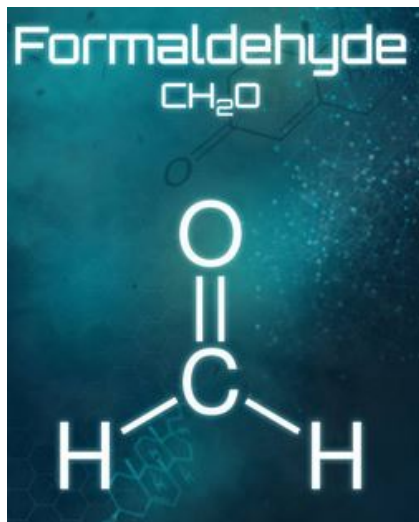


Inter-laboratory Comparison of Third-Party Certifiers and Contract Laboratories

Testing of Formaldehyde Emissions from
Composite Wood Products

2018



December 2019

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Summary

Pursuant to California's Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products, in the winter of 2018/2019, California Air Resources Board (CARB) staff conducted an inter-laboratory comparison (ILC) of CARB-approved third-party certifiers (TPCs) and their contract laboratories. All CARB-approved TPCs and contract laboratories participated in the ILC. CARB's laboratory also participated.

The primary objective of the 2018 ILC was to assess the technical capabilities and proficiencies of individual laboratories to perform formaldehyde emissions testing of composite wood products. Medium density fiberboard (MDF) was selected as the test material and Z-scores were used to determine laboratory testing proficiency. A Z-score is a statistical measure, which compares an individual laboratory's analytical results to the overall mean of all test results, referred to as a consensus mean.

A laboratory's results were considered satisfactory if the following criteria were met:

- Z-score no more +/- 2.0.
- Replicate measurements varied no more than 0.02 parts per million (ppm).

Based on the criteria outlined above, all but one participant demonstrated satisfactory results. This participant has since withdrawn from being a TPC.

I. Introduction

CARB's ATCM (title 17, California Code of Regulations, sections 93120-93120.12) requires TPCs and their contract laboratories to participate in an ILC during the first year the laboratory is used by a TPC, followed by participation in ILCs every two years. CARB previously conducted five ILCs: in 2009, 2011/2012, 2013, 2014/2015, and 2016. In the winter of 2018/2019, CARB staff initiated the 2018 ILC. Additionally, in their final rule (effective June 2018), the United States Environmental Protection Agency (U.S. EPA) requires Toxic Substances Control Act Title VI TPC laboratories and their contract laboratories to participate in CARB's ILC for formaldehyde emissions from composite wood products or in a U.S. EPA recognized proficiency assessment, if available.

II. Purpose

ILCs are useful in assessing the performance and technical capability of individual laboratories in conducting tests and for monitoring performance over time. An individual laboratory can use the information from an ILC to improve and/or maintain internal operating procedures, instruments, and the analytical skills of laboratory staff. The 2018 ILC served the purpose for:

- Evaluating the proficiency of individual laboratories to perform formaldehyde emissions testing of composite wood products using either the primary test method [ASTM E 1333 - large chamber] (ASTM, 1996/2002) or the secondary test method [ASTM D 6007 - small chamber] (ASTM, 2002).
- Evaluating within laboratory repeatability (precision).
- Identifying measurement issues and potential sources of error within individual laboratories.

III. Participants

Forty-four TPCs and contract laboratories participated in the 2018 ILC. Participants included all CARB-approved TPCs and laboratories in addition to CARB's own laboratory. Six laboratories reported results using the primary test method and 38 laboratories reported results using the secondary test method.

The names of the participants are listed in Appendix A. It should be noted that although the participant's names have been provided in Appendix A, all information regarding test results and any follow-up evaluations have been kept confidential through the use of codes. Only CARB staff and the respective laboratory know the code for an individual laboratory.

IV. Study Design

Test Material

CARB selected MDF panels that measured approximately 48 inches x 96 inches for the 2018 ILC test material.

Primary Method Testing: TPCs and laboratories that participated in primary method testing received enough MDF test materials to accommodate their reported large chamber sizes (between 22.0 to 41.5 cubic meters). Laboratories received between one and two panels, cut in halves.

Secondary Method Testing: TPCs and laboratories that participated in secondary method testing received one MDF panel cut into nine pieces. Each piece measured approximately 19 inches x 19 inches.

Additionally, CARB's own laboratory received test samples from the same batch of MDF test material for its small chamber. Analytical samples were cut from three panels, which provided an assessment of the homogeneity of the whole of the test material.

Timeframe

On December 21, 2018, CARB sent participants an overview of the 2018 ILC, which included the ILC protocol (included in Appendix B). The MDF test material was shipped

to participants during the week of February 1, 2019 and participants submitted results to CARB by late May 2019.

Shipping

Primary Method Testing: CARB used pallets to ship MDF test material to laboratories using the primary testing method. Prior to shipping, CARB cut MDF panels into halves for ease of shipping. Panels were fully wrapped in six-millimeter polyethylene protective plastic sheeting. The MDF bundle was strapped to the pallet with waster sheets sandwiched on the top and bottom of the MDF stack.

Secondary Method Testing: CARB used FedEx boxes to package sample material for laboratories using the secondary testing method. Prior to shipping, CARB cut nine 19 inches x 19 inches sample pieces for each laboratory. Samples were wrapped in thin plastic wrap and placed in a shipping box.

2018 ILC Testing Protocol

Laboratories were asked to condition and emission test their test material and to report their results to CARB by a suggested date to avoid potential decay in formaldehyde emissions prior to testing (for additional detail, please refer to Appendix B). The testing methodology is summarized below:

Primary Method Testing: Each laboratory was directed to prepare samples to comply with the required loading ratio for the chamber and to conduct the test according to the ASTM E 1333 requirements. Each laboratory was also required to provide information about testing such as dates, temperature, relative humidity, and any event that might have affected the results of the study. Although section 10.2 of ASTM E 1333 requires that at least two simultaneous air samples be taken, for the purposes of this ILC all laboratories undergoing primary method testing were required to collect four air samples from their chamber. These four air samples could be collected simultaneously or as sequential sample pairs. The data were entered as results Sample 1, Sample 2, Sample 3, and Sample 4 on the data submission sheet that was provided to each laboratory.

Secondary Method Testing: The sampling methodology used for the ILC is described in section 93120.9(a)(2)(A) of the ATCM. Each laboratory was directed to provide information about testing such as dates, temperature, relative humidity, and conditioning time. For secondary method testing, all laboratories were directed to condition samples according to the period used to establish equivalence to the primary test method. The ATCM specifies that nine specimens are to be cut from evenly distributed portions across the panel. The nine specimens are required to be tested in groups of three specimens, resulting in three emission test results. For sampling, duplicate air samples for each of the three chamber tests were to be collected and the analytical results were to be entered on the data submission sheet in pairs as Test 1/Duplicate 1, Test 2/Duplicate 2, and Test 3/Duplicate 3.

V. Statistical Evaluation of the Results

Assigned Values

Assigned values are widely used for the purposes of calculating statistical scores (Thompson et al., 2006). They are derived directly from data sets and may serve as a reference for comparison. In this ILC, we used two assigned values: consensus mean and standard deviation.

Consensus Mean: The assigned value for the consensus mean was achieved by calculating an overall mean of the reported test results for all large and small chamber tests.

Standard Deviation: CARB assigned an acceptable standard deviation at +/- 0.015 parts per million (ppm). This value was based on the published precision of the large and small chamber methods (ASTM, 1996/2002, 2002). ASTM suggested that this standard deviation is typical when conducting repeatability tests at formaldehyde concentrations less than 0.07 ppm. The assigned standard deviation of +/- 0.015 ppm is an acceptable standard deviation and was used to calculate Z-scores.

Proficiency Assessment: Z-score

Proficiency was determined based on Z-scores, a statistical measure which compares an individual laboratory's results to the consensus mean using an assigned standard deviation for proficiency assessment. CARB set an acceptable Z-score of no more than +/- 2.0.

Interpretation of Z-scores is based on the standard normal distribution ("bell curve"). Under this model, 95 percent of calculated Z-scores will fall within +/- 2.0 standard deviations of the consensus mean. Scores in this range are commonly designated as acceptable or satisfactory (Thompson et al., 2006).

Laboratory performance was evaluated according to the following limits:

- $Z \leq \pm 2.0$ Satisfactory
- $Z > \pm 2.0$ Follow-up Evaluation Required

The Z-score of an individual laboratory was calculated according to the following equation:

$$Z_i = \frac{x_i - \bar{X}}{\sigma}$$

where:

- Z_i = Z-score of laboratory “i” for the respective sample;
- x_i = reported formaldehyde content of laboratory “i” for MDF test sample, expressed as the mean of 4 or 6 determinations (depending on primary or secondary method testing)
- \bar{X} = assigned consensus mean concentration for the MDF test material
- σ = standard deviation for proficiency assessment (acceptable standard deviation)

Additional Criteria for Follow-up Evaluation

Laboratories were considered for follow-up evaluation if their emission test results showed more than 0.02 ppm difference between their repeat measurements.

VI. Findings

The large and small chamber methods specify that test results be reported to the nearest 0.01 ppm (ASTM, 1996, 2002). Some participants reported ILC results to the nearest 0.01 ppm and others reported results to the nearest 0.001 ppm. The raw data for each laboratory were entered into an Excel spreadsheet (MS Office Excel 2016) to facilitate the calculations and analysis.

Proficiency was assessed using Z-scores that were calculated using the average test results of both chambers (primary and secondary methods) rounded to the nearest 0.001 ppm. This is referred to the consensus mean, which was calculated to be 0.039 ppm. All laboratories in the 2018 ILC had satisfactory Z-scores.

Table 1 provides a summary of the assigned consensus mean value, acceptable standard deviation, Z-scores, and other relevant data pertaining to the MDF test results.

Table 1. Primary and Secondary Test Method Summary Statistics for MDF

Parameter	Primary Test Method	Secondary Test Method
Number of Laboratories	6	38
Assigned Consensus Value (\bar{x})	0.039 ppm	0.039 ppm
Acceptable Standard Deviation	+/- 0.015 ppm	+/- 0.015 ppm
Z-scores	$z \leq \pm 2.0$	$z \leq \pm 2.0$
Repeatability Measurements (precision)	≤ 0.02 ppm	≤ 0.02 ppm
Range in Reported Mean Results	0.03 – 0.06 ppm	0.02 – 0.08 ppm
Number of Laboratories Identified for Follow-up	None ¹	

1. The participant with unsatisfactory results withdrew from being a TPC, so no follow-up was needed.

Figures 1a and 1b provide graphic summaries of the Z-score results for the primary and secondary test methods. The calculated mean results and Z-scores for each laboratory are provided in Appendix C.

Figure 1a. MDF Z-scores for Primary Test Method

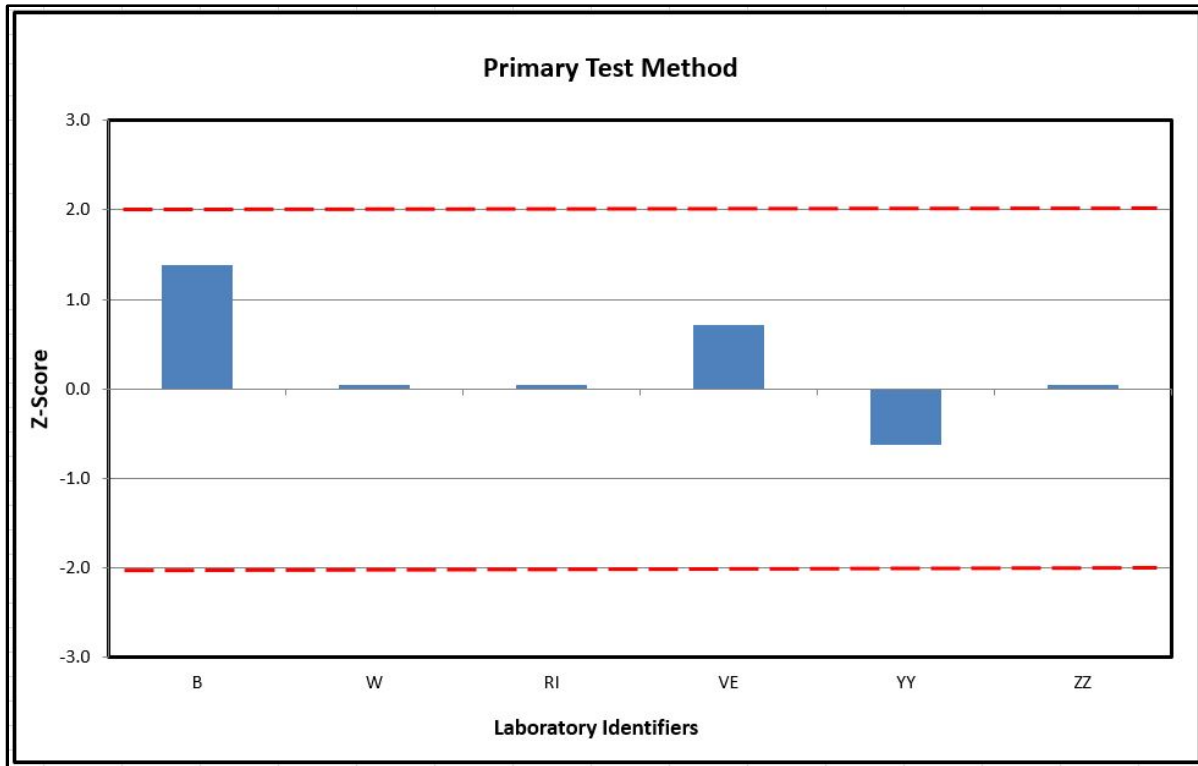
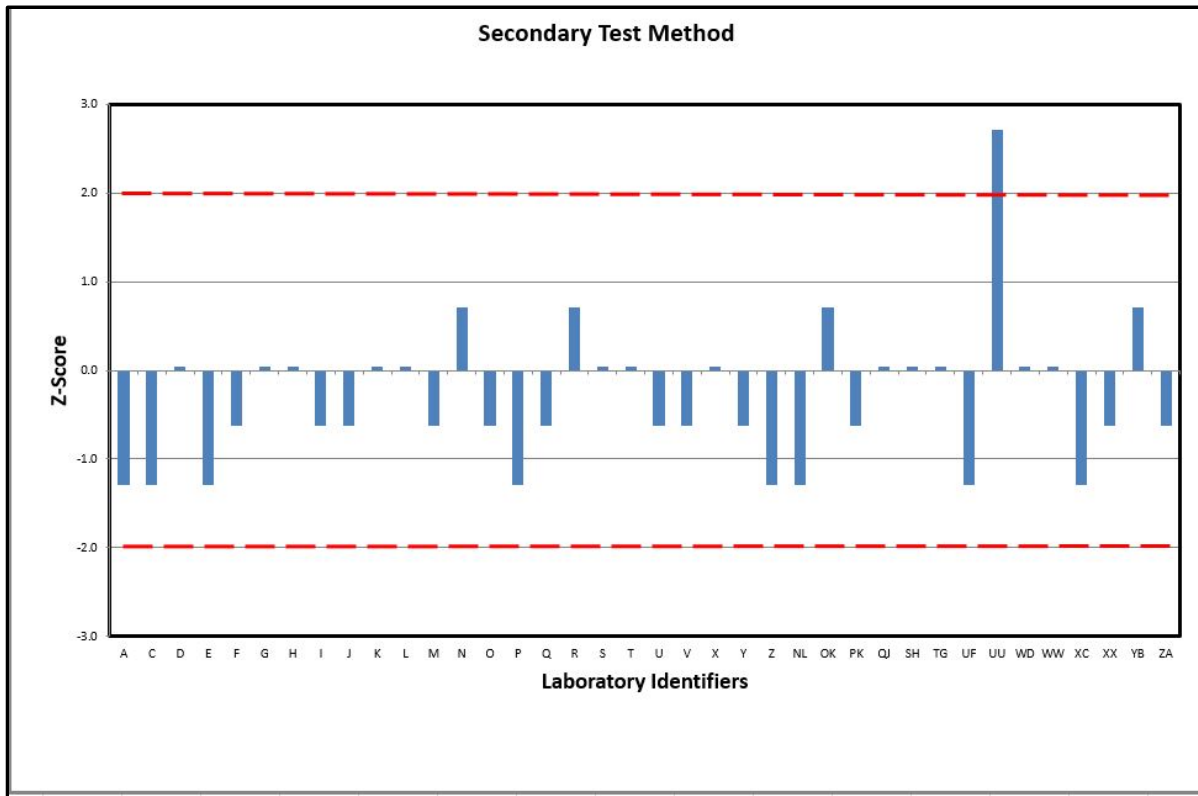


Figure 1b. MDF Z-scores for Secondary Test Method



CARB's laboratory

The mean concentration of CARB's small chamber tests were 0.04 ppm, which is the consensus value (0.039 ppm) rounded to the nearest 0.01 ppm. Test results of specimens cut from the three MDF panels ranged between 0.03 ppm and 0.04 ppm. These results show homogeneity among the test panels.

VII. Within Laboratory Analysis

CARB staff evaluated MDF test results for within-laboratory repeatability (precision). Air samples were evaluated for repeatability as follows:

Primary Method Testing: CARB evaluated each laboratory's test results collected from either method below:

- Four individual air samples collected simultaneous.
- Two sequential sample pairs collected in sequence.

Secondary Method Testing: CARB evaluated each laboratory's test results collected from three sets of samples collected in pairs (e.g., Test 1/Duplicate 1, Test 2/Duplicate 2, Test 3/Duplicate 3).

Laboratories were considered for follow-up evaluation if their test results showed more than a 0.02 ppm difference between replicate samples. Such occurrences may indicate within-laboratory imprecision in sample collection and/or analysis, instrument sensitivity, data reporting errors, or other issues.

All laboratories show close agreement among their replicate sample results for the primary method test and secondary method test, respectively. CARB's test results were within 0.01 ppm.

VIII. Discussion

The 2018 ILC results showed minimal variability among the participating TPCs and laboratories. All but one participant had satisfactory Z-scores and replicate measurements indicated proficiency in conducting primary and secondary method testing. The consensus mean for the primary method test was identical to the secondary method test. This highlights the ability of the secondary test method to produce results equivalent to the primary test method.

IX. References

American Society for Testing and Materials (ASTM), 1996/2002. Designation E 1333 - Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber. ASTM, West Conshohocken, PA.

ASTM, 2002. Designation D 6007 - Standard Test Method for Determining Formaldehyde Concentrations in Air from wood Products Using a Small Scale Chamber. ASTM, West Conshohocken, PA.

Thompson, M., Ellison, S. L. R., & Wood, R., 2006. The International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry Laboratories. *Pure Appl. Chem.*, 78(1), 145–196. doi: 10.1351/pac200678010145. Available at <http://old.iss.it/binary/lcdr/cont/HarmonizedProtocol.pdf>.

APPENDIX A

List of 2018 ILC Participants

TPC/Contract Laboratory Name	Location
TPC-1, Composite Panel Association (CPA)	United States
*TPC-2, Benchmark Holding (BMI)	United States
TPC-3, PFS TECO	United States
TPC-4, Fraunhofer-Institut for Wood Research (WKI)	Germany
TPC-6, PT Mutuagung Lestari (MUTU's Indonesia Certification and Laboratory Office)	Indonesia
TPC-6, Xuzhou MUTU EPTS Co. (MUTU's China Laboratory)	China
TPC-8, Hardwood Plywood and Veneer Association (HPVA)	United States
*TPC-9, SCS Global Services	United States
TPC-10, Entwicklungs- und Prüflabor Holztechnologie GmbH (EPH)	Germany
*TPC-12, Engineered Wood Products Association Pty. Ltd. (EWPA)	Australia
TPC-13, SP Technical Research Institute (RISE)	Sweden
TPC-14, SGS - Hong Kong	China
TPC-15, Instituto Tecnológico Metalmeccánico Muebles Madera, Embalaje y Afines (AIDIMME)	Spain
TPC-16, Centro Ricerca – Sviluppo Laboratorio Prove Settore Legno Arredo (CATAS)	Italy
*TPC-17, FCBA Technological Institute	France
TPC-18, Eberswalde Materialprüfanstalt Brandenburg GmbH (MPA)	Germany
TPC-19, Instytut Technologii Drewna (ITD)	Poland
TPC-20, SGS-CSTC - Guangzhou	China
TPC-22, Dancert / Danish Technological Institute (DTI)	Denmark
TPC-23, Vyzkumny a Vyvojovy Ustav Drevarsky (VVUD)	Czech Republic
TPC-24, Laboratorio Prevenzione Incendi S.p.A. (LAPI)	Italy
TPC-25, NTA Incorporated	United States
TPC-26, SGS – Taiwan	Taiwan
TPC-27, SGS-CSTC - Shanghai	China
*TPC-28, TUV Rheinland - Shenzhen	China
TPC-29, Wood.be	Belgium
*TPC-30, Forestwood Industries	United States
*TPC-31, Intertek Testing Service Ltd. -Shanghai	China

TPC/Contract Laboratory Name	Location
*TPC-32, Intertek Testing Service Ltd. - Hong Kong	China
*TPC-33, Intertek Testing Services Ltd. -Shenzhen	China
TPC-34, TUV Rheinland - Hong Kong	China
TPC-36, Laboratorio Tecnologico per la Qualita (CosMob)	Italy
*TPC-37, Certification Services (CSI)	United States
TPC-38, TUV Rheinland - Shanghai	China
TPC-39, Osrodek Badawczo Rozwojowy Przemyslu Plyt Drewnopochodnych (OBRPPD)	Poland
*TPC-40, Timber Products Inspection	United States
*TPC-41, Intertek-York	United States
TPC-42, UL Environment - Marietta Lab	United States
TPC-42, UL Environment - China Lab	China
*TPC-43, International Certification Testing Technology (ICTT Corp)	China
*TPC-44, International Code Council Evaluation Service, LLC (ICC-ES)	United States
Contract Laboratories	Location
Berkeley Analytical	United States
Advanced Testing Services	United States
FP Innovations	Canada
Beijing Product Quality Supervision & Inspection Institute	China
Nanjing Wood-Based Panels Testing Center	China
Shanghai Hongjun Science and Technology	China
Forest Research Institute Malaysia	Malaysia
Intertek Kentwood	United States
Intertek Guangzhou	China
TUV Rheinland Germany	Germany
VTEC	United States
Government Laboratories	Location
CARB-Monitoring and Laboratory Division	United States

*TPCs that are approved to use a CARB-approved contract laboratory for laboratory services

APPENDIX B

Protocol for Interlaboratory Comparison of Composite Wood Product Third-Party Certifiers

State Of California
Environmental Protection Agency
Air Resources Board

December 2018

Purpose: The California Air Resources Board's (CARB) Interlaboratory Comparison (ILC) for 2018 will fulfill the requirement specified in Appendix 3, section (b)(1)(F) of the Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products, title 17, California Code of Regulations, sections 93120-93120.12. Data from this interlaboratory comparison will be used to assess the testing capabilities of third-party certifiers (TPC) and their contract laboratories in CARB's on-going administration of the TPC program. For more information, please visit: <http://www.arb.ca.gov/regact/2007/compwood07/fro-final.pdf>.

Materials: For the purposes of this ILC, 4 feet (ft.) x 8 ft. medium density fiberboard (MDF) panels will be used as the test material. For ease of handling and reduction of shipping costs, panels will be cut as follows:

- Most of the participating TPCs and contract laboratories will receive nine pieces cut from one MDF panel that measure approximately 19 inches (in.) x 19 in. for use in their secondary test method (small chamber, ASTM D 6007, established as equivalent to a large chamber). The lab will use the pieces to further cut nine custom sized specimens for small chamber testing. These specimens will be tested in groups of three specimens.
- Some of the participating TPCs and contract laboratories will receive enough MDF panels for primary method (large chamber, ASTM E 1333) testing. Each 48 in. x 96 in. panel will be cut into three equal pieces that measure approximately 32 in. x 48 in. These pieces will be used for large chamber testing, based on the loading rate for the size of their large chamber.
Note: some cutting may be needed so that the test material corresponds to the loading ratio for each large chamber.

Shipping: The small chamber MDF test material will be wrapped in plastic wrap and shipped in a box (nine pieces per box). The large chamber test material will be stacked and wrapped in six-millimeter polyethylene plastic sheeting. Waster sheets, used to protect the test material during shipping, will be placed on the exterior of the wrapped test material and subsequently bound together.

We will inform participating TPCs and contract laboratories by email once the test material has been shipped. If you do not receive the test material within two weeks of the date it was shipped, please notify CARB staff.

Additional Considerations - Please be sure to note the following:

- Immediately upon receipt of the samples, the laboratory should store the wrapped test material in a room with a controlled environment. Do not store the test material in a freezer since this changes the emission characteristics of the MDF.
- Do not discard test material following emissions tests. Immediately after testing, please wrap the test material similarly as to how you received them. Please hold onto the test material until you receive notification that the ILC is completed or further instructions are provided. CARB staff may request that you retest your material. Waster sheets used as top and bottom protector panels can be discarded.

Sample Labeling: CARB staff will label each MDF piece with an alphanumeric code so that pieces from a common panel can be identified.

Secondary method testing:

All nine pieces will be labeled with a panel number and piece number, such as M 1-1, M 1-2, M 1-3, M 1-4, M 1- 5, M 1- 6, M 1- 7, M 1-8, and M 1-9.

Primary method testing:

The three pieces cut from each panel, will be labeled with a panel number and letter, such as M 2a, M 2b, and M 2c.

Data Submittal: All test results should be submitted electronically to CARB using a form that will be provided electronically as an Excel worksheet. A copy of the Data Submission Sheet is attached to this protocol.

Sample Testing: We would like all laboratories to initiate conditioning of the test material at about the same time. Conditioning should take place within two to three weeks of receiving the test material (see CARB ATCM, section 93120.9.(a)(2)(A)). This would be late January to early February 2019 (see Table 1), and testing would commence the following week. Each laboratory should report the date of conditioning and testing on the Data Submission Sheet. We understand that samples will arrive at their destinations at different times due to international shipping and due to shipping delays.

Task	Responsible Party	Timeline*
Test Sample Preparation	CARB Staff	Early January 2019
Test Sample Shipment to TPCs and Contract Laboratories	CARB Staff	Early January 2019
Sample Conditioning	TPCs and Contract Laboratories	Late January – early February 2019
Emission Testing		Late January – early February 2019
Report Results to CARB		By February 28, 2019
Data Analysis	CARB Staff	March 2019 – May 2019
Release of Results	CARB Staff	June 2019

*The above dates may shift one to two weeks and you will be notified via email of any changes.

Methodology: For all testing, laboratories must adhere to the following:

1. **Primary Method:** Each laboratory using the primary method is responsible for preparing the test material so that it meets the required loading ratio for the large chamber used as specified in ASTM E 1333. Additionally, test material must be conditioned to requirements in the primary method. For primary method testing, laboratories must document the requirements of ASTM E 1333 and provide the required information about testing such as dates, temperature, relative humidity, background formaldehyde concentration, and any significant event that might affect the results. Section 10.2 of the ASTM method requires that at least two simultaneous air samples be taken. For the purposes of the ILC, laboratories should collect **four air samples** from their chamber. These can be collected simultaneously, or sequentially (i.e., two samples collected during a one-hour period, followed by two additional samples collected during a subsequent one-hour period). Data should be entered as primary method results under Sample 1, Sample 2, Sample 3, and Sample 4 on page 2 of the electronic Data Submission Sheet. Please provide all of the information requested on the electronic Data Submission Sheet.
2. **Secondary Method:** Each laboratory is responsible for preparing specimens to the appropriate dimensions to be consistent with the flow to area (Q/A) ratio for the small chamber used, as specified in ASTM D 6007. For secondary method testing, the sampling methodology described in section 93120.9(a)(2)(A) of the ATCM shall be used. Additionally, test material must be conditioned according to the period used to establish equivalence to the primary method. The secondary method requires that nine specimens be taken from evenly distributed portions across the panel. The nine specimens are to be tested in groups of three specimens, which will result in three emission test results. For sampling

(section 10.2 of ASTM D 6007), laboratories should collect **duplicate air samples** for each of the three small chamber tests. These can be collected simultaneously, or sequentially (i.e., samples collected during consecutive 30-minute sampling periods) and should be entered as secondary method results under Test 1, Duplicate 1, Test 2, Duplicate 2, Test 3, and Duplicate 3 on page 2 of the Data Submission Sheet. Each lab must document the requirements of ASTM D 6007 and provide information about testing such as dates, temperature, relative humidity, background formaldehyde concentrations, conditioning time, and any significant event that might affect the results. Please provide all of the information requested on the electronic Data Submission Sheet.

Immediately after testing, do not discard test material. Each lab shall wrap the chamber samples in plastic wrap or sheeting. Store wrapped specimens in an environmentally controlled room until CARB analyzes the data and the interlaboratory comparison is concluded. In some instances, it may be necessary to request that a laboratory re-test or ship the samples to another testing location.

Results: We ask that you submit test results to Julie Cooper at julie.cooper@arb.ca.gov no later than two weeks from the conclusion of testing. Please inform CARB staff if you will not be able to meet this schedule. On the electronic Data Submission Sheet, please be sure to include:

1. Analytical test method.
2. Primary method results (including duplicate results).
3. Secondary method results (including duplicate results).

For contract laboratories, in addition to providing test results to CARB, we require test results be provided to the TPC(s) to whom they are under contract. Upon receipt of the data from all of the participating laboratories, CARB will summarize the results. All laboratories will be assigned an anonymous identifier known only to CARB and the laboratory. CARB will release the results so that each laboratory can see how they compared to other participants, without disclosing the names of the participants.

CARB staff intends to evaluate the formaldehyde emission testing proficiency of each TPC and contract laboratory in terms of Z-scores that are based on a fitness-for-purpose criterion. This criterion is in accordance with the International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry Laboratories [IUPAC Technical Report, Thompson, M., Ellison, S.L.R. and Wood, R., 2006, and The International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry Laboratories, *Pure Appl. Chem.*, 78(1), 145-196]. For the purposes of the ILC, CARB staff will find a TPC/contract laboratory proficient when their Z-score is less than or equal to ± 2.0 . Statistical outliers will be evaluated (Z-scores of more than ± 2.0) and may be required to conduct follow-up testing or be subject to further examination to evaluate their testing practices in an effort to improve their proficiency.

Contact Information: For questions about this ILC, please contact Julie Cooper at julie.cooper@arb.ca.gov or at (916) 323-0018.

Participating Laboratories

- California Air Resources Board - Monitoring and Laboratory Division
- All CARB-approved Third-Party Certifiers
- All CARB-approved Contract Laboratories

Attachments

1. Data Submission Sheet
(will be provided to TPCs and contract laboratories electronically)

Data Submission Sheet

California Air Resources Board
Transportation and Toxics Division

2018 Interlaboratory Comparison Data Submission Sheet

Laboratory Information

TPC/Laboratory Name		TPC#
Address		<input style="width: 30px; height: 20px;" type="text"/>
Email address		
Chemist/Contact		
Date of report		
Comments:		

Secondary Method Test Report	Configuration	Test #
	Standard face and back	1
Sample Information	Conditioning of Samples	Units
Date sample received	Conditioning background HCHO	ppm
Test date	Date conditioning started	
Type of composite wood	Conditioning time	hours
Comments:	Humidity range	%
	Inlet air flow	m ³ /h
	Sample dimensions	mm x mm
	Total exposed area	m ²
Chamber Information	Testing of Samples	Units
Test chamber volume (m ³)	Testing background HCHO	ppm
Chamber Q/A ratio	Temperature range	°C
# specimens in chamber	Relative humidity range	%
# exposed sample surfaces	Inlet air flow	m ³ /h
Analytical method used		

Secondary Method Test Report	Configuration	Test #
	Standard face and back	2
Sample Information	Conditioning of Samples	Units
Date sample received	Conditioning background HCHO	ppm
Test date	Date conditioning started	
Type of composite wood	Conditioning time	hours
Comments:	Temperature range	°C
	Inlet air flow	m ³ /h
	Sample dimensions	mm x mm
	Total exposed area	m ²
Chamber Information	Testing of Samples	Units
Test chamber volume (m ³)	Testing background HCHO	ppm
Chamber Q/A ratio	Temperature range	°C
# specimens in chamber	Relative humidity range	%
# exposed sample surfaces	Inlet air flow	m ³ /h
Analytical method used		

Secondary Method Test Report	Configuration	Test #
	Standard face and back	3
Sample Information	Conditioning of Samples	Units
Date sample received	Conditioning background HCHO	ppm
Test date	Date conditioning started	
Type of composite wood	Conditioning time	hours
Comments:	Temperature range	°C
	Inlet air flow	m ³ /h
	Sample dimensions	mm x mm
	Total exposed area	m ²
Chamber Information	Testing of Samples	Units
Test chamber volume (m ³)	Testing background HCHO	ppm
Chamber Q/A ratio	Temperature range	°C
# specimens in chamber	Relative humidity range	%
# exposed sample surfaces	Inlet air flow	m ³ /h
Analytical method used		

California Air Resources Board
Transportation and Toxics Division

Interlaboratory Comparison Data Submission Sheet

Primary Method Test Report		Configuration	
		Standard face and back	
Sample Information		Conditioning of Samples	
Date sample received		Conditioning background HCHO	ppm
Test date		Date conditioning started	
Type of composite wood		Conditioning time	hours
		Temperature range	°C
		Humidity range	%
		Inlet air flow	m ³ /h
		Sample dimensions	m x m
		Total exposed area	m ²
Comments:		Testing of Samples	
		Testing background HCHO	ppm
		Temperature range	°C
		Relative Humidity range	%
		Average air change rate	AC/h
		Air sampling rate and time	L/min; min
		Inlet air flow	m ³ /h
Chamber Information		Units	
Test chamber volume			m ³
Chamber loading ratio			m ² /m ³
# specimens in chamber			
# exposed sample surfaces			
Analytical method used			

Test Data

	Primary Method Results (ppm)	Secondary Method Results (ppm)
Sample 1	<input type="text"/>	Test 1 <input type="text"/>
Sample 2	<input type="text"/>	Duplicate 1 <input type="text"/>
Sample 3	<input type="text"/>	Test 2 <input type="text"/>
Sample 4	<input type="text"/>	Duplicate 2 <input type="text"/>
Mean	<input type="text"/>	Test 3 <input type="text"/>
SE	<input type="text"/>	Duplicate 3 <input type="text"/>
		Mean <input type="text"/>
		SE <input type="text"/>
		Are Results Background Subtracted? <input type="text"/>

APPENDIX C

Laboratory Results

Lab ID	Primary Test Method		Secondary Test Method	
	Mean Result (ppm)	Z-score	Mean Result (ppm)	Z-score
A			0.02	-1.3
B	0.06	1.4		
C			0.02	-1.3
D			0.04	0.046
E			0.02	-1.3
F			0.03	-0.62
G			0.04	0.046
H			0.04	0.046
I			0.03	-0.62
J			0.03	-0.62
K			0.04	0.046
L			0.04	0.046
M			0.03	-0.62
N			0.05	0.71
O			0.03	-0.62
P			0.02	-1.3
Q			0.03	-0.62
R			0.05	0.71
S			0.04	0.046
T			0.04	0.046
U			0.03	-0.62
V			0.03	-0.62
W	0.04	0.046		
X			0.05	0.046
Y			0.03	-0.62
Z			0.02	-1.3
NL			0.02	-1.3
OK			0.05	0.71
PK			0.03	-0.62
QJ			0.04	0.046
RI	0.04	0.046		
SH			0.04	0.046
TG			0.04	0.046
UF			0.02	-1.3
UU			0.08	2.7
VE	0.05	0.71		
WD			0.04	0.046
WW			0.04	0.046
XC			0.02	-1.3
XX			0.03	-0.62
YB			0.05	0.71
YY	0.03	-0.62		
ZA			0.03	-0.62
ZZ	0.04	0.046		

Note: Reported MDF laboratory results were averaged and rounded to the nearest 0.01 ppm per large and small chamber methods (ASTM, 1996, 2002).