

## Toxicology of Flame Lecture Plan

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| Author                 | Richard Rediske   |
| Subject:               | Toxicology  |
| Time Available         | 60 minutes  |
| Learning Aids Required | Laptop or computer, LCD projector, White Board, Markers and Eraser  |
| Size of Group          | 20-40   |
| Objective              | <p>At the end of the lecture, the students will be able to:</p> <ul style="list-style-type: none"> <li>◆ <b>explain</b> flame retardants are used, their chemistry, and associated environmental problems</li> <li>◆ <b>explain</b> how chemicals from commercial product use can harm the global environment</li> <li>◆ <b>describe</b> the chemical and toxicological properties of Polybrominated diphenylethers (PBDE)</li> <li>◆ <b>apply</b> the principals of toxicology and green chemistry to examine safe alternatives</li> </ul> |
| Background             | College level for students with an interest and/or background.  |
| Means of Assessment    | Discussion questions during the lecture and applying the lecture information to a blog post   |
| Guidance               | <ul style="list-style-type: none"> <li>◆ Color key: Use red or blue for points that are be emphasized</li> <li>◆ Time - estimate how many minutes will be needed for each part of the content</li> <li>◆ Content - provide introduction, development of content, and summary</li> </ul>   |

| Time      | Details of Content  | Questions   |
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| 5 minutes | <ul style="list-style-type: none"> <li>◆ Describe man's role in altering the biosphere and the new paradigm we must use to look at ecology.</li> <li>◆ Discuss the need for flame retardants, how they work, and the historical problems associated with brominated flame retardants.</li> </ul>  | <p>What does our ability to alter the biosphere tell us about the products that we use?</p>   |
| 20 min    | <ul style="list-style-type: none"> <li>◆ Describe the chemistry and usage of PBDEs.</li> <li>◆ Describe the environmental cycle of PBDEs and their role as an endocrine disruptor that mimics thyroxin.</li> <li>◆ Discuss the health effects data and how our knowledge of hazard has increased over time</li> <li>◆ Illustrate the importance of population and timing on the effects of PBDE.</li> </ul> | <p>Do flame retardants really make us safe?</p>   |
| 20 min    | <ul style="list-style-type: none"> <li>◆ Discuss how PBDEs present a threat to the environment by bioaccumulation</li> <li>◆ Describe the bioaccumulation process and the chemistry that influences it.</li> <li>◆ Discuss Kow and its relationship to bioaccumulation.</li> <li>◆ Discuss how biodegradation can influence bioaccumulation.</li> </ul>   | <p>If PBDEs outside of the Kow range that would bioaccumulate, why do they pose a hazard?</p> |

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| 10 minutes  | <ul style="list-style-type: none"><li>◆ Discuss the role of green chemistry in the development of safer flame retardants.</li><li>◆ Use current examples (Dow Brominated Butadiene/Vinyl Aromatic Copolymers, Caseins, and PVS) to illustrate this point.</li></ul> | Do you see a potential problem with any of the new alternatives? |
| 5 minutes   | <ul style="list-style-type: none"><li>◆ Review and discussion of lessons learned from the history of brominated flame retardants.</li></ul>   |  |
| <p><b>Assignment:</b> Have the students read Distorting science: Makers of flame retardants manipulate research findings to back their products, downplay health risks. (<a href="http://www.chicagotribune.com/news/watchdog/flames/ct-met-flames-science-20120509,0,5238451,full.story">http://www.chicagotribune.com/news/watchdog/flames/ct-met-flames-science-20120509,0,5238451,full.story</a>) and write a blog post on their reaction to the information and discuss what should be done. Discuss the blog posts in the next class.</p> |   |  |