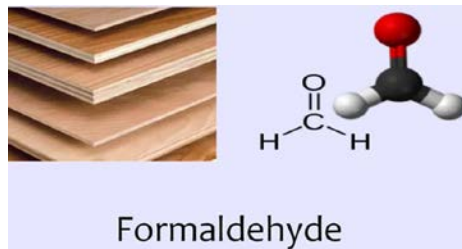


**Inter-laboratory Comparison of
Third Party Certifiers and
Contract Laboratories –
Testing of Formaldehyde Emissions from
Composite Wood Products**

2016



June 2017

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Summary

In the fall of 2016, California Air Resources Board (ARB) staff conducted an inter-laboratory comparison (ILC) of ARB-approved third party certifiers (TPCs) and their contract laboratories, pursuant to California's Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products. There were 42 participants in the 2016 ILC, representing TPCs and contract laboratories. ARB's laboratory also participated. Particleboard was selected as the test material for the 2016 ILC.

The primary objective of the 2016 ILC was to assess the proficiency of individual laboratories to perform formaldehyde emissions testing of composite wood products. Proficiency was determined based on z-scores, a statistical measure which compares an individual laboratory's results to the consensus mean of all participants' results using a pre-determined standard deviation for proficiency assessment. A laboratory's results were considered satisfactory if their z-score was less than or equal to +/- 2.0.

The consensus mean concentration of all participants was 0.08 parts per million (ppm). Based on the criteria outlined above, all 42 laboratories had satisfactory results. Although not required, some laboratories that were sent enough test material to conduct testing using the primary test method also conducted tests using the secondary test method. All laboratories that conducted tests using both methods had close agreement between the two methods. In addition, all laboratories demonstrated satisfactory precision based on repeat measurements that varied by no more than 0.02 ppm.

I. Introduction

The Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products (title 17, California Code of Regulations, sections 93120-93120.12) requires third party certifier (TPCs) and their contract laboratories to participate in an inter-laboratory comparison (ILC) during the first year the laboratory is used by a TPC, followed by participation in ILCs every two years. The California Air Resources Board (ARB) previously conducted four ILCs: in 2009, 2011, 2013, and 2014. In the fall of 2016, ARB staff initiated the 2016 ILC. The following sections describe: objectives for the 2016 ILC, list of participants, program design and testing protocols, approach to statistically evaluate the results to assess laboratory proficiency, and findings of the 2016 ILC.

II. Objectives

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 objectives for the 2016 ILC were to:

- Evaluate 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), established as yielding equivalent results to a large chamber];
- Assess the mean and range in results for laboratories that use the primary test method compared with laboratories that use the secondary test method;
- Evaluate within-laboratory repeatability (precision);
- Identify measurement issues and potential sources of error within individual laboratories; and
- Suggest corrective actions to improve future performance, if necessary.

III. Participants

There were 42 participants in the 2016 ILC, representing TPCs and contract laboratories. Thirty-five TPCs participated; the remaining seven participants were contractor laboratories that provide analytical testing services for TPCs. (Note: some TPCs do not operate a laboratory and rely on contract laboratories.) Fifteen laboratories reported results using the primary test method, 21 used the secondary test method, and six of the participants reported results for both methods. ARB's laboratory also participated using the secondary test method.

The names of the participants are presented 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. The code for an individual laboratory is known only to ARB staff and the respective laboratory.

IV. Study Design

Timeframe

Notifications regarding the ILC and the Protocol for the ILC (included in Appendix B) were sent to participants on September 23, 2016. The test material was shipped to each participant during the week of September 26, 2016. The test results from the participants were reported back to ARB staff between late-October 2016 and early-December 2016. The delay in data reporting for several TPCs/laboratories was the result of customs/border protection agencies review processes prior to approving importation of the test material, which was beyond control of the participants.

Test Material

For the 2016 ILC, particleboard (PB) was selected as the test material. The PB panels measured 48" x 96" x 0.375". Bundles of test material were selected from the same batch of PB products to minimize sample variability. For ease of handling and reduction of shipping costs, each full panel was cut into thirds by ARB staff, yielding three pieces that measured approximately 48" x 32".

ARB staff selected six panels distributed throughout the bundles of test material. These panels were emission tested by ARB's laboratory to assess homogeneity of the test material.

ARB staff selected some laboratories for primary method testing and some for secondary method testing, so that there were at least 20 laboratories using each test method. TPCs/laboratories selected for primary method testing received sufficient test materials to accommodate their reported large chamber sizes (either two or three full panels) amounting to either six or nine 48" x 32" pieces. TPCs/laboratories selected for secondary method testing received one full panel, amounting to three 48" x 32" pieces.

Panels were wrapped in a heavy plastic sheeting (6-mil poly sheeting) which fully covered the boards. Waster sheets (which consisted of structural plywood) were added to the top and bottom of the bundles to protect the plastic sheeting from damage during shipping. The packages were bundled together using heavy duty plastic strapping and shipped via FedEx.

2016 ILC Testing Protocol

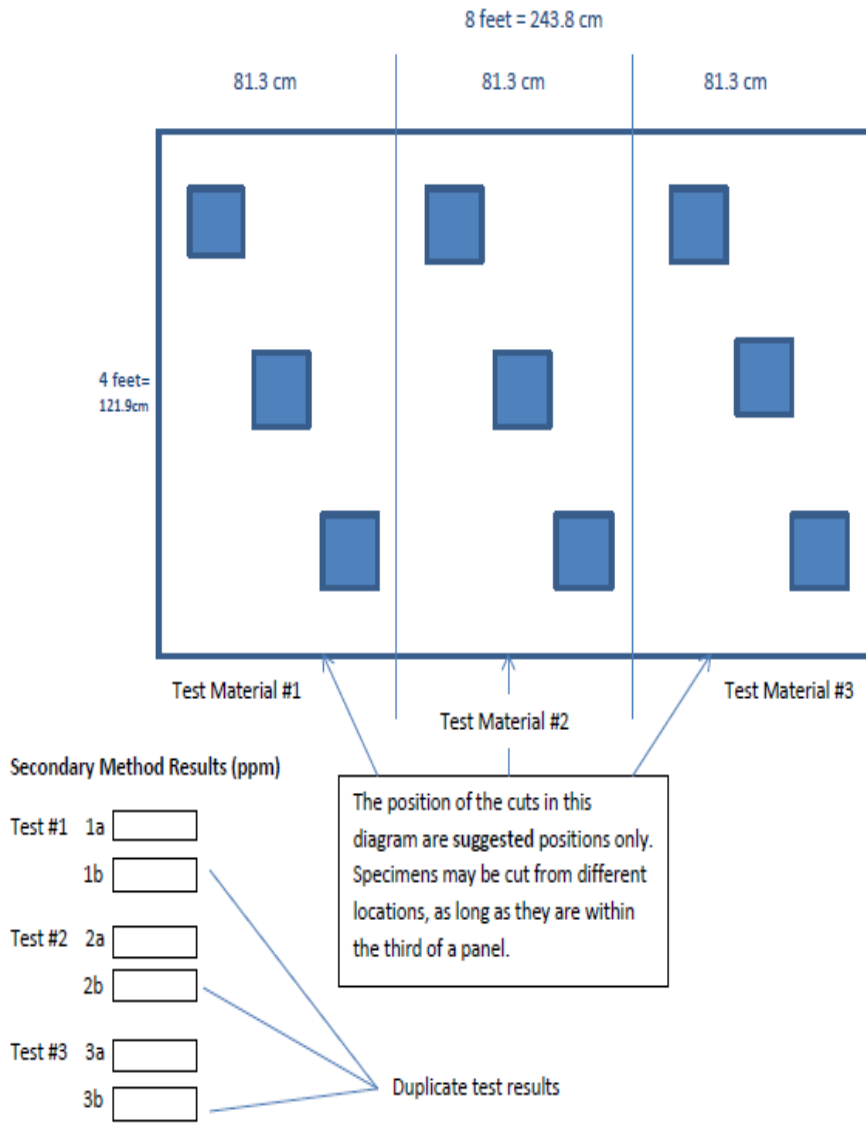
Laboratories were asked to condition and emission test their test material, and to report their results on a data submission sheet by a suggested schedule in an effort to avoid potential decay in formaldehyde emissions prior to testing (for additional detail, please refer to Appendix B). The testing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

Primary Method Testing: Each laboratory was directed to prepare samples to comply with the required loading ratio for the chamber, conduct the test according to the ASTM E 1333 requirements, and 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 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 1a, 1b, 2a, 2b on the data submission sheet provided to each laboratory.

Secondary Method Testing: The sampling methodology used 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. As shown in Figure 1, 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 results were entered as 1a,1b, 2a, 2b, 3a, 3b on the data submission sheet (e.g., 1a is the result of test #1, 1b is the duplicate result).

Figure 1. Sample Preparation for Secondary Method Testing

Panels measuring 4 ft. x 8 ft., cut into thirds, will be shipped to each TPC or contract laboratory. For secondary method testing, three specimens should be cut from each third of a panel, resulting in nine specimens. Each set of three specimens is to be tested together in a small chamber to provide one test result.



V. Statistical Evaluation of the Results

Assigned Value

The assigned value for the concentration of formaldehyde associated with the test material was calculated as the consensus mean of all participants, using the mean values reported by each participant. This approach is widely used (Thompson et al., 2006).

Performance Indicator and Standard Deviation for Proficiency Assessment

Proficiency was determined based on z-scores, a statistical measure which compares an individual laboratory's results to the consensus mean of all participants' results using a pre-determined standard deviation for proficiency assessment. 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 PB test sample, expressed as the mean of 4 or 6 determinations (depending on primary or secondary method testing);
 \bar{X} = assigned consensus concentration for the PB test material; and
 σ = standard deviation for proficiency assessment (acceptable standard deviation).

ARB set the acceptable standard deviation as being +/- 0.015 parts per million (ppm), based on the published precision of the large and small chamber methods (ASTM, 1996/2002, 2002), and an acceptable z-score of no more than +/- 2.0. This acceptable standard deviation was used to calculate z-scores, not the standard deviation of participants' results.

Test sample z-scores were calculated. Laboratory performance was evaluated according to the following limits:

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

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 are to be reported to the nearest 0.01 ppm (ASTM, 1996, 2002). Most participants reported their ILC results to the nearest 0.001 or 0.0001 ppm. The raw data for each laboratory were entered into an Excel spreadsheet (MS Office Excel-2010) to facilitate the calculations and analysis. The reported mean result for each participant was rounded to the nearest 0.01 ppm. Proficiency was assessed using z-scores based on the mean results rounded to the nearest 0.01 ppm.

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

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

Parameter	Primary Test Method	Secondary Test Method
Number of Laboratories*	21	27
Assigned Consensus Value (\bar{X})	0.08 ppm	0.08 ppm
Acceptable Standard Deviation	+/- 0.015 ppm	+/- 0.015 ppm
Range in Reported Mean Results	0.05 – 0.11 ppm	0.05 – 0.11 ppm
Number of Laboratories Identified for Follow-up	none	

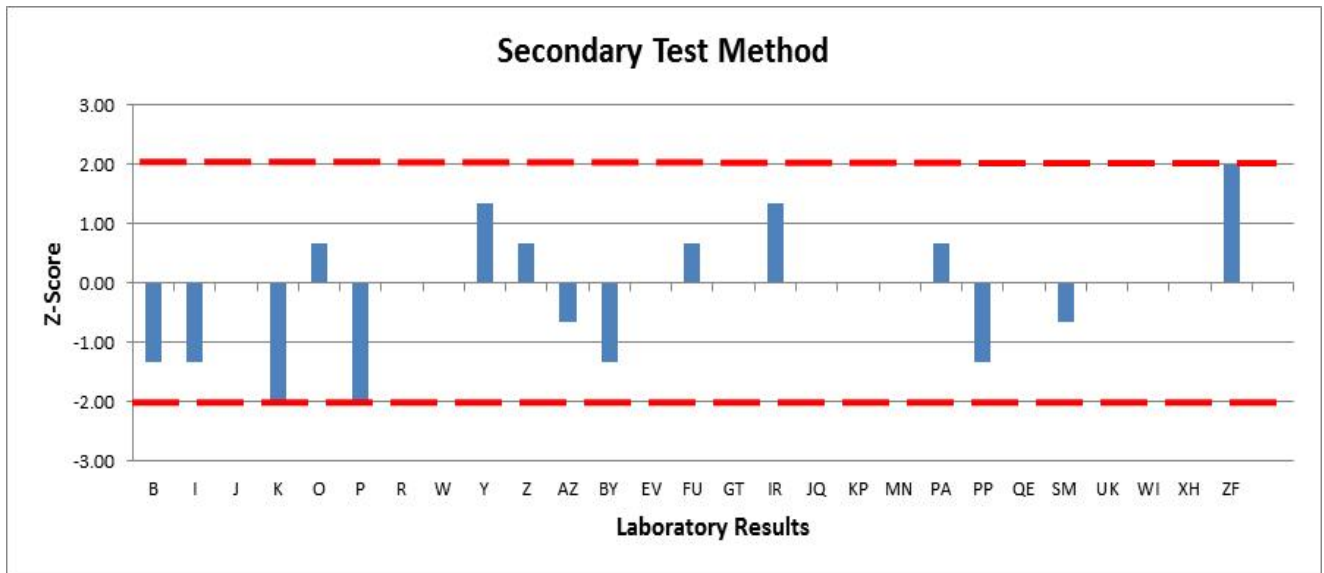
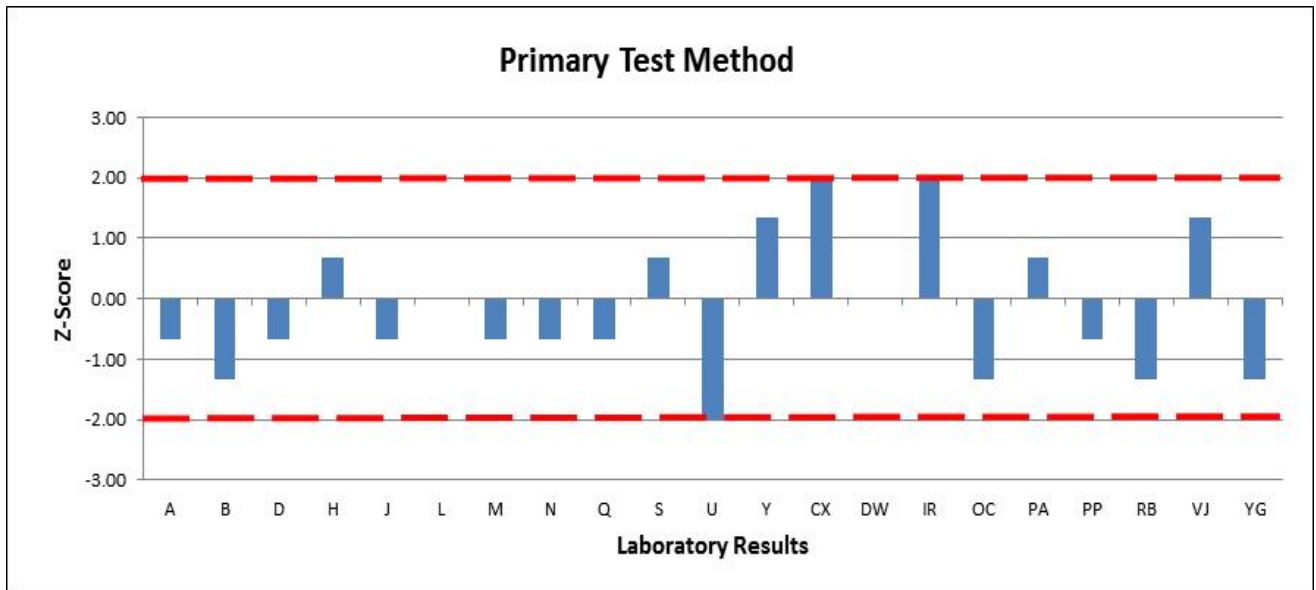
*Note:

- 15 TPCs/laboratories conducted primary method testing
- 21 TPCs/laboratories conducted secondary method testing
- 6 TPCs/laboratories conducted testing using both methods

Figure 2 provides a graphic summary of the z-score results for the primary and secondary test methods. Although not required, some laboratories that were sent enough test material to conduct testing using the primary test method subsequently cut up the test material after the primary method tests and also conducted tests using the secondary test method. All laboratories that conducted tests using both methods had close agreement between the two methods. The reported mean results and z-scores for each laboratory are provided in Appendix C.

ARB's secondary test method results for six PB panels distributed throughout the bundles of test material had a mean concentration of 0.08 ppm, identical to the consensus value. Test results for the six panels ranged from 0.07 to 0.10 ppm. This lack of homogeneity may explain some of the range in participants' results.

Figure 2. PB z-Scores



VII. Within-laboratory Analysis

ARB staff also evaluated within-laboratory repeatability (precision) for PB test results. For primary method testing, of the four data points submitted by laboratories, data were individually assessed as laboratories had the option of collecting four individual air samples simultaneously or sequentially collecting two sample pairs. For secondary method testing, of the six data points submitted by laboratories, paired test results were evaluated (e.g., 1a/1b, 2a/2b, 3a/3b) for repeatability.

Laboratories were considered for follow-up evaluation if their emission test results showed more than 0.02 ppm difference between their repeat measurements. Such occurrences may indicate within-laboratory imprecision, which may be due to rounding reported test values, an indication of insensitive measurement or resolution, or other measurement issues. Repeat measurements were all within 0.02 ppm for all participating laboratories. ARB's repeat test results of the same specimens were within 0.01 ppm.

VIII. Discussion

The 2016 ILC results showed minimal variability among the participating TPCs/laboratories. All laboratories had satisfactory z-scores, which indicated proficiency in conducting primary and secondary method testing. These results demonstrate an overall improvement of precision and accuracy of their chamber testing compared to prior ARB ILCs.

The consensus mean and range in reported mean test results were identical for the 21 laboratories that reported primary method test results and the 27 laboratories that reported secondary method test results. 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., Wood, R. 2006. The International Harmonized Protocol For The Proficiency Testing of Analytical Chemistry Laboratories; International Union of Pure and Applied Chemistry (IUPAC Technical Report). *Pure Appl. Chem.*, Vol. 78, No. 1, pp. 145-196.

Appendix A

List of 2016 ILC Participants

Table A. List of 2016 ILC Participants*

TPC/Contract Laboratory Name	Location
TPC-1, Composite Panel Association (CPA)	United States
TPC-2, Benchmark International (BMI)	United States
TPC-3, PFS Corporation	United States
TPC-4, Fraunhofer-Institut for Wood Research (WKI)	Germany
TPC-6, PT Mutuagung Lestari (MUTU Certification)	Indonesia
Xuzhou MUTU EPTS Co. (MUTU's China Laboratory)	China
TPC-7, PFS TECO	United States
TPC-8, Hardwood Plywood and Veneer Association (HPVA)	United States
TPC-10, Entwicklungs- und Prüflabor Holztechnologie GmbH (EPH)	Germany
TPC-11, Holzforschung Austria (HFA)	Austria
TPC-13, SP Technical Research Institute	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-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-31, Intertek Testing Service Ltd. - Shanghai	China
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-35, TUV Rheinland - Germany	Germany
TPC-36, Laboratorio Tecnologico per la Qualita (CosMob)	Italy
TPC-38, TUV Rheinland - Shanghai	China
TPC-39, Osrodek Badawczo Rozwojowy Przemyslu Plyt Drewnopochodnych (OBRPPD)	Poland
TPC-42, UL Environment - Marietta Lab	United States
UL Environment - China Lab	China
Contract Laboratories	Location
Berkeley Analytical	United States
Advanced Testing Services (ATS)	United States
FP Innovations	Canada
Beijing Product Quality Supervision & Inspection Institute (BPQSII)	China
Nanjing Wood-based Panels Testing Center (Nanjing Forestry)	China
Shanghai Hongjun Science and Technology (SHST)	China
Forest Research Institute Malaysia (FRIM)	Malaysia
Government Laboratories	Location
ARB-Monitoring and Laboratory Division	United States
*TPCs not listed do not operate a laboratory and relied on their contract laboratory(ies) to participate in the ILC.	

Appendix B

Notification Letter and Protocol for Inter-laboratory Comparison of Composite Wood Product Third Party Certifiers



Matthew Rodriguez
Secretary for
Environmental Protection

Air Resources Board

Mary D. Nichols, Chair
1001 I Street • P.O. Box 2815
Sacramento, California 95812 • www.arb.ca.gov



Edmund G. Brown Jr.
Governor

September 23, 2016

Third Party Certifiers and Contract Laboratories

Dear Sirs and Madams:

This letter is to provide you information regarding the upcoming Air Resources Board (ARB) interlaboratory comparison for 2016 (ILC-2016) of third party certifiers (TPCs) and their contract laboratories, and to provide you with the protocol. We request your participation, pursuant to the Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products (title 17, California Code of Regulations, sections 93120-93120.12).

ARB staff plans to initiate the ILC-2016 during late September 2016. The details and tentative schedule are included in the enclosed protocol. Please note that ARB staff requires participating contract laboratories to provide their test results to the TPC(s) to whom they are under contract. Also, please note that we made some changes to the Data Submittal Sheet, so please use the new sheet, not one from prior ILCs.

For the purposes of the ILC-2016, ARB staff will provide each TPC and contract laboratory with one type of composite wood product: particleboard (PB). All PB panels will be cut into thirds for ease of shipping. Half of the participating TPCs and contract laboratories will receive enough PB material to test using their primary test method (large chamber). The other half of the participants will receive one PB panel (cut into thirds) to test using their secondary test method (small chamber established as equivalent to a large chamber).

ARB 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 (see enclosed protocol for further details). For the purposes of the ILC, ARB staff will find a TPC/contract laboratory proficient when their z-score is less than or equal to ± 2.0 . Statistical outliers (z-scores of more than ± 2.0) will be evaluated 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.

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our website: <http://www.arb.ca.gov>.

California Environmental Protection Agency

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Third Party Certifiers and Contract Laboratories
September 23, 2016
Page 2

Thank you in advance for your cooperation and participation. If you have questions regarding the protocol, please contact Mr. Lynn Baker at lynn.baker@arb.ca.gov or at (916) 324-6997.

Sincerely,



for Elizabeth Yura, Chief
Emissions Assessment Branch
Transportation and Toxics Division

Enclosure

cc: Mr. Lynn Baker
Staff Air Pollution Specialist
Technical Analysis Section
Emissions Assessment Branch

Protocol for Interlaboratory Comparison of Composite Wood Product Third Party Certifiers

State Of California
California Environmental Protection Agency
Air Resources Board

September 2016

Purpose: ARB's Interlaboratory Comparison for 2016 (ILC-2016) will fulfill the requirement specified in Appendix 3, section (b)(1)(F) of the Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products ("ATCM," title 17 California Code of Regulations, sections 93120-93120.12, see <http://www.arb.ca.gov/regact/2007/compwood07/fro-final.pdf>). Data from this interlaboratory comparison will be used to assess the testing capabilities of third party certifiers (TPCs) and their contract laboratories in the Air Resources Board's (ARB) on-going administration of the TPC program.

Materials: For the purposes of this ILC, 4 ft. x 8 ft. particleboard (PB) panels will be used as the test material. For ease of handling and reduction of shipping costs, the 4 ft. x 8 ft. panels will be cut into thirds, yielding pieces that measure approximately 48 in. x 32 in. For this ILC:

- Half of the participating TPCs and contract laboratories will receive enough PB panels to allow testing using their primary test method (large chamber), 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.) The other half of participants will receive only one PB panel (cut into thirds measuring 48 in. x 32 in.) for testing using their secondary test method (small chamber established as equivalent to a large chamber).

Shipping: The PB panel pieces will be stacked and wrapped in 6-mil poly sheeting. Waster sheets (CDX plywood), 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 ARB staff.

Additional Considerations - Please be sure to note the following:

- Immediately upon receipt of the samples, the laboratory should store the wrapped boards in a room with a controlled environment. Do not store test material in a freezer.

- Do not discard test materials 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. ARB staff may request that you retest your material.
- Waster sheets (CDX plywood) can be discarded.

Sample Labeling: Prior to cutting, each 48 ft. x 32 ft. piece will be labeled by ARB staff with an alphanumeric code so that pieces from a common panel can be identified. For example, the three pieces from PB panel #1 will be labeled as P1a, P1b, and P1c.

Data Submittal: All testing results should be submitted electronically to ARB 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 about the same time. This would be early October 2016 (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. If it is not possible to follow this schedule, we ask that conditioning commence not more than two weeks from receipt of the samples.

Table 1: 2016 ARB Interlaboratory Comparison Tentative Timeline

Task	Responsible Party	Timeline*
Test Sample Preparation	ARB Staff	Mid-September 2016
Test Sample Shipment to TPCs and Contract Laboratories	ARB Staff	Late September 2016
Sample Conditioning	TPCs and Contract Laboratories	Early – Mid-October 2016
Emission Testing		Mid-October 2016
Report Results to ARB		Late October 2016
Data Analysis	ARB Staff	November 2016 – January 2017
Release of Results	ARB Staff	February 2017

*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. 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 1a, 1b, 2a, 2b 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 (see Figure 1 at the end of the protocol). 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 1a, 1b, 2a, 2b, 3a, 3b 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, each lab shall wrap the chamber samples in plastic and store them in an environmentally controlled room until the data are analyzed 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 Lynn Baker at lynn.baker@arb.ca.gov no later than two weeks from the conclusion of testing. Please inform ARB staff if you will not be able to meet this schedule. On the electronic Data Submission Sheet, please be sure to include:

1. Analytical 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 ARB, 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, ARB will summarize the results. All laboratories will be assigned an anonymous identifier known only to ARB and the laboratory. ARB will release the results so that each laboratory can see how they compared to other participants, without disclosing the names of the participants.

ARB 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, 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, ARB 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 Lynn Baker at lynn.baker@arb.ca.gov or at (916) 324-6997.

Participating Laboratories:

Air Resources Board – Monitoring and Laboratory Division
All ARB-approved Third Party Certifiers
All ARB-approved Contract Laboratories

Attachments

1. Data Submission Sheet
(will be provided to TPCs and contract laboratories electronically)
2. Figure 1 - Sample Preparation for Secondary Method Testing

Data Submission Sheet

California Air Resources Board
Transportation and Toxics Division

Interlaboratory Comparison Data Submission Sheet

Laboratory Information

TPC/Laboratory Name	
Address	
Email address	
Chemist/Contact	
Date of report	
Comments:	

TPC#

Secondary Method Test Report

Sample Information	
Date sample received	
Test date	
Type of composite wood	
Comments:	
Chamber Information	
Test chamber volume (m ³)	m ³
Chamber Q/A ratio	m/h
# specimens in chamber	
# exposed sample surfaces	
Analytical method used	

Configuration

Standard face and back

Test #

1

Conditioning of Samples		Units
Conditioning background HCHO		ppm
Date conditioning started		
Conditioning time		hours
Humidity range		%
Inlet air flow		m ³ /h
Sample dimensions		mm x mm
Total exposed area		m ²
Testing of Samples		Units
Testing background HCHO		ppm
Temperature range		°C
Relative humidity range		%
Inlet air flow		m ³ /h

Secondary Method Test Report

Sample Information	
Date sample received	
Test date	
Type of composite wood	
Comments:	
Chamber Information	
Test chamber volume (m ³)	m ³
Chamber Q/A ratio	m/h
# specimens in chamber	
# exposed sample surfaces	
Analytical method used	

Configuration

Standard face and back

Test #

2

Conditioning of Samples		Units
Conditioning background HCHO		ppm
Date conditioning started		
Conditioning time		hours
Temperature range		°C
Inlet air flow		m ³ /h
Sample dimensions		mm x mm
Total exposed area		m ²
Testing of Samples		Units
Testing background HCHO		ppm
Temperature range		°C
Relative humidity range		%
Inlet air flow		m ³ /h

Secondary Method Test Report

Sample Information	
Date sample received	
Test date	
Type of composite wood	
Comments:	
Chamber Information	
Test chamber volume (m ³)	m ³
Chamber Q/A ratio	m/h
# specimens in chamber	
# exposed sample surfaces	
Analytical method used	

Configuration

Standard face and back

Test #

3

Conditioning of Samples		Units
Conditioning background HCHO		ppm
Date conditioning started		
Conditioning time		hours
Temperature range		°C
Inlet air flow		m ³ /h
Sample dimensions		mm x mm
Total exposed area		m ²
Testing of Samples		Units
Testing background HCHO		ppm
Temperature range		°C
Relative humidity range		%
Inlet air flow		m ³ /h

California Air Resources Board
Transportation and Toxics Division

Interlaboratory Comparison Data Submission Sheet

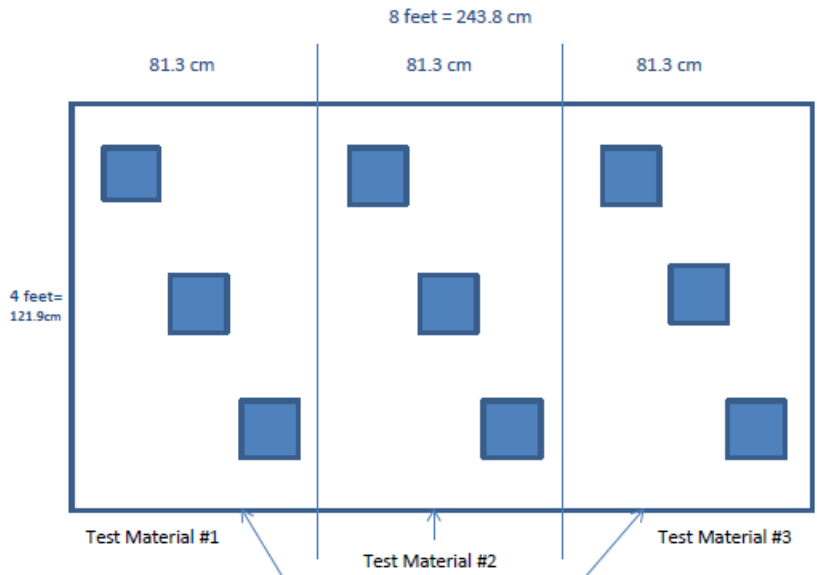
Primary Method Test Report		Configuration	Test#
		Standard face and back	
Sample Information		Conditioning of Samples	
Date sample received		Conditioning background HCHO	ppm
Test date		Date conditioning started	
Type of composite wood		Conditioning time	hours
		Temperature range	°C
		Humidity range	%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

Test Data

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

Sample Preparation for Secondary Method Testing (ASTM D 6007)

Panels measuring 4 ft. x 8 ft., cut into thirds, will be shipped to each TPC or contract laboratory. For secondary method testing, three specimens should be cut from each third of a panel, resulting in nine specimens. Each set of three specimens is to be tested together in a small chamber to provide one test result.



Secondary Method Results (ppm)

- Test #1 1a
- 1b
- Test #2 2a
- 2b
- Test #3 3a
- 3b

The position of the cuts in this diagram are suggested positions only. Specimens may be cut from different locations, as long as they are within the third of a panel.

Duplicate test results

Appendix C

Results

Table C. Reported Mean Results and z-Scores for PB

Lab ID	Primary Test Method		Secondary Test Method	
	Reported Mean Result (ppm)	z-Score	Reported Mean Result (ppm)	z-Score
A	0.07	-0.67		
B	0.06	-1.33	0.06	-1.33
D	0.07	-0.67		
H	0.09	0.67		
I			0.06	-1.33
J	0.07	-0.67	0.08	0.00
K			0.05	-2.00
L	0.08	0.00		
M	0.07	-0.67		
N	0.07	-0.67		
O			0.09	0.67
P			0.05	-2.00
Q	0.07	-0.67		
R			0.08	0.00
S	0.09	0.67		
U	0.05	-2.00		
W			0.08	0.00
Y	0.10	1.33	0.10	1.33
Z			0.09	0.67
AZ			0.07	-0.67
BY			0.06	-1.33
CX	0.11	2.00		
DW	0.08	0.00		
EV			0.08	0.00
FU			0.09	0.67
GT			0.08	0.00
IR	0.11	2.00	0.10	1.33
JQ			0.08	0.00
KP			0.08	0.00
MN			0.08	0.00
OC	0.06	-1.33		
PA	0.09	0.67	0.09	0.67
PP	0.07	-0.67	0.06	-1.33
QE			0.08	0.00
RB	0.06	-1.33		
SM			0.07	-0.67
UK			0.08	0.00
VJ	0.10	1.33		
WI			0.08	0.00
XH			0.08	0.00
YG	0.06	-1.33		
ZF			0.11	2.00