STATE OF VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
AIR POLLUTION CONTROL DIVISION

SOURCE EMISSION TESTING GUIDELINES

REVISED FEBRUARY 2011

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ATTACHMENTS

I. INTRODUCTION

Vermont Air Pollution Control Regulations (Regulations) 5-401 and 5-404 authorize the Vermont Air Pollution Control Division (APCD) to require the owner or operator of a stationary source to prepare written reports and to perform emission testing to determine the air pollution potential of that source. To establish uniform requirements and ensure that the appropriate sampling and analysis procedures are utilized, the APCD has developed these guidelines. They are intended to provide the owner or operator of a stationary source, and their testing consultants, guidance regarding site preparation, acceptable process operating conditions, sampling protocols to be followed during compliance testing, and reporting requirements, among other things.

The emissions test and report must provide data adequate to determine compliance with the emission standards specified in the Regulations or in the source's own Air Pollution Control Permit. Use of these guidelines will facilitate meeting this goal, smooth the pre- and post-test approval process, and prevent delays or rejection of a test series due to unacceptable testing methods or process operating conditions.

II. SITE PREPARATION

A source owner or operator shall provide reasonable and necessary openings (sampling ports) in any stacks, vents, or ducts of interest. Safe and easy access to these ports, and a suitable power source at the testing location, is also required. Scaffolding, ladders, electrical power supply components, and any other site preparation equipment used to aid the performance of the testing should be constructed and assembled in conformance with Vermont Department of Labor and Industry (VOSHA) standards.

Many if not most facilities have developed safety plans and guidelines that should be followed. In addition, the Source Evaluation Society (SES) has developed a safety guidelines handbook that covers a number of topics of interest to stack testers. The SES website is: http://www.sesnews.org.

For particulate matter and other isokinetic testing, ports and sampling traverse points must be located in accordance with Method 1 of 40 CFR 60, Appendix A. Every effort should be made to locate stack sampling ports at least eight duct diameters downstream and two diameters upstream from any flow disturbances (e.g. bend, expansion, contraction, or exit). If a proposed sampling location does not meet Method 1 requirements, prior approval from the APCD should be obtained before proceeding with the test preparations. In some cases a prefabricated temporary stack extension will be needed to allow sampling in accordance with Method 1.

With few exceptions each sampling port should be a four-inch (minimum) diameter threaded pipe connection with a cap. A four-inch diameter (or more) port is recommended so that a particulate sampling probe assembly (i.e. probe, pitot tube, and thermocouple) will fit easily through the port. Where only gaseous emissions are being sampled, a smaller port opening may be acceptable. The inside edge of the port should not extend past the inside surface of the stack or duct.

III. PRETEST REPORT SUBMITTAL REQUIREMENTS

The APCD requires the owner or operator of a stationary source to submit a "Pretest Report" for review at least 30 days prior to the scheduled test date. In the case of a particulate test series involving a single stack, pretest reports may be submitted 15 days prior to the scheduled test. The report must adequately document the equipment and procedures to be used, and types of data to be collected, during the emission test series. Should deficiencies or discrepancies be noted, the company and/or test consultant will be notified and will be required to resolve these areas of concern prior to the test.

In general, the APCD requires strict adherence to the U.S. Environmental Protection Agency (USEPA) approved test methods contained in Title 40 CFR Part 60, Appendix A, and Part 61, Appendix B. All emission testing must be carried out in accordance with these reference methods or with other nationally standardized procedures, such as those developed by the National Institute for Occupational Safety and Health (NIOSH), unless the Director of the APCD (Director) has specifically approved variations from these methods in writing. Any variations from the proposed methods will be considered on a "case by case" basis. Variations from the quality control/quality assurance procedures specified in a method, such as calibrations, will not be approved except in extremely unusual circumstances.

A suggested pretest report outline is attached to these guidelines as Attachment A. It identifies the general information required from all stationary sources being tested. If further information is desired, the USEPA has published a guidance document (GD-042) on the preparation and review of emission test reports. Please note that slightly different reporting requirements exist for incinerator installations (Attachment B), fuel burning equipment that conducts soot-blow/grate cleaning operations (Attachment C), and landfills (Attachment D).

If compliance testing is required by Federal regulations, such as a NSPS, NESHAP or a MACT, you may be required to provide test notification or other information to the USEPA. Reporting of this information should be performed separately from the Vermont pretest report and the information should be provided directly to the USEPA. Federal notification and reporting requirements can be found in 40 CFR Sections 60.8 and 63.7.

IV. GENERAL EMISSION TESTING REQUIREMENTS

A. Testing Consultants

Due to the complexity of testing procedures and report preparation, the Vermont APCD recommends that a qualified testing consultant be retained. The APCD requires that the first compliance test on a given source, including visible emissions evaluations (if required), be performed by a 3rd party (consultant) unrelated to the source or equipment vendor to avoid the appearance of conflict of interest. Further testing on that source, if required, may be performed either by a consultant or by "in house" personnel at the discretion of the source operators.

B. Equipment Calibration

All testing and process equipment requiring calibration must have a current calibration. Documentation of the current calibration must be provided prior to the start of the test series. Lack of such documentation may result in delay or postponement of the test series until such materials can be provided.

C. Observation by Agency Representative

The APCD must be given the opportunity to send a representative to observe the site work associated with the test. Normally, emissions testing performed for the purpose of demonstrating compliance with applicable Regulations or permit limits will be observed (at least in part) by a representative of the APCD.

D. Scheduling of Emission Testing

The compliance test should begin within a reasonable time from the scheduled starting time. The Agency reserves the right to require that the compliance test be rescheduled if a substantial (more than 2 or 3 hours) delay occurs. If inspection, maintenance or adjustment of the process or associated air pollution control equipment is needed, it should be performed on a different day and not the test day. Note that modifications or adjustments made to the process because the first test run indicated a high emission rate are included in this limitation on delays.

E. Process Operating Conditions

Process operating conditions and operating rates must be monitored and documented during compliance testing. Process conditions that the APCD may require to be monitored include process material input, production output, fuel consumption, and control device parameters (e.g., ΔP, temperature). Any operating condition or rate changes during the tests, whether accidental or intentional, must be thoroughly documented.

Process conditions during the test periods should reflect normal, long-term operations. Processes that are normally operated in automatic mode are expected to be in this mode throughout the testing. Process or equipment vendors or consultants may be present during the compliance tests, however are not permitted to operate the equipment; the tested equipment must be operated by the facility's normal operating personnel.

In order to determine the maximum expected emission rate and provide some consistency among emission tests, the APCD requires for compliance determinations that stationary sources be operated at or above the levels listed in Table 1 (on following page). In special cases, depending on the nature of the equipment and its use (e.g., gas turbines), the APCD may require that a source be operated at other operating rates during compliance testing.

If the claimed maximum production rate cannot be consistently maintained during the compliance test period, the future allowable operating rate of a process could be limited by a permit condition to the rate actually achieved during the compliance test (plus 10% or 20% as appropriate).

TABLE 1: Required Minimum Operating Rates	
Equipment Type	Minimum Operating Rate
Fuel burning equipment used primarily for space heating	80% of manufacturer's maximum production rating
All other process equipment	90% of manufacturer's maximum production rating

Operation at a lower capacity during compliance testing may be approved where there is a permit condition or physical limitation that prevents the tested source from operating at a higher level. If the test data is to be used only for a comparison to applicable action levels (established under Section 5-261 of the Regulations), the process should be operated at its normal production rate as determined by recent operating records.

F. Process Malfunctions During Testing

The APCD adheres to the USEPA definition of the term "malfunction," which is as follows:

> "Malfunction means any sudden, infrequent, and not reasonably preventable failure of air pollution control equipment, process equipment, or a process to operate in a normal or usual manner. Failures that are caused in part by poor maintenance or careless operation are not malfunctions."
>
> Source: 40 CFR Section 60.2 Definitions.

If a facility representative believes that the results of a test run were affected by a process malfunction and are not representative of the normal maximum operating rate, the results of that run must still be included in the final test report. The reason(s) for the objection to the use of that run for compliance determination purposes must be clearly stated, and one or more additional test runs should be performed under representative operating conditions as potential replacement runs. Process or other data must be included in the final test report to support the claim that a malfunction occurred.

It should be noted that evidence of excessive, or higher than expected, emissions does not by itself constitute proof that a malfunction has occurred.

G. Number of Test Runs

A satisfactory test series shall consist of a minimum of three test runs performed in accordance with the requirements of the approved pretest protocol and methods. The test runs for the same pollutant must not overlap. This requirement does not apply to test runs performed as "pre-surveys" or for identification of stack gas constituents. The APCD may require that particulate emission rate determinations for combustion sources include the results of additional test runs, during which soot blowing and/or grate cleaning will occur. The emission results of the additional runs will be prorated using USEPA procedures (See Attachment C).

As previously noted, additional test runs should be performed if it is believed that a process malfunction may have affected the results of a run.

H. Compliance Determinations

A compliance determination will be made by the Agency. The test consultant cannot make this determination, however a proposed compliance status has become a customary part of the final test report. The following points should be kept in mind.

- The arithmetic mean of all of the test runs will be considered the actual emission rate of the source for compliance determination purposes, except in the case of landfills (see Attachment D) or where soot-blow and or grate cleaning runs are performed (see Attachment C).

- The mean will be rounded-off to the same number of significant digits as the applicable emission limit.

- The "action levels" established in Appendix C of the Vermont Air Pollution Control Regulations are reference values only and are not emission limits. An emission rate found to be in excess of the applicable action level is not itself a violation; the compliance status depends on other factors.

The length of test runs used for compliance determinations should, whenever possible, be related to the measurement units of the applicable emission limit. Mass-based emission limits are typically based on a quantity of emissions per hour, so a test run that lasts for one hour is a direct measure of compliance with that limit. Unless stated otherwise in the permit, testing for compliance with concentration-based emission limits (ppm, gr/dscf, g/bhp-hr, etc.) should also use test runs of approximately one hour, or as appropriate for a related mass-based limit if there is one. Federal regulations may specify different data averaging times. For example, in the case of visible emissions a six-minute averaging period (24 consecutive readings with a reading taken every 15 seconds) shall be used to determine compliance with limits based on NSPS Subpart OOO. Note that the testing procedures in Subpart OOO changed in 2009; only a 30 minute observation period (5 six-minute averages) instead of one hour is required in some

cases. For determining compliance with Vermont's "do not exceed" (instantaneous) visible emission limits, a two-minute averaging period (8 consecutive readings with a reading taken every 15 seconds) shall be used unless a different averaging period is specified in the facility's permit or applicable regulations.

I. Handling Analytic Results of "Not Detected" or "Not Quantifiable"

The Division requires that test procedures be designed so that a sufficient sample size is collected during each run to detect and quantify the expected concentration of a stack gas contaminant. In some cases, however, it has been found that the actual stack gas concentrations were well below the expected concentrations, or the required stack gas sample size would have been unreasonable. In calculating the stack gas sample size required to ensure an adequate detection limit, allowance should be made for the fact that the analytical laboratory may only estimate what the minimum detection limit will be.

The APCD will accept results of "not detected" ("ND") or "not quantifiable" provided that the test was properly designed and executed, and a stack gas contaminant concentration equivalent to the applicable emission limit would have been quantifiable. If the minimum detection limit is above the regulatory or permit emission limit, the test procedure and results will not be accepted for compliance determination purposes.

Should analytical results of "not detected" or "not quantifiable" be returned from the laboratory despite best efforts to avoid it, the rules listed in Table 2 should be applied.

TABLE 2: Rules Applied to Results of "Not Detected" or "Not Quantifiable"

Test Result	Rule Applied
One or two test runs are "ND"	Values of one-half of the minimum detection or quantification limit will be assigned to the "ND" runs. The calculated (i.e., mean) emission rate will be considered the actual emissions rate and compared to the allowable limit to determine compliance.
All three test runs are "ND"	Actual emissions will be considered "unknown". An emission rate equivalent to the minimum detection or quantification limit will be compared to the allowable limit to determine compliance. Test results should be reported as "unknown, but less than x", where x is the rate calculated using the applicable minimum detection or quantification limit.

Results from field or analytical blanks that are reported "ND" will be considered equivalent to zero and should not be subtracted from the test run data.

J. Dioxin/Furan Toxicity Equivalence Factors

Dioxin/Furan test results should be reported as individual Dioxin and Furan compounds, and as "total 2,3,7,8-TCDD/TCDF Equivalents", unless the permit specifies other measurement units. Attachment F, which is based on USEPA guidance and subject to revision, contains a list of conversion factors to be used to calculate "toxicity equivalent" emissions. Toxicity equivalents for dioxin-like polychlorinated biphenyls (PCBs) are included in the attachment for completeness but these compounds would not necessarily be included in the required sampling and analysis.

K. Sample Hold Times

- If a maximum hold time is specified in the applicable method, samples should be held for this period.

- If the facility is found to be in compliance, samples may be discarded after the final test report has been accepted by the APCD.

- If the facility is found to be in violation, and no hold time is specified in the applicable method, samples should be retained for one year.

L. Audit Samples

In September 2010 the USEPA promulgated regulations that restructured their stationary source audit program including changes to 40 C.F.R. Parts 51, 60, 61 and 63. Test consultants, on behalf of the facility, will obtain audit samples from designated private companies or other organizations ("accredited audit sample providers") instead of from the USEPA itself. A listing of audit sample availability is on this USEPA Emissions Measurement Center website: http://www.epa.gov/ttn/emc/email.html. The results of any audit sample analyses must be included in the final test report.

V. FINAL COMPLIANCE TEST REPORT REQUIREMENTS

A final emission test report must be submitted that contains all of the raw test data, as well as appropriate data concerning the actual process operating conditions, test procedures, and data analysis. A final test report must be sent to the Vermont APCD within 30 days of the test completion date unless other arrangements have been approved in advance.

It is recommended that the final test report be written in a format similar to that listed for the pretest report. Information not included in the pretest but required in the final test report is as follows:

- Actual test dates;
- Names and affiliations of persons involved with the test;
- Summary of operating and emission data;
- Comparison of actual emissions with the applicable standards;
- Discussion of any process upsets observed and their impact on the tested emission rate;
- Discussion of deviations from the approved pretest protocol, with justifications and an estimate of the effect of the deviations on the accuracy and validity of the test data; and
- Sample calculations using actual test data.

The following supporting documents must be submitted with the final test report:

- Copies of all sampling data sheets and process operating logs;
- Copies of all analytical laboratory reports and data sheets;
- Copies of all pretest and post-test calibrations.

For the purpose of inclusion in the final test report, CEM data representing a test run should be reduced to one-minute averages. The actual "raw" data may optionally be included in the final report. If CEM raw data is not in the final report it should be noted in the report that it is available upon request.

Calculations of emission test results and averages should include at least one significant digit more than the applicable regulatory or permit emission limit. Only the final reported emission result should be rounded off.

ATTACHMENT A

SUGGESTED PRETEST REPORT OUTLINE

The following outline is suggested for use in preparing a pretest report for submittal to the Vermont APCD. We are aware that most stack test consultants have already developed their own "standard" report formats that may be different from the outline suggested in this attachment. Changes to this outline can be freely made as long as the essential information is contained in the pretest report.

1.0 INTRODUCTION

1.1 Summary of Test Program: A brief summary, typically one page, which identifies or states the names and addresses of the responsible groups or organizations and other information such as the following.

- Name and location of facility
- Applicable regulations
- Processes being tested
- Air pollution control devices (if any)
- Pollutants measured
- Expected test dates

1.2 Test Program Organization: Names and phone numbers of the primary and secondary contact persons, and if necessary their areas of responsibility.

2.0 SOURCE DESCRIPTION

2.1 Process Description: Include a process flow diagram and a general description of the process. List the process operating parameters that are or will be monitored.

2.2 If production is not continuous (batch-type processes), list:

- The duration of each portion of the process cycle
- Identify which portions of the cycle are expected to have the highest potential or actual emissions and
- Which portions of the cycle will be included in the test program.

2.3 Control Equipment Description: Include a diagram showing the relationship of the control device to the remainder of the process if the control device is not illustrated in the process flow diagram used for section 2.1. Identify the control device operating parameters that are or will be monitored.

3.0 TEST OBJECTIVES

3.1. List of Objectives: List in order of priority the specific goals of the test program for both emissions and process operation data collection.

3.2. Test Matrix: Include a table that lists, for each pollutant measured,

- The number of runs,
- Duration of each run,
- Sampling/analysis method.

If more than one analytical laboratory will be involved, include information in the table on which laboratory is involved in which method.

4.0 SAMPLING LOCATIONS

4.1 Flue Gas Sampling Location: Provide illustrations, such as a stack or ductwork elevation and cross section, at the sampling location. Include:

- The stack cross-section dimensions at the sampling location
- Distances to the nearest upstream and downstream flow disturbances
- The number of traverse points and the distance along a traverse to each.

Note whether or not any stack or ductwork modifications, such as installation of a temporary stack extension, will be made for testing purposes.

Confirm that the sampling location meets USEPA criteria. If it does not, discuss the available sampling options and their potential effect on the test results.

4.2 Process Sampling: If process samples, such as fuel or raw ingredients, are to be taken, describe the sampling location and frequency. Note whether or not the process samples will be taken at the same time as the emissions samples.

5.0 SAMPLING AND ANALYSIS PROCEDURES

5.1 Test Methods and Equipment: Place a copy of the test methods in the pretest report, or indicate where a copy can be found (for example, a web page or the CFR). Specify any changes that will be made to the standard test method for the purpose of this test program, and why. Summarize the inventory of equipment that will be brought to the test site.

5.2 Preliminary Measurements: List any measurements that were made during a preliminary site visit, such as stack gas parameters and process operating data. Note whether or not a cyclonic flow check was made.

5.3 Documentation: Include in the pretest report examples of field data collection forms that will be used during the compliance testing.

6.0 QA/QC ACTIVITIES

6.1 On-Site QA/QC Activities: For each test method, summarize the QA/QC activities that will be performed on site. Examples include collection of field

blanks and equipment calibrations. Provide example documentation if not already included in section 5.3.

6.2 Data Validation: Mention whether any data validation procedures are applicable and are being used during the compliance test. Possible procedures include:

- The use of F_o factor to validate CO_2 and O_2 data
- Comparison of related process and stack test equipment readings
- Comparison with previous or preliminary test results
- Analysis of process mass balance (input vs. output streams) to estimate emission rates.

6.3 Sample Identification and Custody: Summarize the method of labeling and preparing the samples for shipment, and the chain-of-custody procedures that will be implemented. Include an example of the documentation.

7.0 PLANT ENTRY AND SAFETY

7.1 Safety Responsibilities: Identify the person(s) responsible for ensuring compliance with plant entry, health and safety requirements.

7.2 Safety Requirements: Summarize the portions of the facility's safety requirements and emergency response plan that are applicable to visitors and the test crew. List any required personal safety equipment.

ATTACHMENT B

ADDITIONAL REQUIREMENTS FOR INCINERATOR INSTALLATIONS

Along with the general requirements listed previously, the Vermont APCD also requires the following additional information be included in the pretest or final test reports when stack testing incinerators:

1. A description of the refuse to be combusted during the test periods and normal and maximum rated capacities in pounds/hour (in pretest).

2. The type and quantity, by weight, of refuse and supplemental fuel burned during the testing, and the time intervals of their introduction into the incinerator (in final report).

3. The method, duration, and final temperature of the preheat cycle (if any), (in both pretest & final reports).

The charge weights must be determined independently for each test run. The use of combined and/or averaged weights must be approved by the APCD prior to the test series.

For Batch Charged Incinerators:

Each test run must include the period of maximum emissions, which is expected to be the initial portion of the batch cycle. Only one test run per batch cycle will be allowed. An excessive delay between the start of the batch cycle and the start of a test run could be grounds for rejection of the test run.

ATTACHMENT C

PARTICULATE EMISSIONS PRORATION PROCEDURES

Excerpted from memo to all U.S. EPA Regions from E. Reich dated March 6, 1979:

Units which do not blow soot continuously may have the effect of soot blowing included by performance testing in the normal manner, provided:

1. soot blowing is permitted only during one of the test runs (if greater than 50% of particulate emissions occur during soot blowing periods, then soot blowing should be required during two test runs), and

2. the soot blowing performance test run should include as much of the soot blowing cycle as possible.

When a short duration soot blowing period limits the number of points which will be sampled during the portion of the test ran that the soot blowers are on, then all of the sampling points lying on at least one stack or duct diameter should be sampled while the soot blower are on, if possible.

The representative average emissions must be calculated by the following generalized equation (instead of simple averaging as outlined in 40 CFR 60.8(f)):

$$E = E_{sbr}\frac{(A+B)S}{AR} + E_{nosb}\left[\frac{(R-S)}{R} - \frac{BS}{AR}\right]$$

Where:

E	=	average E for daily operating time
E_{sbr}	=	average E of sample(s) containing soot blowing
E_{nosb}	=	average E of sample(s) with no soot blowing
A	=	hours of soot blowing during sample(s)
B	=	hours not blowing during sample(s) containing soot blowing
R	=	average hours of operating per 24 hours
S	=	average hours of soot blowing per 24 hours

ATTACHMENT D

EMISSIONS CONCENTRATIONS FROM LANDFILL GAS

1. Confidence Limits

The Vermont APCD will allow the use of the upper 80% confidence limit value for the NMOC and HAC concentration as input into the USEPA Landfill Air Emissions Estimation model in lieu of the default values. The modeled emission rate shall be determined using the adjusted mean emissions concentration, which shall be calculated using the following equation:

$$E = \overline{X} + D \text{ where } D = t_{(0.2)} \frac{S}{\sqrt{N}}$$

Where:

E	=	the adjusted mean emissions concentration
X	=	the measured mean value
D	=	the half width from the average (mean) value of the samples to the upper 80% confidence value
$t_{(0.2)}$	=	the Student's t - distribution value for 80% confidence and N-1 degrees of freedom (see Attachment E on the following page)
N	=	the number of samples
S	=	the standard deviation of the samples.

2. Simplified Modeling

Where detailed (year by year) information regarding landfill receipts is not available, an estimate for each year of operation should be derived by dividing the total landfill volume by the total number of years of landfill operation.

For screening purposes the landfill may be treated as a single cell that is 2 of the age of the landfill.

ATTACHMENT E

STUDENT'S *t*-DISTRIBUTION FOR 80% CONFIDENCE LIMIT

df is number of degrees of freedom (= number of samples minus 1)

df	$t_{(0.2)}$
1	1.376
2	1.061
3	0.978
4	0.941
5	0.920
6	0.906
7	0.896
8	0.880
9	0.883
10	0.879
11	0.876
12	0.873
13	0.870
14	0.868
15	0.866
16	0.865
17	0.863
18	0.862
19	0.861
20	0.860
21	0.859
22	0.858
23	0.858
24	0.857
25	0.856
26	0.856
27	0.855
28	0.855
29	0.854
30	0.854
40	0.851
60	0.848
120	0.845
infinity	0.8416

ATTACHMENT F

TOXICITY EQUIVALENCE FACTORS	
Compound	TEF
Polychlorinated Dibenzo-*p*-dioxins (PCDDs):	
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.0003
Polychlorinated Dibenzofurans (PCDFs):	
2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDF	0.03
2,3,4,7,8-PeCDF	0.3
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
OCDF	0.0003
Dioxin-like Polychlorinated Biphenyls (PCBs):	
3,3′,4,4′-TCB (77)	0.0001
3,4,4′,5-TCB (81)	0.0003
3,3′,4,4′,5-PeCB (126)	0.1
3,3′,4,4′,5,5′-HxCB (169)	0.03
2,3,3′,4,4′-PeCB (105)	0.00003
2,3,4,4′,5-PeCB (114)	0.00003
2,3′,4,4′,5-PeCB (118)	0.00003
2′,3,4,4′,5-PeCB (123)	0.00003
2,3,3′,4,4′,5-HxCB (156)	0.00003
2,3,3′,4,4′,5′-HxCB (157)	0.00003
2,3′,4,4′,5,5′-HxCB (167)	0.00003
2,3,3′,4,4′,5,5′-HpCB (189)	0.00003

Source: USEPA/WHO (van den Berg et al. 2006)

$$Toxic\ Equivalence\ of\ Mixture = \sum_{i=1}^{n} (C_i \times TEF_i)$$

where C_i is the concentration of the emitted compound.