

The following Formaldehyde samples were collected from JFK on 12/07/18 from the listed areas:

U02A Center Desk

M23, Center of the Room

M04D Bookshelf

M04E Desk

Air Analysis For: JFK  
Location Tested: -

Report Number: 75682  
Laboratory ID: 75682-1

Sampling Professional: Donald Johnson  
Eastern Washington University  
002 Martin Hall  
Cheney, WA 99004

**Thank you for using  
IAQ Commercial Survey!**  
If you have questions about your report,  
please contact your service provider who  
performed this test.

Client Sample ID: Center Desk; U02A  
Sample Volume (L): 6.0  
Date Sampled: 12/07/2018  
Sample Type: TDT ZZ466  
Sample Condition: Acceptable

Order Date: 12/12/2018  
Scan Date: 12/12/2018  
Report Date: 12/14/2018

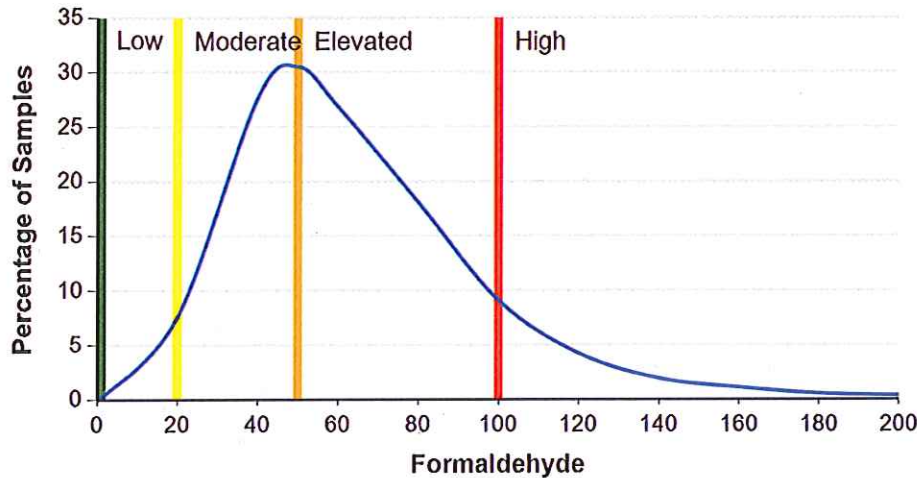
Formaldehyde Concentration: 12 ng/L (9.6 ppb)

**Your Formaldehyde Level (Highlighted)**

Low	Moderate	Elevated	High
< 20 ng/L < 16 ppb	20-50 ng/L 16-40 ppb	50-100 ng/L 40-80 ppb	> 100 ng/L > 80 ppb

**Recommendation:** No significant formaldehyde issues.

**All IAQ Survey Formaldehyde Results**



This chart represents the Formaldehyde distribution of over 7,000 samples.

Approximately half the samples have concentrations in the 30-70 ng/L range.

The chart above shows the formaldehyde concentrations for all locations tested using IAQ Survey. Results for this air sample are displayed on the chart as a yellow circle. The blue curved line represents the relationship between the percentage of locations (indicated on the vertical y-axis) and the formaldehyde concentration (indicated on the horizontal x-axis). The green, yellow, orange, and red vertical bars represent divisions between Low, Moderate, Elevated, and High formaldehyde concentrations.

Formaldehyde concentrations can vary depending on environmental conditions such as temperature, humidity, and ventilation rate. As temperature and humidity increase, the formaldehyde concentration will increase and as the ventilation rate increases, the formaldehyde concentration will decrease.

---

Prism Analytical Technologies, Inc., the creator of IAQ Commercial Survey, has been performing air quality assessments to industry and environmental consultants since 1995. Prism Analytical Technologies, Inc. (ID 166272) is accredited by the AIHA Laboratory Accreditation Programs, LLC (AIHA-LAP, LLC) in the Unique Scope accreditation program for Formaldehyde as documented by the Scope of Accreditation Certificate and associated Scope. Reference internal SOP 523.

## Formaldehyde Exposure Guidelines

The US Occupational Safety and Health Administration (OSHA) has set a workplace **permissible exposure limit (PEL)** of 940 ng/L (750 parts per billion). The National Institute for Occupational Safety and Health (NIOSH) has set a **recommended exposure limit (REL)** of 20 ng/L (16 ppb) with a 120 ng/L (100 ppb) 15 minute ceiling limit.

Although these formaldehyde concentration limits are applicable to all types of workplace environments, most office or retail locations without additional occupational exposure (e.g., industrial or manufacturing processes generating formaldehyde) typically have formaldehyde concentrations less than 100 ng/L (80 ppb). Most indoor environments measured by Prism's air test have concentrations in the range of 30 to 70 ng/L.

The table below provides some of the limits applicable to workplace environments. In general, formaldehyde concentrations should be kept as low as reasonably achievable.

Organization	Concentration		Type
	ng/L	ppb	
OSHA	630	500	Action Level (8 hour)
	940	750	PEL (8 hour)
	2,500	2,000	STEL (15 min)
NIOSH	20	16	REL (8 hour)
	120	100	Ceiling (15 min)
ACGIH	370	300	TLV (8 hour)
LEED	32	27	Green Building (4 hour)
WHO	100	80	Short-Term (0.5 hour)

OSHA: Occupational Health and Safety Administration  
 NIOSH: National Institute for Occupational Safety and Health  
 ACGIH: American Conference of Governmental Industrial Hygienists  
 LEED: Leadership in Energy & Environmental Design (Green Building Council)  
 WHO: World Health Organization

PEL: Permissible Exposure Limit  
 REL: Recommended Exposure Limit  
 TLV: Threshold Limit Value  
 TWA: Time Weighted Average  
 STEL: Short Term Exposure Limit

Note: Concentration can be expressed in several ways and various organizations may use different units.

1 ng/L = 1 µg/m<sup>3</sup> = 0.001 mg/m<sup>3</sup>

1 ppb = 0.001 ppm

To convert between the two sets of units listed above the molecular weight of formaldehyde must be used, which produces the conversion factors below:

ppb concentration = ng/L concentration \* 0.8 or ng/L concentration = ppb concentration \* 1.25

## Major Health Effects of Formaldehyde Exposure

Health effects vary depending on the individual. Common symptoms of acute exposure include irritation of the throat, nose, eyes, and skin; this irritation can potentially exacerbate asthma symptoms and other respiratory illnesses. Long term, or chronic, exposure may also cause chronic runny nose, chronic bronchitis, and obstructive lung disease. In 2004, the International Agency for Research on Cancer (IARC) reclassified formaldehyde from "probably carcinogenic to humans" to "carcinogenic to humans" related to nasopharyngeal cancer. Since many factors are involved in the development of cancer, no definitive "safe level" of exposure has been established. The best way to reduce the risk of cancer is to limit exposure.

## Formaldehyde Sources

There are many possible sources for formaldehyde in the indoor environment, although building products typically make up a large proportion of the concentration. Any recent renovation or new material brought into the building is likely to increase the formaldehyde levels. The concentration will decrease over time as the materials off gas, so increasing the ventilation as much as possible is typically the best way to quickly decrease formaldehyde after recent renovation or installation of new materials.

- Products that contain urea-formaldehyde (UF) resins
  - particleboard, hardwood plywood paneling, medium density fiberboard
- Products that contain phenol-formaldehyde (PF) resins (lower concentrations of formaldehyde than UF resins)
  - softwood plywood, flake or oriented strand board
- Pre-finished engineered flooring
- Insulation
- Glues and adhesives
- Paints and coatings
- Textiles
- Disinfectant cleaning products and soaps
- Preservatives
- Personal care products, especially certain hair products
- Cosmetics
- Pet care products
- Bactericides and fungicides
- Combustion byproduct (burning)
  - Tobacco smoke and fuel-burning appliances (gas stoves, kerosene space heaters and fireplaces)

Formaldehyde is also produced naturally in living systems, e.g., trees and other plant life, and during decay and combustion processes. Formaldehyde is also involved in atmospheric processes. Outdoor concentrations of formaldehyde from both natural and man-made sources can range from less than 1 ng/L in remote areas to 10-20 ng/L in urban environments.

## Additional Resources

US OSHA [Toxic and Hazardous Substances-Formaldehyde](#)

US OSHA [Fact Sheet-Formaldehyde](#)

US NIOSH [Formaldehyde](#)

World Health Organization (WHO) [Air Quality Guidelines for Europe, 2nd Edition \(2000\): pg 87-91](#)

Europe: [Report No. 7-Indoor Air Pollution by Formaldehyde in European Countries \(1990\)](#)

US Consumer Product Safety Commission (CPSC) [Update on Formaldehyde \(2013\)](#)

US Environmental Protection Agency: [Formaldehyde](#)

US Agency for Toxic Substances and Disease Registry (ATSDR): [Formaldehyde ToxFAQs™](#)

US National Institutes of Health (NIH): [ToxTown: Formaldehyde](#)

Chemical Reviews (Journal): [Formaldehyde in the Indoor Environment](#)

Household Products Database: [Formaldehyde](#)

These results are authorized by the Laboratory Director or approved representative.

This analysis was performed by Prism Analytical Technologies, Inc. (Prism) using the Hantzsch, or acetylacelone (acac), method. This test method has been correlated with or is compliant with the California Air Resources Board (CARB) § 93120, European DIN Standard EN-717, and ASTM methods D-5582 and E-1333. It has also been compared with DNPH testing used in NIOSH 2016 and found to be in good agreement.

The results contained in this report are dependent upon a number of factors over which Prism has no control, which may include, but are not limited to, the sampling technique utilized, the size or source of sample, and the ability of the sampler to collect a proper or suitable sample. Therefore, the opinions contained in this report may be invalid and cannot be considered or construed as definitive and neither Prism, nor its agents, officers, directors, employees, or successors shall be liable for any claims, actions, causes of action, costs, loss of service, medical or other expenses or any compensation whatsoever which may now or hereafter occur or accrue based upon the information or opinions contained herein.

© Copyright 2018, Prism Analytical Technologies, All rights reserved.

**Air Analysis For:** JFK  
**Location Tested:** -

**Report Number:** 75682  
**Laboratory ID:** 75682-2

**Sampling Professional:** Donald Johnson  
Eastern Washington University  
002 Martin Hall  
Cheney, WA 99004

**Thank you for using  
IAQ Commercial Survey!**  
If you have questions about your report,  
please contact your service provider who  
performed this test.

**Client Sample ID:** Center: M23  
**Sample Volume (L):** 5.2  
**Date Sampled:** 12/07/2018  
**Sample Type:** TDT AD355  
**Sample Condition:** Acceptable

**Order Date:** 12/12/2018  
**Scan Date:** 12/12/2018  
**Report Date:** 12/14/2018

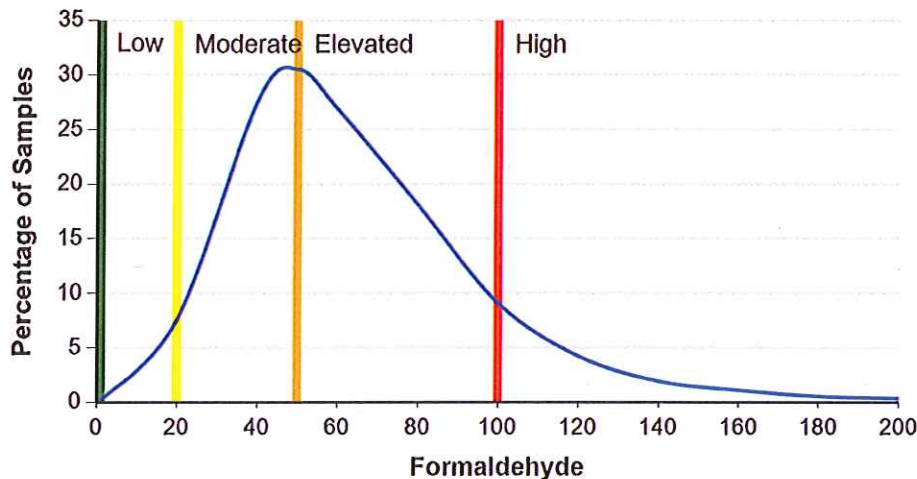
**Formaldehyde Concentration:** 14 ng/L (11 ppb)

**Your Formaldehyde Level (Highlighted)**

Low < 20 ng/L < 16 ppb	Moderate 20-50 ng/L 16-40 ppb	Elevated 50-100 ng/L 40-80 ppb	High > 100 ng/L > 80 ppb
------------------------------	-------------------------------------	--------------------------------------	--------------------------------

**Recommendation:** No significant formaldehyde issues.

**All IAQ Survey Formaldehyde Results**



This chart represents the Formaldehyde distribution of over 7,000 samples.

Approximately half the samples have concentrations in the 30-70 ng/L range.

The chart above shows the formaldehyde concentrations for all locations tested using IAQ Survey. Results for this air sample are displayed on the chart as a yellow circle. The blue curved line represents the relationship between the percentage of locations (indicated on the vertical y-axis) and the formaldehyde concentration (indicated on the horizontal x-axis). The green, yellow, orange, and red vertical bars represent divisions between Low, Moderate, Elevated, and High formaldehyde concentrations.

Formaldehyde concentrations can vary depending on environmental conditions such as temperature, humidity, and ventilation rate. As temperature and humidity increase, the formaldehyde concentration will increase and as the ventilation rate increases, the formaldehyde concentration will decrease.

---

Prism Analytical Technologies, Inc., the creator of IAQ Commercial Survey, has been performing air quality assessments to industry and environmental consultants since 1995. Prism Analytical Technologies, Inc. (ID 166272) is accredited by the AIHA Laboratory Accreditation Programs, LLC (AIHA-LAP, LLC) in the Unique Scope accreditation program for Formaldehyde as documented by the Scope of Accreditation Certificate and associated Scope. Reference internal SOP 523.

## Formaldehyde Exposure Guidelines

The US Occupational Safety and Health Administration (OSHA) has set a workplace **permissible exposure limit (PEL)** of 940 ng/L (750 parts per billion). The National Institute for Occupational Safety and Health (NIOSH) has set a **recommended exposure limit (REL)** of 20 ng/L (16 ppb) with a 120 ng/L (100 ppb) 15 minute ceiling limit.

Although these formaldehyde concentration limits are applicable to all types of workplace environments, most office or retail locations without additional occupational exposure (e.g., industrial or manufacturing processes generating formaldehyde) typically have formaldehyde concentrations less than 100 ng/L (80 ppb). Most indoor environments measured by Prism's air test have concentrations in the range of 30 to 70 ng/L.

The table below provides some of the limits applicable to workplace environments. In general, formaldehyde concentrations should be kept as low as reasonably achievable.

Organization	Concentration		Type
	ng/L	ppb	
OSHA	630	500	Action Level (8 hour)
	940	750	PEL (8 hour)
	2,500	2,000	STEL (15 min)
NIOSH	20	16	REL (8 hour)
	120	100	Ceiling (15 min)
ACGIH	370	300	TLV (8 hour)
LEED	32	27	Green Building (4 hour)
WHO	100	80	Short-Term (0.5 hour)

OSHA: Occupational Health and Safety Administration  
 NIOSH: National Institute for Occupational Safety and Health  
 ACGIH: American Conference of Governmental Industrial Hygienists  
 LEED: Leadership in Energy & Environmental Design (Green Building Council)  
 WHO: World Health Organization

PEL: Permissible Exposure Limit  
 REL: Recommended Exposure Limit  
 TLV: Threshold Limit Value  
 TWA: Time Weighted Average  
 STEL: Short Term Exposure Limit

Note: Concentration can be expressed in several ways and various organizations may use different units.

1 ng/L = 1 µg/m³ = 0.001 mg/m³

1 ppb = 0.001 ppm

To convert between the two sets of units listed above the molecular weight of formaldehyde must be used, which produces the conversion factors below:

ppb concentration = ng/L concentration \* 0.8 or ng/L concentration = ppb concentration \* 1.25

## Major Health Effects of Formaldehyde Exposure

Health effects vary depending on the individual. Common symptoms of acute exposure include irritation of the throat, nose, eyes, and skin; this irritation can potentially exacerbate asthma symptoms and other respiratory illnesses. Long term, or chronic, exposure may also cause chronic runny nose, chronic bronchitis, and obstructive lung disease. In 2004, the International Agency for Research on Cancer (IARC) reclassified formaldehyde from "probably carcinogenic to humans" to "carcinogenic to humans" related to nasopharyngeal cancer. Since many factors are involved in the development of cancer, no definitive "safe level" of exposure has been established. The best way to reduce the risk of cancer is to limit exposure.



## Formaldehyde Sources

There are many possible sources for formaldehyde in the indoor environment, although building products typically make up a large proportion of the concentration. Any recent renovation or new material brought into the building is likely to increase the formaldehyde levels. The concentration will decrease over time as the materials off gas, so increasing the ventilation as much as possible is typically the best way to quickly decrease formaldehyde after recent renovation or installation of new materials.

- Products that contain urea-formaldehyde (UF) resins
  - particleboard, hardwood plywood paneling, medium density fiberboard
- Products that contain phenol-formaldehyde (PF) resins (lower concentrations of formaldehyde than UF resins)
  - softwood plywood, flake or oriented strand board
- Pre-finished engineered flooring
- Insulation
- Glues and adhesives
- Paints and coatings
- Textiles
- Disinfectant cleaning products and soaps
- Preservatives
- Personal care products, especially certain hair products
- Cosmetics
- Pet care products
- Bactericides and fungicides
- Combustion byproduct (burning)
  - Tobacco smoke and fuel-burning appliances (gas stoves, kerosene space heaters and fireplaces)

Formaldehyde is also produced naturally in living systems, e.g., trees and other plant life, and during decay and combustion processes. Formaldehyde is also involved in atmospheric processes. Outdoor concentrations of formaldehyde from both natural and man-made sources can range from less than 1 ng/L in remote areas to 10-20 ng/L in urban environments.

## Additional Resources

US OSHA [Toxic and Hazardous Substances-Formaldehyde](#)

US OSHA [Fact Sheet-Formaldehyde](#)

US NIOSH [Formaldehyde](#)

World Health Organization (WHO) [Air Quality Guidelines for Europe, 2nd Edition \(2000\): pg 87-91](#)

Europe: [Report No. 7-Indoor Air Pollution by Formaldehyde in European Countries \(1990\)](#)

US Consumer Product Safety Commission (CPSC) [Update on Formaldehyde \(2013\)](#)

US Environmental Protection Agency: [Formaldehyde](#)

US Agency for Toxic Substances and Disease Registry (ATSDR): [Formaldehyde ToxFAQs™](#)

US National Institutes of Health (NIH): [ToxTown: Formaldehyde](#)

Chemical Reviews (Journal): [Formaldehyde in the Indoor Environment](#)

Household Products Database: [Formaldehyde](#)

These results are authorized by the Laboratory Director or approved representative.

---

This analysis was performed by Prism Analytical Technologies, Inc. (Prism) using the Hantzsch, or acetylacetone (acac), method. This test method has been correlated with or is compliant with the California Air Resources Board (CARB) § 93120, European DIN Standard EN-717, and ASTM methods D-5582 and E-1333. It has also been compared with DNPH testing used in NIOSH 2016 and found to be in good agreement.

The results contained in this report are dependent upon a number of factors over which Prism has no control, which may include, but are not limited to, the sampling technique utilized, the size or source of sample, and the ability of the sampler to collect a proper or suitable sample. Therefore, the opinions contained in this report may be invalid and cannot be considered or construed as definitive and neither Prism, nor its agents, officers, directors, employees, or successors shall be liable for any claims, actions, causes of action, costs, loss of service, medical or other expenses or any compensation whatsoever which may now or hereafter occur or accrue based upon the information or opinions contained herein.

---

© Copyright 2018, Prism Analytical Technologies, All rights reserved.

Air Analysis For: JFK  
Location Tested: -

Report Number: 75682  
Laboratory ID: 75682-3

Sampling Professional: Donald Johnson  
Eastern Washington University  
002 Martin Hall  
Cheney, WA 99004

**Thank you for using  
IAQ Commercial Survey!**  
If you have questions about your report,  
please contact your service provider who  
performed this test.

Client Sample ID: Bookshelf: MO40 **D**  
Sample Volume (L): 4.0  
Date Sampled: 12/07/2018  
Sample Type: TDT TT546  
Sample Condition: Acceptable

Order Date: 12/12/2018  
Scan Date: 12/12/2018  
Report Date: 12/14/2018

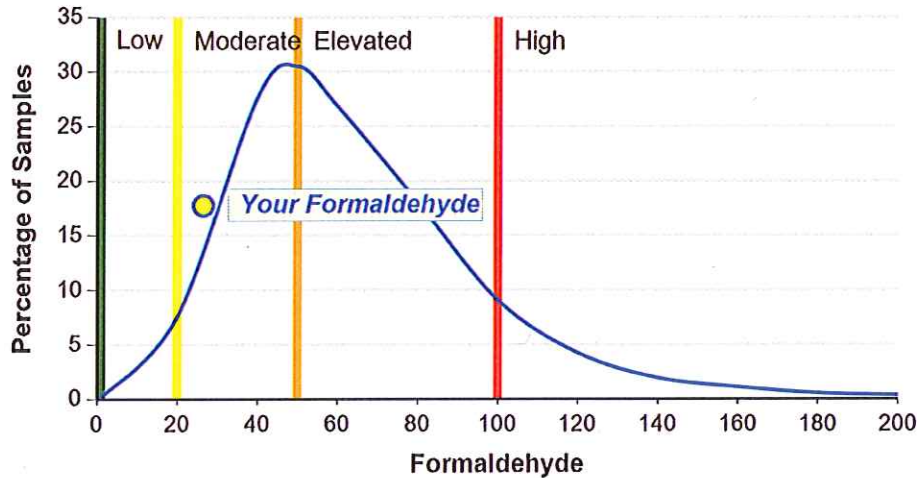
**Formaldehyde Concentration: 27 ng/L (22 ppb)**

**Your Formaldehyde Level (Highlighted)**

Low	Moderate	Elevated	High
< 20 ng/L	20-50 ng/L	50-100 ng/L	> 100 ng/L
< 16 ppb	16-40 ppb	40-80 ppb	> 80 ppb

**Recommendation:** Moderate formaldehyde level but improvements can be achieved by locating and removing sources. See formaldehyde sources section for more information.

**All IAQ Survey Formaldehyde Results**



This chart represents the Formaldehyde distribution of over 7,000 samples.

Approximately half the samples have concentrations in the 30-70 ng/L range.

The chart above shows the formaldehyde concentrations for all locations tested using IAQ Survey. Results for this air sample are displayed on the chart as a yellow circle. The blue curved line represents the relationship between the percentage of locations (indicated on the vertical y-axis) and the formaldehyde concentration (indicated on the horizontal x-axis). The green, yellow, orange, and red vertical bars represent divisions between Low, Moderate, Elevated, and High formaldehyde concentrations.

Formaldehyde concentrations can vary depending on environmental conditions such as temperature, humidity, and ventilation rate. As temperature and humidity increase, the formaldehyde concentration will increase and as the ventilation rate increases, the formaldehyde concentration will decrease.

---

Prism Analytical Technologies, Inc., the creator of IAQ Commercial Survey, has been performing air quality assessments to industry and environmental consultants since 1995. Prism Analytical Technologies, Inc. (ID 166272) is accredited by the AIHA Laboratory Accreditation Programs, LLC (AIHA-LAP, LLC) in the Unique Scope accreditation program for Formaldehyde as documented by the Scope of Accreditation Certificate and associated Scope. Reference internal SOP 523.

## Formaldehyde Exposure Guidelines

The US Occupational Safety and Health Administration (OSHA) has set a workplace **permissible exposure limit** (PEL) of 940 ng/L (750 parts per billion). The National Institute for Occupational Safety and Health (NIOSH) has set a **recommended exposure limit** (REL) of 20 ng/L (16 ppb) with a 120 ng/L (100 ppb) 15 minute ceiling limit.

Although these formaldehyde concentration limits are applicable to all types of workplace environments, most office or retail locations without additional occupational exposure (e.g., industrial or manufacturing processes generating formaldehyde) typically have formaldehyde concentrations less than 100 ng/L (80 ppb). Most indoor environments measured by Prism's air test have concentrations in the range of 30 to 70 ng/L.

The table below provides some of the limits applicable to workplace environments. In general, formaldehyde concentrations should be kept as low as reasonably achievable.

Organization	Concentration		Type
	ng/L	ppb	
OSHA	630	500	Action Level (8 hour)
	940	750	PEL (8 hour)
	2,500	2,000	STEL (15 min)
NIOSH	20	16	REL (8 hour)
	120	100	Ceiling (15 min)
ACGIH	370	300	TLV (8 hour)
LEED	32	27	Green Building (4 hour)
WHO	100	80	Short-Term (0.5 hour)

OSHA: Occupational Health and Safety Administration  
 NIOSH: National Institute for Occupational Safety and Health  
 ACGIH: American Conference of Governmental Industrial Hygienists  
 LEED: Leadership in Energy & Environmental Design (Green Building Council)  
 WHO: World Health Organization

PEL: Permissible Exposure Limit  
 REL: Recommended Exposure Limit  
 TLV: Threshold Limit Value  
 TWA: Time Weighted Average  
 STEL: Short Term Exposure Limit

Note: Concentration can be expressed in several ways and various organizations may use different units.

1 ng/L = 1 µg/m<sup>3</sup> = 0.001 mg/m<sup>3</sup>

1 ppb = 0.001 ppm

To convert between the two sets of units listed above the molecular weight of formaldehyde must be used, which produces the conversion factors below:

ppb concentration = ng/L concentration \* 0.8 or ng/L concentration = ppb concentration \* 1.25

## Major Health Effects of Formaldehyde Exposure

Health effects vary depending on the individual. Common symptoms of acute exposure include irritation of the throat, nose, eyes, and skin; this irritation can potentially exacerbate asthma symptoms and other respiratory illnesses. Long term, or chronic, exposure may also cause chronic runny nose, chronic bronchitis, and obstructive lung disease. In 2004, the International Agency for Research on Cancer (IARC) reclassified formaldehyde from "probably carcinogenic to humans" to "carcinogenic to humans" related to nasopharyngeal cancer. Since many factors are involved in the development of cancer, no definitive "safe level" of exposure has been established. The best way to reduce the risk of cancer is to limit exposure.

## Formaldehyde Sources

There are many possible sources for formaldehyde in the indoor environment, although building products typically make up a large proportion of the concentration. Any recent renovation or new material brought into the building is likely to increase the formaldehyde levels. The concentration will decrease over time as the materials off gas, so increasing the ventilation as much as possible is typically the best way to quickly decrease formaldehyde after recent renovation or installation of new materials.

- Products that contain urea-formaldehyde (UF) resins
  - particleboard, hardwood plywood paneling, medium density fiberboard
- Products that contain phenol-formaldehyde (PF) resins (lower concentrations of formaldehyde than UF resins)
  - softwood plywood, flake or oriented strand board
- Pre-finished engineered flooring
- Insulation
- Glues and adhesives
- Paints and coatings
- Textiles
- Disinfectant cleaning products and soaps
- Preservatives
- Personal care products, especially certain hair products
- Cosmetics
- Pet care products
- Bactericides and fungicides
- Combustion byproduct (burning)
  - Tobacco smoke and fuel-burning appliances (gas stoves, kerosene space heaters and fireplaces)

Formaldehyde is also produced naturally in living systems, e.g., trees and other plant life, and during decay and combustion processes. Formaldehyde is also involved in atmospheric processes. Outdoor concentrations of formaldehyde from both natural and man-made sources can range from less than 1 ng/L in remote areas to 10-20 ng/L in urban environments.

## Additional Resources

US OSHA [Toxic and Hazardous Substances-Formaldehyde](#)

US OSHA [Fact Sheet-Formaldehyde](#)

US NIOSH [Formaldehyde](#)

World Health Organization (WHO) [Air Quality Guidelines for Europe, 2nd Edition \(2000\): pg 87-91](#)

Europe: [Report No. 7-Indoor Air Pollution by Formaldehyde in European Countries \(1990\)](#)

US Consumer Product Safety Commission (CPSC) [Update on Formaldehyde \(2013\)](#)

US Environmental Protection Agency: [Formaldehyde](#)

US Agency for Toxic Substances and Disease Registry (ATSDR): [Formaldehyde ToxFAQs™](#)

US National Institutes of Health (NIH): [ToxTown: Formaldehyde](#)

Chemical Reviews (Journal): [Formaldehyde in the Indoor Environment](#)

Household Products Database: [Formaldehyde](#)

These results are authorized by the Laboratory Director or approved representative.

This analysis was performed by Prism Analytical Technologies, Inc. (Prism) using the Hantzsch, or acetylacetone (acac), method. This test method has been correlated with or is compliant with the California Air Resources Board (CARB) § 93120, European DIN Standard EN-717, and ASTM methods D-5582 and E-1333. It has also been compared with DNPH testing used in NIOSH 2016 and found to be in good agreement.

The results contained in this report are dependent upon a number of factors over which Prism has no control, which may include, but are not limited to, the sampling technique utilized, the size or source of sample, and the ability of the sampler to collect a proper or suitable sample. Therefore, the opinions contained in this report may be invalid and cannot be considered or construed as definitive and neither Prism, nor its agents, officers, directors, employees, or successors shall be liable for any claims, actions, causes of action, costs, loss of service, medical or other expenses or any compensation whatsoever which may now or hereafter occur or accrue based upon the information or opinions contained herein.

© Copyright 2018, Prism Analytical Technologies, All rights reserved.

Air Analysis For: JFK  
Location Tested: -

Report Number: 75682  
Laboratory ID: 75682-4

Sampling Professional: Donald Johnson  
Eastern Washington University  
002 Martin Hall  
Cheney, WA 99004

**Thank you for using  
IAQ Commercial Survey!**  
If you have questions about your report,  
please contact your service provider who  
performed this test.

Client Sample ID: Desk: MO4E  
Sample Volume (L): 4.0  
Date Sampled: 12/07/2018  
Sample Type: TDT AB661  
Sample Condition: Acceptable

Order Date: 12/12/2018  
Scan Date: 12/12/2018  
Report Date: 12/14/2018

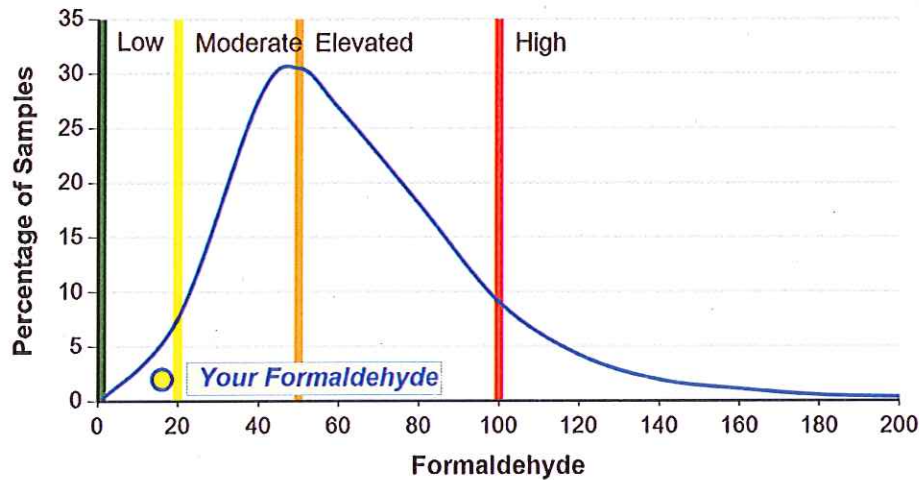
Formaldehyde Concentration: 17 ng/L (14 ppb)

**Your Formaldehyde Level (Highlighted)**

Low	Moderate	Elevated	High
< 20 ng/L	20-50 ng/L	50-100 ng/L	> 100 ng/L
< 16 ppb	16-40 ppb	40-80 ppb	> 80 ppb

**Recommendation:** No significant formaldehyde issues.

**All IAQ Survey Formaldehyde Results**



This chart represents the Formaldehyde distribution of over 7,000 samples.

Approximately half the samples have concentrations in the 30-70 ng/L range.

The chart above shows the formaldehyde concentrations for all locations tested using IAQ Survey. Results for this air sample are displayed on the chart as a yellow circle. The blue curved line represents the relationship between the percentage of locations (indicated on the vertical y-axis) and the formaldehyde concentration (indicated on the horizontal x-axis). The green, yellow, orange, and red vertical bars represent divisions between Low, Moderate, Elevated, and High formaldehyde concentrations.

Formaldehyde concentrations can vary depending on environmental conditions such as temperature, humidity, and ventilation rate. As temperature and humidity increase, the formaldehyde concentration will increase and as the ventilation rate increases, the formaldehyde concentration will decrease.

---

Prism Analytical Technologies, Inc., the creator of IAQ Commercial Survey, has been performing air quality assessments to industry and environmental consultants since 1995. Prism Analytical Technologies, Inc. (ID 166272) is accredited by the AIHA Laboratory Accreditation Programs, LLC (AIHA-LAP, LLC) in the Unique Scope accreditation program for Formaldehyde as documented by the Scope of Accreditation Certificate and associated Scope. Reference internal SOP 523.

## Formaldehyde Exposure Guidelines

The US Occupational Safety and Health Administration (OSHA) has set a workplace **permissible exposure limit** (PEL) of 940 ng/L (750 parts per billion). The National Institute for Occupational Safety and Health (NIOSH) has set a **recommended exposure limit** (REL) of 20 ng/L (16 ppb) with a 120 ng/L (100 ppb) 15 minute ceiling limit.

Although these formaldehyde concentration limits are applicable to all types of workplace environments, most office or retail locations without additional occupational exposure (e.g., industrial or manufacturing processes generating formaldehyde) typically have formaldehyde concentrations less than 100 ng/L (80 ppb). Most indoor environments measured by Prism's air test have concentrations in the range of 30 to 70 ng/L.

The table below provides some of the limits applicable to workplace environments. In general, formaldehyde concentrations should be kept as low as reasonably achievable.

Organization	Concentration		Type
	ng/L	ppb	
OSHA	630	500	Action Level (8 hour)
	940	750	PEL (8 hour)
	2,500	2,000	STEL (15 min)
NIOSH	20	16	REL (8 hour)
	120	100	Ceiling (15 min)
ACGIH	370	300	TLV (8 hour)
LEED	32	27	Green Building (4 hour)
WHO	100	80	Short-Term (0.5 hour)

OSHA: Occupational Health and Safety Administration  
 NIOSH: National Institute for Occupational Safety and Health  
 ACGIH: American Conference of Governmental Industrial Hygienists  
 LEED: Leadership in Energy & Environmental Design (Green Building Council)  
 WHO: World Health Organization

PEL: Permissible Exposure Limit  
 REL: Recommended Exposure Limit  
 TLV: Threshold Limit Value  
 TWA: Time Weighted Average  
 STEL: Short Term Exposure Limit

Note: Concentration can be expressed in several ways and various organizations may use different units.

1 ng/L = 1 µg/m<sup>3</sup> = 0.001 mg/m<sup>3</sup>

1 ppb = 0.001 ppm

To convert between the two sets of units listed above the molecular weight of formaldehyde must be used, which produces the conversion factors below:

ppb concentration = ng/L concentration \* 0.8 or ng/L concentration = ppb concentration \* 1.25

## Major Health Effects of Formaldehyde Exposure

Health effects vary depending on the individual. Common symptoms of acute exposure include irritation of the throat, nose, eyes, and skin; this irritation can potentially exacerbate asthma symptoms and other respiratory illnesses. Long term, or chronic, exposure may also cause chronic runny nose, chronic bronchitis, and obstructive lung disease. In 2004, the International Agency for Research on Cancer (IARC) reclassified formaldehyde from "probably carcinogenic to humans" to "carcinogenic to humans" related to nasopharyngeal cancer. Since many factors are involved in the development of cancer, no definitive "safe level" of exposure has been established. The best way to reduce the risk of cancer is to limit exposure.



## Formaldehyde Sources

There are many possible sources for formaldehyde in the indoor environment, although building products typically make up a large proportion of the concentration. Any recent renovation or new material brought into the building is likely to increase the formaldehyde levels. The concentration will decrease over time as the materials off gas, so increasing the ventilation as much as possible is typically the best way to quickly decrease formaldehyde after recent renovation or installation of new materials.

- Products that contain urea-formaldehyde (UF) resins
  - particleboard, hardwood plywood paneling, medium density fiberboard
- Products that contain phenol-formaldehyde (PF) resins (lower concentrations of formaldehyde than UF resins)
  - softwood plywood, flake or oriented strand board
- Pre-finished engineered flooring
- Insulation
- Glues and adhesives
- Paints and coatings
- Textiles
- Disinfectant cleaning products and soaps
- Preservatives
- Personal care products, especially certain hair products
- Cosmetics
- Pet care products
- Bactericides and fungicides
- Combustion byproduct (burning)
  - Tobacco smoke and fuel-burning appliances (gas stoves, kerosene space heaters and fireplaces)

Formaldehyde is also produced naturally in living systems, e.g., trees and other plant life, and during decay and combustion processes. Formaldehyde is also involved in atmospheric processes. Outdoor concentrations of formaldehyde from both natural and man-made sources can range from less than 1 ng/L in remote areas to 10-20 ng/L in urban environments.

## Additional Resources

US OSHA [Toxic and Hazardous Substances-Formaldehyde](#)

US OSHA [Fact Sheet-Formaldehyde](#)

US NIOSH [Formaldehyde](#)

World Health Organization (WHO) [Air Quality Guidelines for Europe, 2nd Edition \(2000\): pg 87-91](#)

Europe: [Report No. 7-Indoor Air Pollution by Formaldehyde in European Countries \(1990\)](#)

US Consumer Product Safety Commission (CPSC) [Update on Formaldehyde \(2013\)](#)

US Environmental Protection Agency: [Formaldehyde](#)

US Agency for Toxic Substances and Disease Registry (ATSDR): [Formaldehyde ToxFAQs™](#)

US National Institutes of Health (NIH): [ToxTown: Formaldehyde](#)

Chemical Reviews (Journal): [Formaldehyde in the Indoor Environment](#)

Household Products Database: [Formaldehyde](#)

These results are authorized by the Laboratory Director or approved representative.

---

This analysis was performed by Prism Analytical Technologies, Inc. (Prism) using the Hantzsch, or acetylacetone (acac), method. This test method has been correlated with or is compliant with the California Air Resources Board (CARB) § 93120, European DIN Standard EN-717, and ASTM methods D-5582 and E-1333. It has also been compared with DNPH testing used in NIOSH 2016 and found to be in good agreement.

The results contained in this report are dependent upon a number of factors over which Prism has no control, which may include, but are not limited to, the sampling technique utilized, the size or source of sample, and the ability of the sampler to collect a proper or suitable sample. Therefore, the opinions contained in this report may be invalid and cannot be considered or construed as definitive and neither Prism, nor its agents, officers, directors, employees, or successors shall be liable for any claims, actions, causes of action, costs, loss of service, medical or other expenses or any compensation whatsoever which may now or hereafter occur or accrue based upon the information or opinions contained herein.

---

© Copyright 2018, Prism Analytical Technologies, All rights reserved.