



DEPARTMENT OF
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State of Washington

Flame Retardants in General Consumer and Children's Products

Addendum 3 to Quality Assurance Project
Plan: Nap Mats 2018

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This is an addendum to the *Quality Assurance Project Plan: Flame Retardants in General Consumer and Children's Products* (2012). It is not a correction (errata) to the original plan. The addendum is also similar to QAPP Addendum 2; it describes measuring chlorinated and non-chlorinated flame retardants in a new line of children's products – nap mats.

The formatting of this document reflects Ecology's current QAPP template, which was not available when the original QAPP and Addendum 2 were published. However, the activities described here are easily linked to those publications.

Original Publication

The *Quality Assurance Project Plan: Flame Retardants in General Consumer and Children's Products*, publication 12-07-025, is available on the Department of Ecology's website at:

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Flame Retardants in General Consumer and Children's Products

Addendum 3 to Quality Assurance Project Plan: Nap Mats 2018

June 2018

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Signatures not available on the internet version.

HWTR: Hazardous Waste and Toxics Reduction Program

MEL: Manchester Environmental Laboratory

EAP: Environmental Assessment Program

2.0 Abstract

The Washington State Department of Ecology (Ecology) will investigate several flame retardants, including Tris(1,3-dichloroisopropyl)phosphate (TDCPP) and Tris(2-chloroethyl)phosphate (TCEP), in children's nap mats. These flame retardants are restricted in certain children's products and residential upholstered furniture as part of the Children's Safe Products Act (CSPA), Revised Code of Washington (RCW) Chapter 70.240 which was amended in April 2016 and implemented in July of 2017. This study is being carried out to assess compliance in one category of products. The project plan has been amended for product category, sample numbers, data quality objectives and total project costs and only the changes to the project are reflected in this addendum to the *Quality Assurance Project Plan: Flame Retardants in General Consumer and Children's Products*.

3.0 Background

In January 2015, [Technical Bulletin \(TB\) 117-2013](#)¹ became mandatory in California and replaced TB 117, one of the major drivers for flame retardant use in upholstered furniture in the United States which was frequently met with flame retardants including:

- Tris(1,3-dichloro-2-propyl) phosphate (TDCPP)
- Firemaster® 550 (FM 550), which contains a mixture of flame retardants including 2-ethylhexyl 2,3,4,5-tetrabromobenzoate (TBB), (2-ethylhexyl) tetrabromophthalate (TBPH), and triphenyl phosphate (TPP) (Stapleton, 2011, 2012).

Additional flame retardants detected in foam with the TB-117 label are tris(1-chloro-2-propyl) phosphate (TCPP), 2,2-bis(chloromethyl)propane-1,3-diyl-tetrakis(2-chloroethyl)bis(phosphate (V6) and Tris (2-chloroethyl)phosphate (TCEP), which is frequently associated with V6 (Stapleton 2011, 2012, Ecology 2014).

While the new California standard can be met without flame retardants, it does not ban their use. In January 2015, [California Senate Bill 1019](#)² also became mandatory. This law requires any flexible polyurethane foam or upholstered furniture sold in California that must meet TB117-2013 to identify whether or not the product contains added flame retardant chemicals. This updated law now exempts children's nap mats.

In 2016, a new section of the Washington's Children's Safe Products Act was added that restricts the use of TDCPP, TCEP, TBBPA, HBCD and deca-BDE. After July 1, 2017, certain children's products and residential upholstered furniture sold in Washington (WA) cannot contain more

¹ http://www.bearhfti.ca.gov/about_us/tb117_2013.pdf

² http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB1019

than 1,000 parts per million of these flame retardant chemicals. This update also requires children's product manufacturers report the use of additional flame retardants including TPP, Tris (1-chloro-2-propyl) phosphate (TCPP), TBB and TBPH.

Recently, a child's nap mat was purchased by a WA childcare facility and the products purchased were labeled with the original TB-117 label. This labeling likely indicates the product was manufactured before 2015. While not all foam products with the TB-117 label contain flame retardants, it is likely flame retardants are present.

4.0 Study Description

In Spring 2018, Ecology will purchase up to 20 children's nap mats from several online stores that sell nap mats individually and in bulk (including the vendor used by the childcare mentioned above). The foam components will be screened for antimony and bromine using XRF and sent to Manchester Environmental Laboratory (MEL) for the analysis of the flame retardants identified in Table 1. They will be screened using the X-ray fluorescence (XRF) analyzer since one of the analytes (TPP) is frequently associated with two commercial mixtures that contain brominated flame retardants: Firemaster 550 and 600. Antimony has been used as a synergist with halogenated flame retardants.

Table 1. Analytes of interest using GC/MS

Analyte type	Analyte	CAS Number
Chlorinated phosphates	TCEP	115-96-8
Chlorinated phosphates	TCPP	13674-84-5
Chlorinated phosphates	TDCPP	13674-87-8
Non-halogenated phosphates	TPP	115-86-6

4.1 Study goals

This study aims to assess the levels of the flame retardants listed in Table 2 that are present in children's nap mats offered for sale in Washington at several online childcare supply retailers.

The data will serve to support appropriate enforcement action taken by Ecology.

4.6 Tasks Required

The study will include the following tasks:

- Purchase up to 20 nap mats.
- Screen products with the XRF analyzer.
- Submit up to 20 samples to the laboratory for analysis of the analytes in Table 2.
- Review analytical data.
- Write a technical memo or other acceptable documentation of results.

5.0 Organization and Schedule

5.1 Key individuals and their responsibilities

Table 2. Organization of Project Staff and Responsibilities

Staff	Title	Responsibilities
Tina Schaefer HWTR-HQ (360) 407-6997	Client	Reviews project scope. Provides review of the QAPP Addendum and approves it.
Saskia van Bergen HWTR (360) 407-6609	Project Manager	Writes QAPP Addendum; coordinates with laboratory; oversees product collection, processing, and transportation of samples to laboratory; conducts QA review of data; analyzes and interprets data. Writes the technical memo.
Christina Wiseman HWTR 360-407-7672	Sample and Processing Coordinator	Purchases products; Enters purchases and products into the product testing database; conducts XRF screening of products, processes samples and sends samples to laboratory; enters XRF data into Product Testing Database.
Sean Smith HWTR (360) 407-7609	Section Manager for the Client	Reviews project scope and budget; tracks progress; reviews draft QAPP Addendum; approves final QAPP Addendum.
Tom Gries EAP (360) 407-6327	Acting Ecology Quality Assurance Officer	Reviews draft QAPP Addendum; approves final QAPP Addendum.
Alan Rue MEL 360-871-8801	Laboratory Director	Reviews draft QAPP Addendum; approves final QAPP Addendum.
Ken Zarker HWTR (360) 407-6698	Section Manager for the Project Manager	Reviews draft QAPP Addendum; approves final QAPP Addendum.

HWTR: Hazardous Waste and Toxics Reduction Program. QAPP: Quality Assurance Project Plan. EAP: Environmental Assessment Program. MEL: Manchester Environmental Laboratory

5.4 Study schedule

Table 3. Proposed Schedule for Completing Product Collection and Laboratory Work, Data Reviews, Data Entry into Product Testing Database (PTDB), and Technical Memo

Phase	Task	Due Date	Lead Staff
Product Collection and Laboratory Work	Product purchasing completed	6/2018	Saskia van Bergen Chrissy Wiseman
Product Collection and Laboratory Work	Product logging in completed	7/2018	Chrissy Wiseman

Phase	Task	Due Date	Lead Staff
Product Collection and Laboratory Work	XRF screening completed	7/2018	Chrissy Wiseman
Product Collection and Laboratory Work	Samples sent to the laboratory	7/2018	Saskia van Bergen Chrissy Wiseman
Product Collection and Laboratory Work	Internal PTDB and XRF data QA completed	8/2018	Chrissy Wiseman
Product Collection and Laboratory Work	Laboratory analyses and validation completed and received (60 days from receipt)	09/2018	
Data Review	Lab data QA reviewed	09/2018	Saskia van Bergen
Data Review	Lab data loaded in PTDB	09/2018	Saskia van Bergen
Data Review	PTDB data QA review completed	09/2018	Saskia van Bergen
Final Technical Memo	Draft due to supervisor	10/2018	Saskia van Bergen
Final Technical Memo	Drafts due to client/peer reviewer	10/2018	Saskia van Bergen
Final Technical Memo	Final Memo due to client	11/2018	Saskia van Bergen

XRF: X-ray fluorescence

QA: Quality Assurance

PTDB: Product Testing Database

5.6 Budget and Funding

The proposed study budget is displayed in Table 3. Funding is provided by the Product Testing Program at Ecology.

Table 4. Study Budget

Activity/Parameter	Number of Samples	QC Samples ⁺	Approximate Cost of Sample	Subtotal	Total
Product Collection	20	---	\$40	\$ 800	---
Product Collection Total:					\$ 800
Flame Retardant analysis (TDCPP, TCEP, TCPP, TPP)	20	3	\$350	\$ 8,050	---
Laboratory Total:					\$ 8,050
Study Total:					\$8,850

⁺QC samples in this table include those that are not provided free of charge. MEL does not charge for Method blank, LCS and LCS duplicate. MEL does charge for sample duplicate, matrix spike and matrix spike duplicate.

6.0 Data Quality Objectives

An LCS duplicate was added for this project. The laboratory measurement quality objectives (MQOs) for this study were those that were actually achieved for the original study which differed from those written original QAPP (Ecology 2014, 2012) (Table 5).

Table 5. MQOs for Laboratory Analyses

Analyte	Laboratory Control Samples (LCS) (recovery)	Matrix Spikes (MS) (recovery)	LCS, MS and Sample Duplicates (RPD) +	Surrogate Recovery (recovery)	Reporting Limit (ppm)++
TDCPP	50-150%	50-150%	± 40%	50-150%	100
TCEP	50-150%	50-150%	± 40%	50-150%	100
TCPP	50-150%	50-150%	± 40%	50-150%	100
TPP	50-150%	50-150%	± 40%	50-150%	100

+RPD = Relative Percent Difference

++ppm = parts per million of analyte in sample by weight

7.0 Study Design

Product Selection

Ecology will collect a snapshot of twenty available napmats from child care supply companies (including the vendor used by the childcare facility mentioned above). The following products will be preferentially purchased if they:

- mention TB-117 or flame retardancy
- have been previously reported to contain TDCPP or TCEP (Cox, 2013)
- are at a lower price point.

Product Screening

Products will be screened for bromine and antimony using a portable X-Ray Fluorence (XRF). The matrix of interest is foam. Photos of the California labels will be recorded and stored in Ecology's Product Testing Database.

8.0 Field Procedures References

8.2 Measurement and sampling procedures

Product collection and processing will follow the PT Program SOP (PTP001) Sample Collection and Processing (Ecology 2018a).

8.8 Other activities

XRF screening will follow the PT Program SOP (PTP003) Standard Operating Procedure for the Operation of the Thermo Fisher Scientific Niton XL3t 700 X-Ray Fluorescence Analyzer (Ecology, 2018c).

9.0 Laboratory Procedures

MEL or a contract laboratory will conduct the analytical work using the methods repeated below.

Table 6. Laboratory Methods

Analyte	Extraction Method	Instrumentation	Method
TCEP	3546	GC/MS+	EPA 8270
TCPP	3546	GC/MS+	EPA 8270
TDCPP	3546	GC/MS+	EPA 8270
TPP	3546	GC/MS+	EPA 8270

+ GC/MS = Gas chromatography/mass spectroscopy

10.0 Quality Control Procedures

10.1 Laboratory quality control

Laboratory QC tests will consist of the laboratory control samples, laboratory control sample duplicates, laboratory duplicates, and method blanks (Table 7).

Table 7. Quality Control

Analyte	LCS/ LCS Duplicate	MS/ MS Duplicate	Laboratory Duplicates	Method Blanks
Flame Retardant Analysis	1 set/batch	1 set/batch	1/batch	1/batch

Batch: 20 or fewer samples

11.0 Data Management Procedures

11.1 Data recording and reporting requirements

Product login will follow the Product Testing (PT) Program Standard Operating Procedure (SOP) PTP002 Data Entry and Database (Ecology 2018b).

12.0 Audits and Reports

12.4 Responsibility for reports

The project manager will be responsible for writing a Technical Memo or other acceptable format discussing the data quality and usability of the data to the Client.

15.0 References

Cox, 2013. Naptime Nightmares? Toxic Flame Retardants in Chile Care Nap Mats.
https://www.ceh.org/legacy/storage/documents/Flame_Retardants/nap_mat_report_2_19_2013.pdf last accessed 4/2018.

Ecology, 2012. Quality Assurance Project Plan: Flame Retardants in General Consumer and Children's Products, Publication number 12-07-025, 29 pages,
<https://fortress.wa.gov/ecy/publications/SummaryPages/1207025.html>

Ecology, 2014. Flame Retardants in General Consumer and Children's Products, Publication number 14-04-021, 41 pages, <https://fortress.wa.gov/ecy/publications/SummaryPages/1404021.html>

Ecology, 2018a. Product Testing Standard Operating Procedure: Sample Collection and Processing. Internal document No. PTP001. Washington State Department of Ecology, Olympia, WA.

Ecology, 2018b. Product Testing Standard Operating Procedure: Data Entry and Database. Internal document No. PTP002. Washington State Department of Ecology, Olympia, WA.

Ecology, 2018c. Standard Operating Procedure for the Operation of the Thermo Fisher Scientific Niton XL3t 700 X-Ray Fluorescence Analyzer. Internal document No. PTP003. Washington State Department of Ecology, Olympia, WA.

Stapleton, Heather, Susan Klosterhaus, Alex Keller, P. Lee Ferguson, Saskia van Bergen, Ellen Cooper, Thomas F. Webster and Arlene Blum, 2011. *Identification of Flame Retardants in Polyurethane Foam Collected from Baby Products*, **Environ. Sci. Technol.**, 45, pages 5323-5331.

Stapleton, Heather, Smriti Sharma, Gordon Getzinger, P. Lee Ferguson, Michelle Gabriel, Thomas F. Webster and Arlene Blum, 2012. *Novel and High Volume Use Flame Retardants in US Couches Reflective of the 2005 PentaBDE Phase Out*, **Environ. Sci. Technol.**, 46, pages 13432-13439.