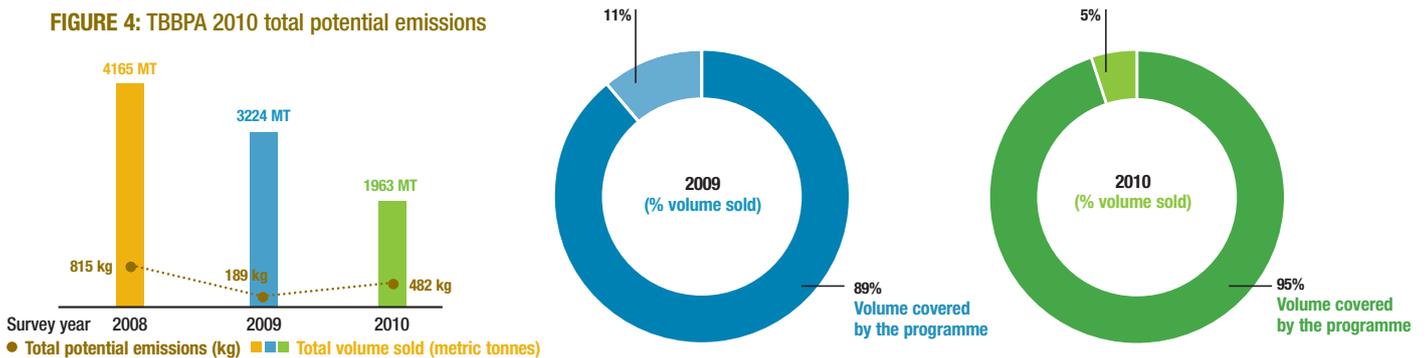


FIGURE 4: TBBPA 2010 total potential emissions



DECA-BDE

Decabromodiphenyl ether (Deca-BDE) is a highly effective brominated flame retardant which increases resistance to fire and allows up to 15 times more time to escape in case of fire. It is used to prevent fires in textiles, in the transportation sector (e.g. automotive and aviation industries) and in construction and building (e.g. wires, cables, pipes).

2010 SURVEY RESULTS FOR DECA-BDE

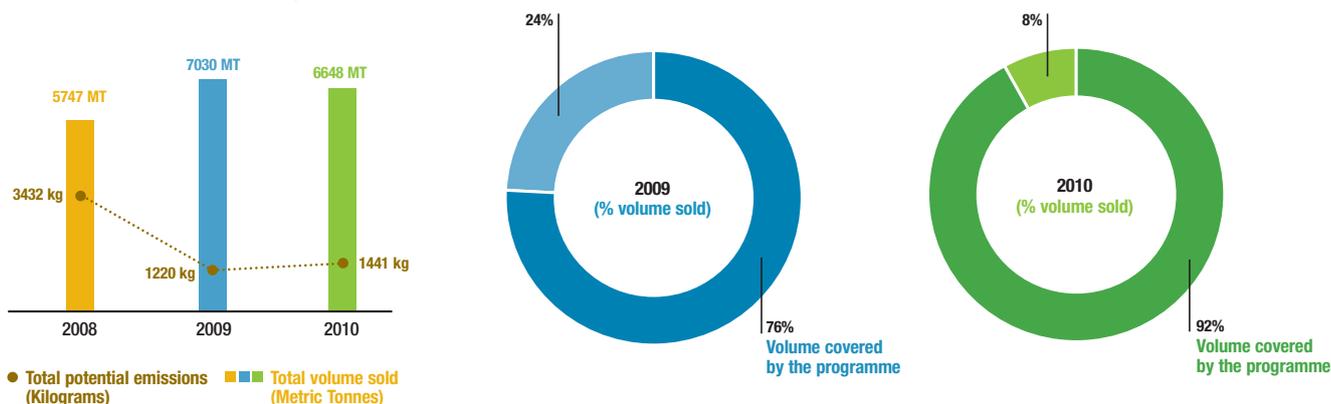
Results included in the survey carried out in 2010 are based on volumes sold in 2009. The VECAP survey covers 44 out of 75 user sites, 10 of which are second line users. This represents 92% of the volume sold by EFRA member companies.

For Deca-BDE, total potential emissions in 2010 are estimated to be 1441 kilograms, i.e. less than 0.1% of the 6648 tonnes sold by EFRA member companies in 2009.

Overall, potential emissions have remained steady in relation to the 2009 survey, while volume has slightly decreased. However,

the volume covered by VECAP in 2010 has notably increased, as seen in Figure 5.

FIGURE 5: Deca-BDE 2010 survey results



2010 POTENTIAL EMISSIONS TO AIR, WATER AND LAND

2010 findings estimate potential yearly emissions to air at 110 kilograms. While this figure is higher than for previous years, this represents only a small fraction of total potential emissions. Two principal factors contributed to this increase: new methodology for estimating potential air emissions and higher volume coverage. In order to allow for comparison with previous surveys, we have recalculated potential air emissions from the 2008 and 2009 using new criteria applied in the 2010 survey. These new criteria take into account the presence or

absence of a ventilation system equipped with a filter, as well as its maintenance.

Recalculations of previous surveys illustrated in Figure 7, allow the VECAP team to demonstrate that there was in fact no increase in potential air emissions over the last three years. In addition, it shows that a steady state has been reached, while volume coverage has increase.

Potential water emissions almost doubled (107 kilograms) from the 2009 to the 2010 survey, although this only represents a minor part of total emissions. The main reason for this increase is the addition of UK textile users to

the 2010 survey, as textile applications utilise water-based formulations including Deca-BDE. The VECAP team is committed to supporting these users in implementing the programme's best practices. Details related to each application are shown in Figure 8.

Finally, estimates for 2010 show a substantial reduction in potential land emissions from packaging waste, from 2210 kilograms in 2008 to 1068 kilograms. 80% of total potential emissions come from the use of inappropriate disposal routes for packaging, namely recycling or uncontrolled landfill (Figure 10).

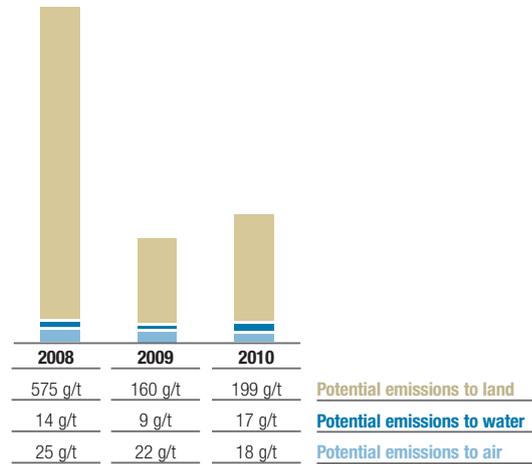
FIGURE 6: Comparative Deca-BDE survey results (2008-2010) by emission type (kg/year)

Survey year	Potential air emissions from surveyed volume	Potential water emissions from surveyed volume	Potential land emissions from surveyed volume
2008	42 kg/year	81 kg/year	3309 kg/year
2009	32 kg/year	66 kg/year	1122 kg/year
2010	110 kg/year	107 kg/year	1124 kg/year

Recalculated potential air emissions (g/t)

2008 survey	Revised 2008 survey	2009 survey	Revised 2009 survey	2010 survey
7 g/t	25 g/t	5 g/t	22 g/t	18 g/t

FIGURE 7: Potential emissions (g/t)



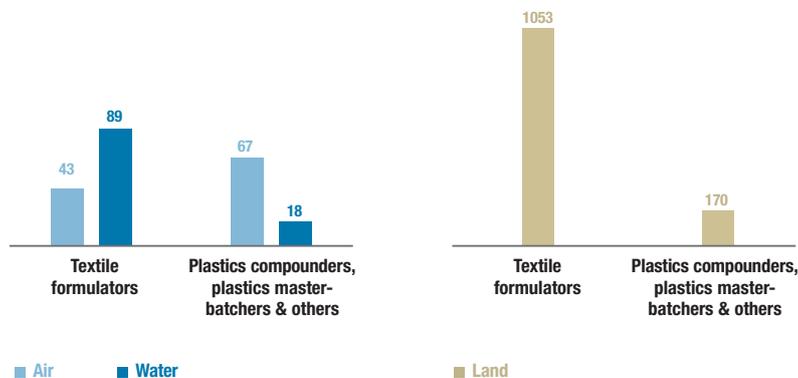
2010 POTENTIAL EMISSIONS FOR TEXTILES AND PLASTICS

Looking at potential emissions estimates by application, the 2010 survey found that the main source of estimated land emissions is the textile sector. While this application only represents one third of volume sold, it accounts

for 86% of total potential land emissions. This is obviously related to the recent introduction of the programme to some textile users. Improvement measures have been recommended to the users concerned and will hopefully be implemented as a priority in 2011 (Figure 8).

FIGURE 8: Deca-BDE survey results by application

Total potential emissions in kg/year



DESTINATION OF DECA-BDE PACKAGING WASTE

According to VECAP best practices, used packaging material must be either incinerated or disposed of in controlled landfill sites. The 2010 survey

demonstrated that 95% of Deca-BDE volume covered was handled in line with these practices, representing an increase of 15% over the previous survey. The remaining 5% was dealt with through recycling, uncontrolled landfill, or its destination was unknown and therefore

considered under VECAP as a potential source of emissions to land. An exception is paper recycling in France, as described in the case study below.

FIGURE 9: Potential land emissions from packaging waste residues

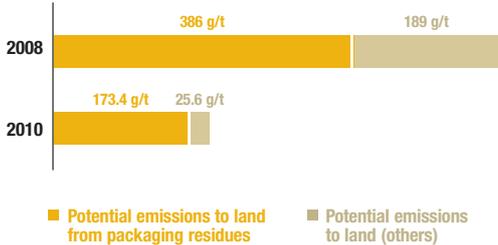
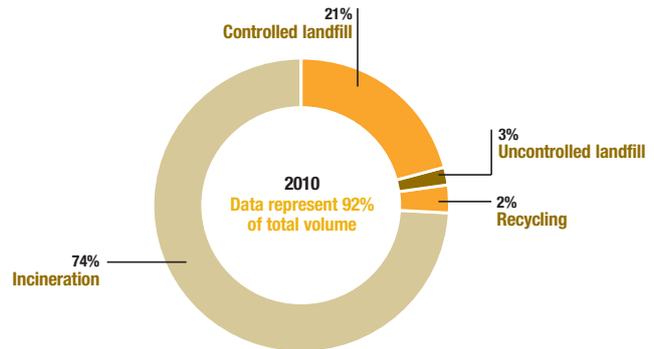


FIGURE 10: Survey 2010 (volume 2009): destination of Deca-BDE packaging



CASE STUDY: PAPER RECYCLING PRACTICES IN FRANCE

Local authorities in some European countries recommend recycling as the best way to handle packaging waste. This is the case in France, among others. As our VECAP methodology considers recycling of industrial packaging made of paper as a source of potential emissions, the VECAP team set out to understand the processes used in France to assess whether the assumptions were correct.

It was discovered that, at the paper recycling site, the paper was mixed with water to help break down links between cellulose fibres and separate them from residual products contained in the bags. The waste water then underwent chemical and physical treatment (decantation and filtration) and the sludge was sent to either incineration or controlled landfill. There is indeed legislation in France which regulates the disposal of waste from paper recyclers, as this waste is considered to be potentially dangerous. The authorities therefore strictly control the paper recycling companies with respect to their treatment of waste water and sludge.

Based on this experience, the VECAP team now considers packaging waste disposal through paper recycling, as seen in France, as another BAT for the programme.

HBCD

Hexabromocyclododecane (HBCD) is a flame retardant used mainly in thermal insulation foams in order 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 has also a minor application in electrical boxes (HIPS). Finally, it is used in the back coating of textiles, mainly for upholstered furniture. However, this is not covered in this report, as EFRA members no longer supply this application.

2010 SURVEY RESULTS FOR HBCD

The following results are from the survey carried out in 2010, based on volume consumption in 2009. The VECAP/SECURE survey covers manufacturing plants, first-line users and a high number of user sites (40 out of 54, 2 of which are second-line users). This

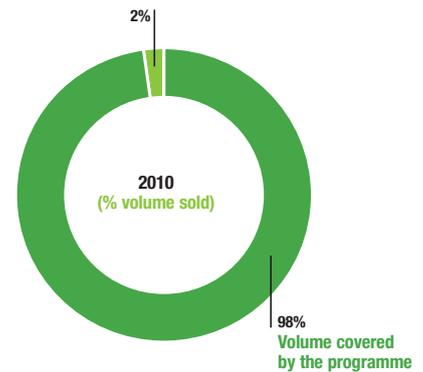
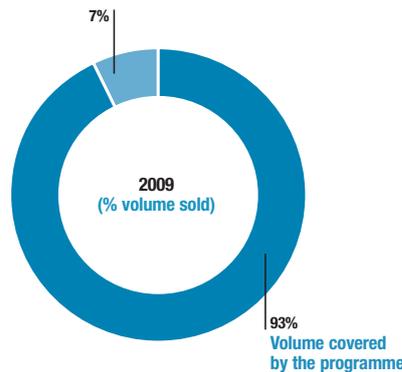
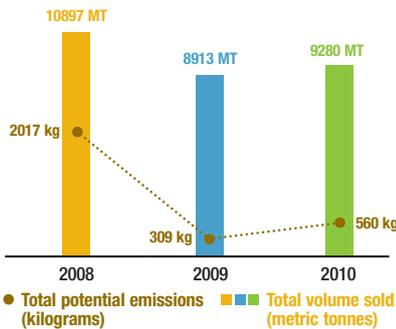
represents 98% of total volume sold by EFRA members in 2009 (9280 tonnes).

Total potential emissions are estimated to be at 560 kilograms/year, which represents less than 0.01% of 2010 sales.

Moreover, 92% of volume sold is now covered by either VECAP or SECURE, meaning that the

code of good practice has been signed. This demonstrates good uptake of the VECAP principles and gives us confidence that the product stewardship message has been widely accepted and operationally implemented.

FIGURE 11: HBCD 2010 survey results



2010 POTENTIAL EMISSIONS TO AIR, WATER AND LAND

Potential air emissions are now estimated at 451 kilograms/year or 49 g/tonne and are the main contributors to total potential emissions. This is mainly due to improvements in the methodology used to calculate estimates. 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. The

VECAP team has identified this area as a priority to be addressed in next year's survey.

In order to allow for comparison with previous surveys, we have recalculated potential air emissions from the 2008 and 2009 surveys employing new criteria used in the 2010 survey. These new criteria take into consideration the presence or absence of a ventilation system equipped with a filter, as well as its maintenance.

Recalculations of previous surveys, shown in Figure 13, demonstrate that there was in fact

no significant increase in potential air emissions over the last three years, and that the increase shown is mainly due to the new and improved methodology.

Potential emissions to water in 2010 also decreased and are estimated at 27 kilograms/year or 3 g/tonne sold.

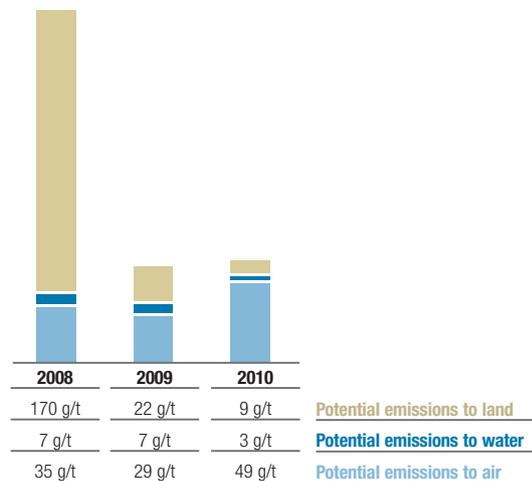
FIGURE 12: Comparative HBCD survey results (2008-2010) by emission type (kg/year)

Survey year	Potential air emissions from surveyed volume	Potential water emissions from surveyed volume	Potential land emissions from surveyed volume
2008	87 kg/year	73 kg/year	1857 kg/year
2009	54 kg/year	79 kg/year	196 kg/year
2010	451 kg/year	27 kg/year	82 kg/year

Recalculated potential air emissions (g/t)

2008 survey	Revised 2008 survey	2009 survey	Revised 2009 survey	2010 survey
8 g/t	35 g/t	6 g/t	29 g/t	49 g/t

FIGURE 13: Potential emissions (g/t)



Of particular interest are figures for potential land emissions, which are estimated at 82 kilograms/year or 9 g/tonne (as shown in Figure 14). This represents a significant reduction compared to 2009 and 2008, with a respective decrease of 59% and 87%. Having been identified as an area of concern in previous surveys,

these figures are very welcome, as they demonstrate that the VECAP best practices have been implemented by a large majority of users.

The 2008 survey identified packaging waste residues as the main source of potential emissions (77%). In 2010, however, it only represents 12.5% of the total potential emissions.

DESTINATION OF HBCD PACKAGING

For 95% of HBCD volume surveyed, packaging waste is now handled using VECAP best practices, compared to 93% in the 2008 survey (as described in Figure 15).

FIGURE 14: Potential land emissions from packaging waste residues

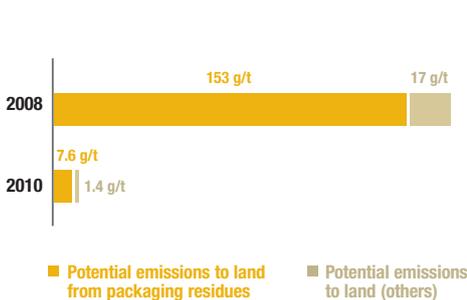
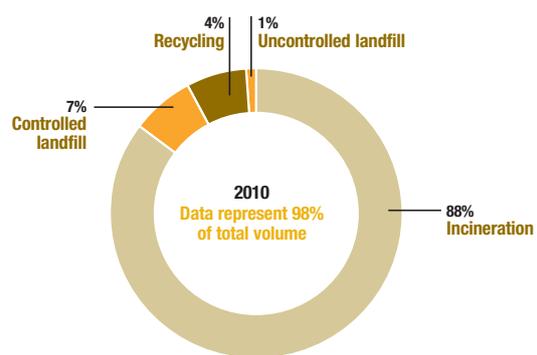


FIGURE 15: Survey 2010 (volume 2009): destination of HBCD packaging



TBBPA

Tetrabromobisphenol-A is the brominated flame retardant with the largest global production volume today and is used to improve fire safety, mainly in the context of printed wiring boards in electrical and electronic equipment. It is used in more than 90% of FR-4 printed circuit boards, the most commonly used board in electronic devices.

2010 SURVEY RESULTS FOR TBBPA

These results are from the survey conducted in 2010, based on volume consumption from the previous year.

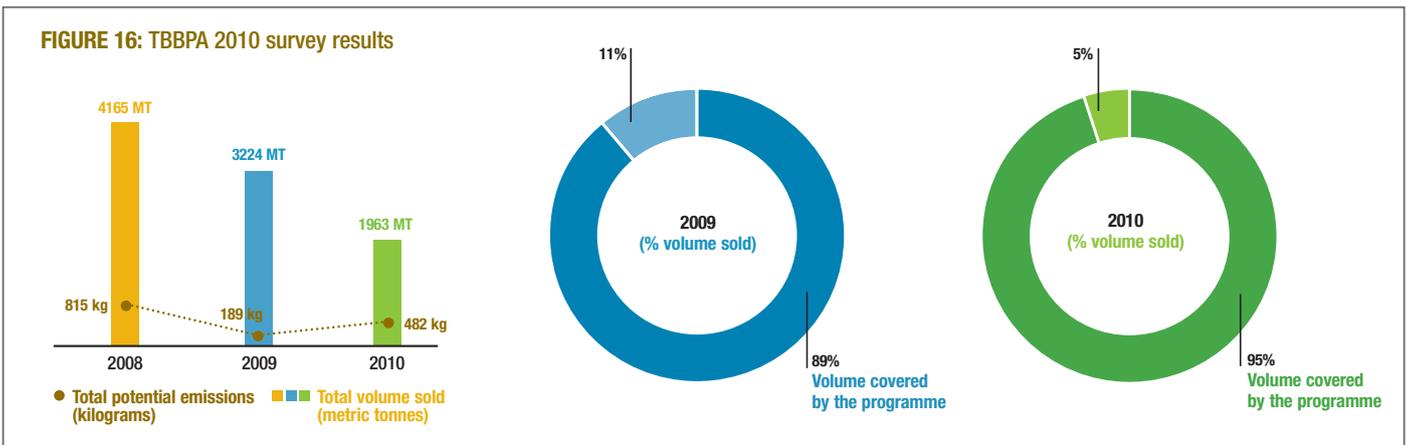
The VECAP survey covers 11 out of 15 TBBPA user sites, representing 95% of total volume sold in 2009 in Europe by EFRA members. The survey is further supported by written commitment to VECAP for 93% of volume.

In total, volume sold by EFRA members in 2009 was 1963 tonnes, a reduction of 39% compared to the previous year.

For TBBPA, total potential emissions in 2010 are estimated to be 504 kilograms, less than 0.1% of the 1963 tonnes sold by EFRA member companies in 2009.

Survey results show an increase in potential emissions, while sales volume has decreased.

The main reason for this is that, when total volume is low, users not implementing VECAP BATs have a greater influence on the aggregated results. The VECAP team has identified this as a priority and will be working to further the implementation of BATs in 2011.



2010 POTENTIAL EMISSIONS TO AIR, WATER AND LAND

For 2010, potential emissions to air are estimated at 21.6 kilograms or 12 g/tonne. This represents an increase over previous years and is mainly due to the change in methodology for potential air emissions estimates. In order to allow for comparison with previous surveys, we have recalculated potential air emissions from the 2008 and 2009 surveys employing new criteria

used in the 2010 survey. These new criteria take into account the presence or absence of a ventilation system equipped with a filter, as well as its maintenance.

Recalculations of previous surveys, shown in Figure 18, reveal that there was in fact no significant increase in potential air emissions between 2008 and 2010. The increase is mainly due to implementation of the new methodology. It is likely that the 2009 survey

results underestimated potential emissions due to lack of awareness that some users were not always complying with VECAP BATs. This has been corrected in the 2010 survey.

As shown in Figure 17, potential emissions to water remain very low, estimated at 0.3 kilograms.

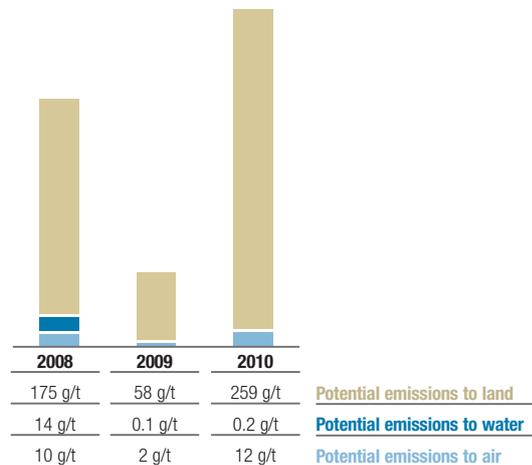
FIGURE 17: Comparative TBBPA survey results (2008-2010) by emission type (kg/year)

Survey year	Potential air emissions from surveyed volume	Potential water emissions from surveyed volume	Potential land emissions from surveyed volume
2008	32 kg/year	59 kg/year	724 kg/year
2009	0.5 kg/year	0.4 kg/year	188 kg/year
2010	21.6 kg/year	0.3 kg/year	482 kg/year

Recalculated potential air emissions (g/t)

2008 survey	Revised 2008 survey	2009 survey	Revised 2009 survey	2010 survey
8 g/t	10 g/t	0.2 g/t	2 g/t	12 g/t

FIGURE 18: Potential emissions (g/t)



Potential land emissions are higher than in previous years at 482 kilograms/year or 259 g/tonne sold. This is mainly due to the clarification of non-compliant practices for two large volume users, not reported in the previous survey. Recommendations were provided and hopefully improvements will be made in 2011.

Numbers show that total potential emissions for TBBPA are still mainly linked to packaging waste

(96% for the 2010 survey, as illustrated in Figure 19). While there is room for improvement, this can be easily addressed by following VECAP best practices for packaging waste disposal.

DESTINATION OF TBBPA PACKAGING

Most packaging disposal is currently done via incineration, with limited amounts going to controlled landfill (as described in Figure 20).

Disposal of 94% of packaging volume surveyed is handled using VECAP best practices, representing a marked increase (20%) over the previous survey. For 6% of volume, packaging waste disposal practices are unknown. The VECAP methodology currently applies the worst case scenario for these cases, and will continue to do so until clarification is obtained on actual disposal practices.

FIGURE 19: Potential land emissions from packaging waste residues

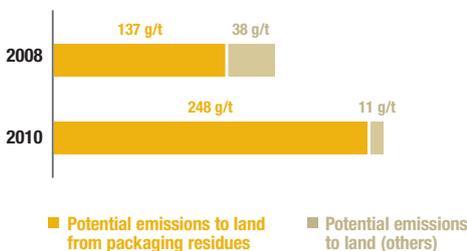
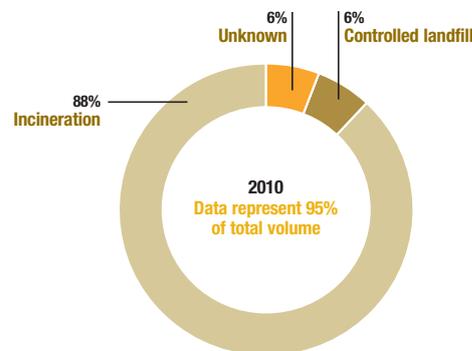


FIGURE 20: Survey 2010 (volume 2009): destination of TBBPA packaging



III. REAFFIRMING OUR VISION FOR THE FUTURE



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

Targeting the main sources of potential emissions

A major accomplishment of VECAP has been to identify the main potential sources of emissions. In the 2010 survey, a new area for clarification was discovered with regard to potential air emissions. Initial surveys assumed that all users operated with a ventilation system equipped with a filter. As it became clear that this was not always the case, estimates for potential air emissions had to be recalculated. As a next step, the VECAP team will work with users to implement best practices in order to ensure that appropriate ventilation systems are in place. In

2008, the handling of used packaging was a major source of potential emissions that had not previously been considered as an area warranting attention by the VECAP team. Issues of implementation of best practices, handling, storage and correct disposal of used packaging have all now been successfully addressed by the majority of users.

Increasing VECAP coverage

Our industry will continue to promote the use and benefits of the programme with a view to increasing participation of other BFR users. In particular, the VECAP team will focus on second-line users, including distributors. A further key challenge will be to involve other producers in addition to Albemarle, Chemtura, and ICL-IP and to engage their user chains.

Implementing VECAP BATs where potential emissions have been identified

The VECAP team welcomes the participation of the UK textile formulators industry and

looks forward to assisting user companies in implementing best practices, thereby reducing potential emissions. At the same time, VECAP aims to promote the enforcement of best practices among all other users, who have not yet implemented recommendations to reduce their potential emissions.

Enhancing understanding of packaging waste recycling practices

During the 2010 survey, the VECAP team added paper packaging recycling practices in France to its BATs, on the basis of research conducted in that area. Authorities in other countries, such as Italy and the UK, still recommend packaging recycling as the preferred option for treating waste. Further inquiries are needed to assess whether practices applied in those Member states are VECAP-compliant.

Ensuring continuous improvement of data handling

Data constitute the backbone of VECAP and the availability and quality of estimated data determine the quality of the programme. However, progressive expansion of the scope of the programme, and improvements in identifying and quantifying potential sources of emissions, have made it more challenging to compare year-on-year estimated data. The VECAP team will continue to seek and address further sources of emissions. With the introduction in 2009 of clear protocols and an independent database, year-on-year comparability of emissions estimates should be assured.

Widening the scope to encompass other materials

While its application in the current context is restricted to emissions control for three BFRs, the VECAP methodology is suitable for use for a wide range of substances. The methodology has already been used for other products by individual producer companies. The VECAP team is currently widening the scope, so that the process can be applied by other companies and industries.

Encouraging widespread acceptance of VECAP certification

So far, it is mainly BFR manufacturing sites that have been certified, while only one user site volunteered for VECAP certification. It is important for the programme to broaden third party certification acceptance among users, as this represents the ultimate commitment to the programme and assurance that the voluntary emissions reduction scheme is properly implemented.

Broadening the scope to address the 'end of life' of BFR-containing products

In 2010, EFRA members created a working group focused on 'end of life' as well as recycling practices and possibilities for products containing flame retardants. While the focus is currently on electrical and electronic equipment (flat panel displays), the VECAP team also aims to broaden the scope to incorporate other applications and identify practices that could generate potential environmental emissions. The ultimate goal is, as always, to develop BATs to avoid these emissions.

ABBREVIATIONS

BAT	Best available technique
BFR	Brominated Flame Retardants
BSEF	Bromine Science and Environmental Forum
Cefic	European Chemical Industry Council
Deca-BDE	Decabromodiphenyl ether
EFRA	European Flame Retardants Association
HBCD	Hexabromocyclododecane
HIPS	High Impact Polystyrene
SECURE	Self Enforced Control of Use to Reduce Emissions
TBBPA	Tetrabromobisphenol-A
TFA	Textile Finishers Association (UK)
VECAP	Voluntary Emissions Control Action Programme

FOR FURTHER INFORMATION:

www.vecap.info

VECAP Product Steward

info@vecap.info

The European Flame Retardants Association (EFRA) brings together the leading companies which manufacture or market flame retardants in Europe. EFRA covers all types of flame retardants: chemicals based on bromine, chlorine, phosphorus, nitrogen and inorganic compounds. EFRA is a sector group of Cefic, the European Chemical Industry Council.

www.flameretardants.eu

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The Bromine Science and Environmental Forum (BSEF) is the international organisation 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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VECAP

VECAP is a voluntary initiative of member companies of the European Flame Retardants Association (EFRA) together with the industry's global organisation, the Bromine Science and Environmental Forum (BSEF).

