Overview: We focused on Decabromodiphenyl ether (Deca-BDE), which is known as cost-effective brominated flame retardant used in TV enclosure components, for the evaluation of risk trade-off caused by the avoidance of its use. Background: Risk trade-off framework, which enables to evaluate and compare the different type of risks, such as human health risk and fire risk is constructed. To date, several governments, especially in EU, made clear that their approach against environmental issue is based on the precautionary principle. Thus, there observed a tendency to place more value on human health risk than physical risk (i.e. fire risk in this case). Strategy: In the current study, we tried to quantify and compare these risks. Result (1): At first, we conducted a Cost Benefit Analysis (CBA) considering human health impacts of Deca-BDE use and both economic and health damage by TV fires. The results suggested that net benefits of Deca-BDE use were positive under all the five scenarios considered. Result (2): Secondly, we tried to re-evaluate the net benefits of Deca-BDE use by replacing the rate of TV fires with more stringent one. Although it diminished fire rate by 75%, under the most realistic two scenarios, results showed positive net benefits of Deca-BDE use.

1. Introduction

Application of Deca-BDE: In late 90’s, Alternate Corp. declared that 85% of Deca-BDE is used in HIPS for casings of E/E appliances. It is commonly said that:

- Deformiation lower PBEFs
- Diffuse into environment and accumulate in biota
- Human health effects of Deca-BDE:
- European Chemical Bureau (2004) declared that there were at present no need for further information and/ or testing, and no need for risk reduction measures beyond those which had been taken already to protect both human health and the environment.
- Trade-off relationship between Deca-BDE use and TV fires:

Fig. 1 Trends in number of TV fires in Sweden [2]

Fig. 2 Set endures tested that contained halogens [9]

2. Goal of this quantitative Cost Benefit Analysis

We tried to answer the following questions:
- Do the benefits, which obtained as reducing number of TV fires, outweigh the human health risks caused by exposure to Deca-BDE, and how much the margin of benefits are there?

3. Method

(i) based on the CBA by Simonson[4]

We improved Simonson’s CBA concerning about following:
1) Assuming the costs and benefits as non-steady state
2) Excluding the cost for disposition of TV
3) Taking adverse effects to human health of Deca-BDE used in TV enclosure components into account
4) Taking uncertainties of several parameters into account, using Monte Carlo Simulation

Fig. 3 Schematic of Deca-BDE CBA (Only the parameters with distribution are shown)

4. Results and Discussion

1) Monte Carlo Simulation (100,000 iterations)

Table 2 Scenarios for our CBA calculations

Table 3 Parameters for calculation, and their distributors for Monte Carlo Simulation

Table 4 List of official VSL’s in several EU countries

Table 5 Data of fire damage/Unit person/year/(Non-TV)

Table 6 Distribution of annual net benefits

Table 7 Sensitivity Analysis between net benefits and parameters (Fig. 6, scenario 4)

Fig. 4 Distribution of annual net benefits (before VSL was re-evaluated)

Fig. 6 Distribution of annual net benefits (after VSL was re-evaluated)

Fig. 7 Sensitivity Analysis between net benefits and parameters (Fig. 6, scenario 4)

Fig. 8 Distribution of annual net benefits (before VSL was re-evaluated)

Fig. 9 Distribution of annual net benefits (after VSL was re-evaluated)

Fig. 10 Distribution of annual net benefits (after VSL was re-evaluated)

Fig. 11 Sensitivity Analysis between net benefits and parameters (Fig. 6, scenario 4)

Fig. 12 Distribution of annual net benefits (after VSL was re-evaluated)

Fig. 13 Sensitivity Analysis between net benefits and parameters (Fig. 6, scenario 4)

Fig. 14 Distribution of annual net benefits (after VSL was re-evaluated)

Fig. 15 Sensitivity Analysis between net benefits and parameters (Fig. 6, scenario 4)

Fig. 16 Distribution of annual net benefits (after VSL was re-evaluated)

Fig. 17 Sensitivity Analysis between net benefits and parameters (Fig. 6, scenario 4)

Fig. 18 Distribution of annual net benefits (after VSL was re-evaluated)

Fig. 19 Sensitivity Analysis between net benefits and parameters (Fig. 6, scenario 4)

Fig. 20 Distribution of annual net benefits (after VSL was re-evaluated)

Fig. 21 Sensitivity Analysis between net benefits and parameters (Fig. 6, scenario 4)

Fig. 22 Distribution of annual net benefits (after VSL was re-evaluated)

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Fig. 41 Sensitivity Analysis between net benefits and parameters (Fig. 6, scenario 4)

Fig. 42 Distribution of annual net benefits (after VSL was re-evaluated)

Fig. 43 Sensitivity Analysis between net benefits and parameters (Fig. 6, scenario 4)

Fig. 44 Distribution of annual net benefits (after VSL was re-evaluated)

Fig. 45 Sensitivity Analysis between net benefits and parameters (Fig. 6, scenario 4)