

19. ITEM NO	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT
0001	<p>September 28, 2016. All work shall be in accordance with the attached statement of work and contractor's final quote dated September 8, 2015.</p> <p>Risk Assessment Services</p> <p>The total amount of award: \$131,760.00. The obligation for this award is shown in box 26.</p>	1	LO	131,760.00	131,760.00

32a. QUANTITY IN COLUMN 21 HAS BEEN

RECEIVED INSPECTED ACCEPTED, AND CONFORMS TO THE CONTRACT, EXCEPT AS NOTED: _____

32b. SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE	32c. DATE	32d. PRINTED NAME AND TITLE OF AUTHORIZED GOVERNMENT REPRESENTATIVE
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32e. MAILING ADDRESS OF AUTHORIZED GOVERNMENT REPRESENTATIVE	32f. TELEPHONE NUMBER OF AUTHORIZED GOVERNMENT REPRESENTATIVE
32g. E-MAIL OF AUTHORIZED GOVERNMENT REPRESENTATIVE	

33. SHIP NUMBER <input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL	34. VOUCHER NUMBER	35. AMOUNT VERIFIED CORRECT FOR	36. PAYMENT <input type="checkbox"/> COMPLETE <input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL	37. CHECK NUMBER
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38. S/R ACCOUNT NUMBER	39. S/R VOUCHER NUMBER	40. PAID BY
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41a. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT	42a. RECEIVED BY (<i>Print</i>)
41b. SIGNATURE AND TITLE OF CERTIFYING OFFICER	41c. DATE
42b. RECEIVED AT (<i>Location</i>)	
42c. DATE REC'D (<i>YY/MM/DD</i>)	42d. TOTAL CONTAINERS

Statement of Work
 (Contract# CPSC-D-12-0001 / Task Order 0018)
Flame Retardant Exposure Assessment

1. Description of Services

The Contractor shall estimate human exposure to the selected flame retardant (FR) chemicals (Table 1) from indoor sources, such as indoor air and household dust, using the data from the database organized in Task Order 0015.

In addition,

- The CPSC Contracting Officer’s Representative (COR) and Contractor shall meet by teleconference to discuss and initiate the project.
- The Contractor shall meet with the COR by phone following the completion of each of the subtasks listed below (Section 8), or once a month, to discuss progress on the work.
- CPSC staff can obtain many journal articles in pdf form through the National Library of Medicine (NLM) at low cost. After updating the literature search, the Contractor shall provide a list of references needed (including PMID if available) to the COR. The COR will request these from NLM and forward them to the Contractor. The Contractor shall not purchase articles that can be obtained through NLM.
- Copies of references cited, not provided by the CPSC staff, shall be made available to the COR in paper or electronic form when the task is completed.
- The Contractor shall produce the exposure assessment report in the format of a scientific report, with an introduction, methods section, results, discussion, and references. The report will also include discussion and documentation for exposure data utilized, assumptions assumed, and uncertainties and limitations encountered. The results shall include tables with results briefly summarized in the text. In addition:
 - Exposure estimates for each age range shall include estimates of central tendency (e.g., mean or median), upper bound (e.g., 95th percentile or maximum), or other statistics, as appropriate.

Table 1: Selected FR chemicals for exposure assessment

FR Chemical	CASN
<i>Trialkyl phosphates</i>	
• Tris(1,3-dichloro-2-propyl) phosphate (TDCPP)	13674-87-8
• Tris(chloropropyl) phosphate, mixture of isomers (TCPP)	13674-84-5, 76649-15-5, 76025-08-6, 6145-73-9, 26248-87-3
• Tris(2-chloroethyl) phosphate (TCEP)	115-96-8, 29716-44-7
• Triethyl phosphate (TEP)	78-40-0
<i>Aromatic phosphates</i>	

FR Chemical	CASN
<ul style="list-style-type: none"> Triphenyl phosphate (TPP) 	1145-86-6
<i>Brominated flame retardants</i>	
<ul style="list-style-type: none"> 2-Ethylhexyl 2,3,4,5-tetrabromobenzoate (TBB) 	Unknown
<ul style="list-style-type: none"> Di(2-ethylhexyl) tetrabromophthalate (TBPH) 	Unknown
<ul style="list-style-type: none"> Tetrabromobisphenol A (TBBPA) 	79-94-7; 121839-52-9
<i>Inorganic flame retardants</i>	
<ul style="list-style-type: none"> Antimony trioxide (ATO) 	1309-64-4

The work will be conducted in two phases. In Phase 1, the Contractor shall identify and organize the data for the nine flame retardants and design an exposure assessment strategy. In Phase 2, the Contractor shall conduct the exposure assessments and write the assessment report.

The Phase 1 scope shall include:

- A review of the exposure data in the database developed in Task Order 15 considering the relevant data to design an exposure assessment strategy. This strategy includes identifying:
 - Chemical moieties (and combinations) for assessment;
 - Exposure assumptions,
 - Default values and sources/references;
 - Population characteristics and activity patterns;
 - Scenarios; and,
 - Appropriate statistics.

This strategy shall be discussed and finalized in consultation with the CPSC COR.

- Conducting the exposure assessment considering existing uses of the FR chemicals. The available data should be used in the assessment; however, if newer data are available, then they should be considered. CPSC will assist in providing the Contractor with applicable product and chemical use profiles (i.e., when these FRs were used and what types of products were they used on, over the time frame of interest).
- Stipulating the use of the data: distributions of values for parameters reflecting possible concentrations in various media and other similar data use issues (e.g., creating parametric distributions for what types for what data).
- Determining population characteristics (for selected populations) including, when possible, time spent in house/work/public space by gender and age and periodicity of contact with products, dust, areas where chemicals are expected.

For Phase 2, the Contractor shall use the Phase 1 strategy and data in the exposure database (Task Order 15) to conduct the exposure assessment and prepare the exposure assessment report. As needed, the Contractor will update the literature searching done under Task Orders 8 and 10 to capture new studies reporting concentration measurements on the FRs in media of interest and conduct gap searching to retrieve additional needed data or information to conduct the exposure assessment.

The Phase 2 scope shall include:

- The written exposure assessment report in the following format:
 - Introduction
 - Methods – description of the strategy and approach used (see Phase 1)
 - Results - summarized with appropriate tables, graphics, and text for each of the nine flame retardants
 - Discussion – discussion of key issues, uncertainties, limitations, and data gaps
 - References – for all data and methods used
 - Appendices – as needed
- Exposure estimates ($\mu\text{g}/\text{kg}\cdot\text{d}$) for the media in the database, including exposure estimates for adults, infants, toddlers, and children, shall be made using conventional methods and assumptions, such as in the EPA Exposure Factors Handbook or other suitable sources. Estimates shall:
 - Include inhalation of indoor air.
 - Include incidental ingestion of household dust.
 - Include other routes and exposure scenarios to be determined in consultation with the COR.
 - Be presented in tabular form for each route, pathway, and receptor similar to Table 2.
 - Consider adults to be age ≥ 18 years; infants < 1 year; toddlers 1 to < 3 years; children 3 to < 12 years; and juveniles (12 to < 18 years) for the purpose of the exposure assessment.

Table 2: Sample table for exposure estimate summary

Receptor	Pathway	Chemical	Chemical	Chemical
Infant	Dermal	ADD values	→	
	Oral			
	Inhalation			
	Total			
Toddler	Dermal	↓		
	Oral			
	Inhalation			
	Total			

2. **Contract Type**

This is a firm fixed price task order under CPSC-D-12-0001.

3. **Background**

FRs are chemicals that are added to natural and synthetic materials to improve their resistance to ignition or reduce flame spread after ignition occurs (WHO, 1998). FRs are used in a variety of consumer products including upholstered furniture, mattresses, appliances, electronics, and apparel. The U.S. Consumer Product Safety Commission (CPSC) has been studying the toxicity of FR chemicals since the 1970's. CPSC has investigated the use of FRs in children's sleepwear (CPSC, 1977; Ulsamer et al., 1980), upholstered furniture cover fabrics (Babich and Thomas, 2001; NRC, 2000), upholstered furniture foam (Babich, 2006), and mattresses (Thomas and Brundage, 2006).

FRs have been detected in ambient and indoor air, surface and groundwater, food, house dust, and consumer products. They have also been found in human tissues and in body fluids. FRs have been under scrutiny due to their health effects in animal studies, which include reproductive and developmental toxicity, chronic organ toxicity, and cancer. Recently, concerns have been expressed about FRs found in infant and children's products and the possible health effects that may occur in children due to the use of these products.

Many FR chemicals are semivolatile organic compounds (SVOCs). FRs emitted by any FR-treated household product, furnishing, or building material are found in indoor air, especially in the particulate phase, and in household dust (Weschler and Nazaroff, 2008; Weschler and Nazaroff, 2010). Incidental ingestion of household dust is believed to be a major source of human exposure to FR chemicals (Johnson et al., 2013; Lorber, 2008; Meeker and Stapleton, 2010; Stapleton et al., 2009). In the residential environment, SVOCs in indoor air and household dust are believed to derive, at least in part, from products in CPSC's jurisdiction.

4. **Objective**

The objective of this task is to perform an exposure assessment to estimate human exposure to the chemicals in Table 1. The data for these chemicals was organized into a database in Task Order 0015 and will be used to estimate exposure. This exposure assessment will be used by CPSC staff to determine whether FR exposure from household products in the indoor environment presents a hazard to consumers. They will also be used to prioritize future work on specific products and FR chemicals.

5. **Period of Performance**

The period of performance shall be from September 29, 2015 through September 28, 2016.

6. **Government-Furnished Materials**

The Government will provide the final database from task order 0015, and if necessary, final task orders 0008 and 0010 reports.

7. Deliverables or Performance

The Contractor shall provide the draft exposure assessment report to the CPSC COR within 110 calendar days after acceptance of the strategy and approach for the exposure assessment. The Contractor shall e-mail the exposure assessment report in a Microsoft Word file to the COR.

8. Delivery Schedule

Item(s)	Quantity	Delivery or Performance
The CPSC Contracting Officer's Representative (COR) and Contractor shall meet by teleconference to discuss and initiate the project.	1 meeting	Within 5 calendar days of period of performance start date.
The CPSC COR will be available to consult with the Contractor by teleconference.	As appropriate	At the completion of each subtask, or monthly, whichever comes first.
The Contractor shall review the exposure data in the database and propose initial decisions regarding key components of the strategy. The Contractor shall identify issues and questions to discuss with the CPSC COR regarding scoping and context for the exposure assessment. The Contractor and the CPSC COR shall meet by teleconference for agreement of components of scoping and context of this task.	1 -2 meetings, as appropriate	Within 110 calendar days of project initiation meeting.
The Contractor shall prepare an exposure assessment strategy description, a draft introduction, and appropriate exposure factors to be used in the assessment and submit to the CPSC COR. The Contractor and the CPSC COR shall meet via teleconference for agreement on these factors.	1-2 meetings, as appropriate	Within 40 calendar days of agreement on key components.
The Contractor shall perform the exposure assessment and submit a draft report to the CPSC COR.	1 draft report	Within 110 calendar days of agreement on strategy and approach.

Item(s)	Quantity	Delivery or Performance
The CPSC COR will provide written comments on the draft report to the Contractor.	1 set of comments on draft report	Within 21 calendar days after receipt of the draft report.
The Contractor shall revise the draft report as appropriate and shall submit a draft final report to the CPSC COR.	1 draft final report	Within 21 calendar days after receipt of comments on the draft report.
The CPSC COR will provide written comments on the draft final report to the Contractor.	1 set of comments on draft final report	Within 7 calendar days after receipt of draft final report.
The Contractor will revise the draft final report as appropriate and shall submit a final report to the CPSC COR.	1 final report	Within 7 calendar days after receipt of comments on draft final report.
Inspection and Acceptance.	The final report will be reviewed by the COR	Within 7 calendar days after receipt of the report.

9. Place of Delivery

The contractor shall return the revised report by email to the COR, Melanie Biggs (mbiggs@cpsc.gov). If needed, the Contractor may mail or send written materials by the deadlines to:

Melanie B. Biggs, Ph.D.
U.S. Consumer Product Safety Commission
5 Research Pl
Rockville, MD 20850

10. Inspection and Acceptance

The draft exposure assessment report submitted to the U.S. Consumer Product Safety Commission will be reviewed within 21 calendar days of receipt of the draft report for any additional questions and/or comments. If returned to the Contractor as a result of the review, the Contractor shall address and/or revise their report accordingly and return the draft final version to the COR within 21 calendar days of receipt. The CPSC COR will then have an additional 7 calendar days to review the draft final report. If returned to the Contractor as a result of the review, the Contractor shall address and/or revise their draft final report accordingly and return the final version to the COR within 7 calendar days of receipt. The CPSC COR will then have an additional 7 calendar days to review and accept the final report.

11. Requirement for CPSC Clearance

The final report is the property of the U.S. Consumer Product Safety Commission. The Contractor shall not publish the final report, present the information at scientific meetings, or in any other way make the findings public in any form without the written permission of the COR. Any publication must be cleared in accordance with CPSC-D-12-0001 clause LC21A Disclosure of Information – Limits on Publication.

12. References

- Babich, M.A. 2006. CPSC Staff Preliminary Risk Assessment of Flame Retardant (FR) Chemicals in Upholstered Furniture Foam. U.S. Consumer Product Safety Commission, Directorate for Health Sciences, Bethesda, MD 20814.
- Babich, M.A., and T.A. Thomas. 2001. CPSC staff exposure and risk assessment of flame retardant chemicals in residential upholstered furniture. U.S. Consumer Product Safety Commission, Bethesda, MD 20814.
- CPSC. 1977. Children's wearing apparel containing TRIS; interpretation as a banned hazardous substance. *Federal Register*. 42:18850-18854. [Later withdrawn following judicial proceedings.].
- Johnson, P.I., H.M. Stapleton, B. Mukherjee, R. Hauser, and J.D. Meeker. 2013. Associations between brominated flame retardants in house dust and hormone levels in men. *The Science of the total environment*. 445-446:177-184.
- Lorber, M. 2008. Exposure of Americans to polybrominated diphenyl ethers. *Journal of exposure science & environmental epidemiology*. 18:2-19.
- Meeker, J.D., and H.M. Stapleton. 2010. House dust concentrations of organophosphate flame retardants in relation to hormone levels and semen quality parameters. *Environmental health perspectives*. 118:318-323.
- NRC. 2000. Toxicological Risks of Selected Flame Retardant Chemicals. National Research Council, National Academy Press, Washington, DC.
- Stapleton, H.M., S. Klosterhaus, S. Eagle, J. Fuh, J.D. Meeker, A. Blum, and T.F. Webster. 2009. Detection of organophosphate flame retardants in furniture foam and U.S. house dust. *Environmental science & technology*. 43:7490-7495.
- Thomas, T.A., and P. Brundage. 2006. Quantitative assessment of potential health effects from the use of flame retardant (FR) chemicals in mattresses. B. U.S. Consumer Product Safety Commission, MD 20814. January 2006, editor.
- Ulsamer, A.G., R.E. Osterberg, and J.J. McLaughlin. 1980. Flame retardant chemicals in textiles. *Clin Toxicol*. 17:101-132.
- Weschler, C.J., and W.W. Nazaroff. 2008. Semivolatile organic compounds in indoor environments. *Atmospheric Environment*. 42:9018-9040.
- Weschler, C.J., and W.W. Nazaroff. 2010. SVOC partitioning between the gas phase and settled dust indoors. *Atmospheric Environment*. 44:3609-3620.
- WHO. 1998. Environmental Health Criteria, 209. Flame retardants: Tris(Chloropropyl) phosphate and Tris(2-Chlorethyl) phosphate. In ENVIRONMENTAL HEALTH CRITERIA, 209; FLAME RETARDANTS: TRIS (CHLOROPROPYL) PHOSPHATE AND TRIS(2-CHLORETHYL) PHOSPHATE. XIX+106P. WHO: GENEVA, SWITZERLAND. ISBN 92-4-157209-4; 209 (0). 1998. i-xix; 1-106.