

September 4, 2014

Mr. Bob Johnson  
ACME Printing Corporation, Inc.  
100 Main Street  
Happy Valley, Washington 70001

**SUBJECT: ANNUAL AIR SAMPLING SURVEY**

Dear Mr. Johnson:

The subject report is attached and discusses the results of the air sampling survey that I conducted on July 23rd at the ACME Printing Corporation facility in Happy Valley, WS. The purpose of the survey was to evaluate personal exposures to select components of commonly used chemicals associated with the ACME printing process. An additional sample was collected to assess ambient concentrations of ozone. A discussion of relevant exposure limits is included.

If you have any comments or questions, call me at 720/123-4567.

Thank you.

Signature Here

Sam "IH" Sampler  
Industrial Hygienist  
1234 1<sup>st</sup> Street  
Gilbert, WS 70002  
720/123-4567

# **2012 ANNUAL AIR SAMPLING REPORT**

ACME Printing Corporation, Inc.

September 4, 2014

Sampling Conducted By:

Sam "IH" Sampler  
Industrial Hygienist  
1234 1<sup>st</sup> Street  
Gilbert, WS 70002  
720/123-4567

## **EXECUTIVE SUMMARY**

ACME Printing Corporation has had an active air-sampling program in place for several years. Air sampling was conducted to assess personal exposures to select components of commonly used chemicals associated with the printing process. An additional sample was collected to assess ambient concentrations of ozone. A total of five personal samples were collected and analyzed for ink components; one area sample was collected and analyzed for ozone. Sampling was conducted in accordance with established procedures with results being compared to two relevant exposure limits. Personal samples ranged from 14.8 - 59.0% of the calculated additive Permissible Exposure Limit (i.e., n-propanol and n-propyl acetate combined). The results are in general agreement with samples taken in previous years. The area sample result for ozone was deemed insignificant after it was determined that the lamination process was non-operational the day of the study. Recommendations are made to share results with affected personnel, continue the annual sampling survey, and conduct another ozone study.

## **BACKGROUND**

The printing industry uses a variety of inks, solvents, and adhesives that have chemical constituents deemed hazardous according to definitions established by the Occupational Safety and Health Administration (OSHA). Federal regulations require employers to evaluate employee exposures to select substances and assure that airborne concentrations do not exceed eight-hour, time-weighted averages known as Permissible Exposure Limits (PELs). Employee exposures below PELs are not expected to cause adverse health effects in a majority of a healthy working population.

To evaluate exposures, ACME Printing has been conducting air sampling on an annual basis for several years. Previous year's results have generally shown personal sampling results at or below 50% of the applicable PEL. Area samples in high traffic areas near production units have shown levels below PELs. Additional process-specific studies have also been conducted and have shown localized areas where ambient concentrations exceed the applicable PEL. However, given the highly variable nature of work activities, workers do not occupy these areas for enough time to reach the PEL. Finally, air-sampling surveys have been conducted that characterize short-duration, potentially high-exposure activities. These studies showed ambient vapor concentrations near the associated OSHA short-term exposure limit but concluded that the infrequent nature of the activity and the "worst case" design used for the study resulted in low worker exposure potential.

## **CHEMICAL HAZARDS & EXPOSURE POTENTIAL**

A review of current chemical usage shows that inks and adhesives are two of the most commonly used chemical materials across the plant. A review of the Safety Data Sheets (SDSs) for a typical ink and adhesive used shows two primary ingredients: n-propyl alcohol (n-propanol) and n-propyl acetate. A brief hazard review and exposure assessment is as follows:

<b>Chemical Name</b>	<b>CAS#</b>	<b>Primary Route(s) of Exposure</b>	<b>Health Hazard</b>	<b>Exposure Potential</b>
<b>n-propyl alcohol</b>	71-23-8	inhalation, dermal absorption	irritation eyes, nose, throat; dry cracking skin; drowsiness, headache; ataxia, gastrointestinal pain; abdominal cramps, nausea, vomiting, diarrhea	chemical used daily; inhalation is likely based on usage; skin contact is minimized via use of gloves
<b>n-propyl acetate</b>	109-60-4	inhalation, dermal absorption	irritation eyes, nose, throat; narcosis; dermatitis	chemical used daily; inhalation is likely based on usage; skin contact is minimized via use of gloves

Centers for Disease Control (2011) *National Institute for Occupational Safety and Health (NIOSH) Pocket Guide*.

Retrieved f <http://www.cdc.gov/niosh/npg>

To evaluate exposure potential, ACME Printing Corporation has been conducting air sampling on an annual basis for several years. Previous year's results have generally shown personal sampling results at or below 50% of the applicable PEL. Several other exposure studies have been conducted on a process-specific basis and have also documented low worker exposure potential. However, given the variable nature of the business, ACME Printing Corporation has taken a prudent approach of documenting worker exposures on an annual basis.

## **SAMPLING STRATEGY**

A sampling strategy was devised in consultation with the Plant Director. In addition to the organic constituents routinely included in past annual surveys, an area sample was collected for ozone. Ozone is a by-product of the lamination process and has been of interest to plant personnel recently. The following samples were collected for this year's study:

Personal Sample – Josh, W&H 3 - n-propanol, n-propyl acetate  
Personal Sample – Jake, W&H 2 - n-propanol, n-propyl acetate  
Personal Sample – Percy, Vision - n-propanol, n-propyl acetate  
Personal Sample – Mike, Pre-Press - n-propanol, n-propyl acetate  
Personal Sample – Ronnie, W&H 3 – n-propanol, n-propyl acetate  
Area Sample – Laminator Work Station - ozone

## **SAMPLING METHODOLOGY**

A total of five personal air samples and one area sample were collected. Air sampling was conducted using a sampling pump and appropriate charcoal tubes provided by the analytical lab contracted for the project. Pumps were operated for as close to a full shift as possible with a flow rate that ensured collection of the necessary air volume stated in the analytical method established by the National Institute for Occupational Safety and Health (NIOSH). All pumps were pre- and post-calibrated to ensure accurate airflow rates. Personal samples were placed in the breathing zone of the employee with the sampling charcoal tube being attached to the lapel; the area sample was placed in a location where employees are expected to spend most their time. Sampling media was sent for analysis to a laboratory accredited by the American Industrial Hygiene Association (AIHA).

## **SAMPLING RESULTS**

Attachment A contains Tables 1-6 that summarize the sampling results. All personal monitoring results were compared to the applicable PEL. For n-propyl alcohol and n-propyl acetate, an additive formula method was used. Since both materials have similar potential adverse health effects (e.g., both affect the central nervous system), it is acceptable to consider exposure to each in an additive fashion (see data tables for specific calculations).

Table 1 shows personal air sampling results for Josh, W&H 2. This sample showed an ambient concentration of n-propanol of 47.0 parts per million (ppm) and 14.0 ppm of n-propyl acetate. The additive percentage of the PEL is 30.5%.

Table 2 shows personal air sampling results for Jake, W&H 2. This sample showed an ambient concentration of n-propanol of 64.0 parts per million (ppm) and 26.0 ppm of n-propyl acetate. The additive percentage of the PEL is 40.0%.

Table 3 shows personal air sampling results for Percy, Vision. This sample showed an ambient concentration of n-propanol of 23.0 parts per million (ppm) and 6.5 ppm of n-propyl acetate. The additive percentage of the PEL is 14.8%.

Table 4 shows personal air sampling results for Mike, Pre-Press. This sample showed an ambient concentration of n-propanol of 32.0 parts per million (ppm) and 10.0 ppm of n-propyl acetate. The additive percentage of the PEL is 21.0%.

Table 5 shows personal air sampling results for Ronnie, W&H 3. This sample showed an ambient concentration of n-propanol of 91.0 parts per million (ppm) and 27.0 ppm of n-propyl acetate. The additive percentage of the PEL is 59.0%.

Table 6 shows area sampling for the sample taken at the laminator work station. This sample showed an ambient concentration of ozone of <0.013 ppm which is 2.5% of the PEL.

## **DISCUSSION & RECOMMENDATIONS**

All personal samples are below their respective PELs and in general agreement with the range of personal exposures measured in previous years. Although ACME Printing continues to be in compliance with OSHA regulations, it is a best management practice to keep employee exposures below 50% of the relevant PEL. Accordingly, ACME Printing should continue to conduct annual sampling and periodically assess any trends associated with exposures (i.e., are exposures regularly exceeding 50% of the PEL). Recommendations are as follows:

- 1) **Share sampling information with employees.** ACME Printing has a strong record of sharing monitoring results with affected employees. Employees are well versed in the meaning of sampling and employee exposure results.
- 2) **Continue the annual air-sampling program.** Day to day operations can change and may impact exposure potential to employees. It is prudent to conduct regular air sampling even though ACME Printing is full compliance with OSHA regulations.
- 3) **Conduct a separate study to evaluate ozone concentrations.** It is unfortunate that the lamination unit did not end up running on the day of sampling. A separate study should be conducted to fully evaluate ambient ozone concentrations.

**ATTACHMENT A**  
**PERSONAL & AREA SAMPLE DATA**  
**TABLES 1-6**

**TABLE 1 - PERSONAL AIR SAMPLING RESULTS**

**Josh  
W&H 2**

**ACME Printing Corporation, Inc.  
Sampling Date: July 23, 2014  
Sampling Conducted by: Sam "IH" Sampler**

<b>LOCATION</b>	<b>SAMPLE TYPE</b>	<b>ANALYTE</b>	<b>RESULT (ppm)</b>	<b>OSHA PEL (ppm)</b>	<b>(% PEL)* &gt;PEL?</b>
Josh W&H 2	Personal	n-Propanol	47.0	200	(30.5)
		n-Propyl Acetate	14.0	200	No

**NOTES:**

1) **Abbreviations:**

ppm = part of analyte per million parts of air  
OSHA = Occupational Safety & Health Administration  
PEL = Permissible Exposure Limit  
% PEL = what percent the measured concentration is of the PEL

2) **Definitions:**

PEL - legally enforceable, 8-hour, time-weighted average concentrations allowed during a work shift; concentrations below OSHA PEL are not expected to cause adverse health effects in the majority of workers.

3) **Additive Formula Calculation:**

“\*” = % PEL calculated using OSHA additive formula: (concentration of contaminant 1 divided by OSHA PEL for contaminant 1) + (concentration of contaminant 2 divided by OSHA PEL for contaminant 2):

$$(n\text{-propanol: } 47.0/200) + (n\text{-propyl acetate: } 14.0/200) = 23.5 + 7.0 = 30.5$$



**TABLE 2 - PERSONAL AIR SAMPLING RESULTS**

**Jake  
W&H 2**

**ACME Printing Corporation, Inc.  
Sampling Date: July 23, 2014  
Sampling Conducted by: Sam "IH" Sampler**

<b>LOCATION</b>	<b>SAMPLE TYPE</b>	<b>ANALYTE</b>	<b>RESULT (ppm)</b>	<b>OSHA PEL (ppm)</b>	<b>(% PEL)* &gt;PEL?</b>
Jake W&H 2	Personal	n-Propanol	64.0	200	(40.0)
		n-Propyl Acetate	16.0	200	No

**NOTES:**

1) **Abbreviations:**

ppm = part of analyte per million parts of air  
 OSHA = Occupational Safety & Health Administration  
 PEL = Permissible Exposure Limit  
 % PEL = what percent the measured concentration is of the PEL

2) **Definitions:**

PEL - legally enforceable, 8-hour, time-weighted average concentrations allowed during a work shift; concentrations below OSHA PEL are not expected to cause adverse health effects in the majority of workers.

3) **Additive Formula Calculation:**

“\*” = % PEL calculated using OSHA additive formula: (concentration of contaminant 1 divided by OSHA PEL for contaminant 1) + (concentration of contaminant 2 divided by OSHA PEL for contaminant 2):

$$(n\text{-propanol: } 64.0/200) + (n\text{-propyl acetate: } 16.0/200) = 32.0 + 8.0 = 40.0$$

**TABLE 3 - PERSONAL AIR SAMPLING RESULTS**

**Percy  
Vision**

**ACME Printing Corporation, Inc.  
Sampling Date: July 23, 2014  
Sampling Conducted by: Sam "IH" Sampler**

<b>LOCATION</b>	<b>SAMPLE TYPE</b>	<b>ANALYTE</b>	<b>RESULT (ppm)</b>	<b>OSHA PEL (ppm)</b>	<b>(% PEL)* &gt;PEL?</b>
Percy Vision	Personal	n-Propanol	23.0	200	(35.7) No
		n-Propyl Acetate	6.5	200	

**NOTES:**

1) **Abbreviations:**

ppm = part of analyte per million parts of air  
OSHA = Occupational Safety & Health Administration  
PEL = Permissible Exposure Limit  
% PEL = what percent the measured concentration is of the PEL

2) **Definitions:**

PEL - legally enforceable, 8-hour, time-weighted average concentrations allowed during a work shift; concentrations below OSHA PEL are not expected to cause adverse health effects in the majority of workers.

3) **Additive Formula Calculation:**

“\*” = % PEL calculated using OSHA additive formula: (concentration of contaminant 1 divided by OSHA PEL for contaminant 1) + (concentration of contaminant 2 divided by OSHA PEL for contaminant 2):

$$(n\text{-propanol: } 23.0/200) + (n\text{-propyl acetate: } 6.5/200) = 11.5 + 3.3 = 35.7$$

**TABLE 4 - PERSONAL AIR SAMPLING RESULTS**

**Mike  
Pre-Press**

**ACME Printing Corporation, Inc.  
Sampling Dates: July 23, 2014  
Sampling Conducted by: Sam "IH" Sampler**

<b>LOCATION</b>	<b>SAMPLE TYPE</b>	<b>ANALYTE</b>	<b>RESULT (ppm)</b>	<b>OSHA PEL (ppm)</b>	<b>(% PEL)* &gt;PEL?</b>
Mike Pre-Press	Personal	n-Propanol	32.0	200	(21.0) No
		n-Propyl Acetate	10.0	200	

**NOTES:**

1) **Abbreviations:**

ppm = part of analyte per million parts of air  
OSHA = Occupational Safety & Health Administration  
PEL = Permissible Exposure Limit  
% PEL = what percent the measured concentration is of the PEL

2) **Definitions:**

PEL - legally enforceable, 8-hour, time-weighted average concentrations allowed during a work shift; concentrations below OSHA PEL are not expected to cause adverse health effects in the majority of workers.

3) **Additive Formula Calculation:**

“\*” = % PEL calculated using OSHA additive formula: (concentration of contaminant 1 divided by OSHA PEL for contaminant 1) + (concentration of contaminant 2 divided by OSHA PEL for contaminant 2):

$$(n\text{-propanol: } 32.0/200) + (n\text{-propyl acetate: } 10.0/200) = 16.0 + 5.0 = 21.0$$

**TABLE 5 - PERSONAL AIR SAMPLING RESULTS**

**Ronnie  
W&H 3**

**ACME Printing Corporation, Inc.  
Sampling Date: July 23, 2014  
Sampling Conducted by: Sam "IH" Sampler**

<b>LOCATION</b>	<b>SAMPLE TYPE</b>	<b>ANALYTE</b>	<b>RESULT (ppm)</b>	<b>OSHA PEL (ppm)</b>	<b>(% PEL)* &gt;PEL?</b>
Ronnie W&H 3	Personal	n-Propanol	91.0	200	(59.0)
		n-Propyl Acetate	27.0	200	Yes

**NOTES:**

1) **Abbreviations:**

ppm = part of analyte per million parts of air  
OSHA = Occupational Safety & Health Administration  
PEL = Permissible Exposure Limit  
% PEL = what percent the measured concentration is of the PEL

2) **Definitions:**

PEL - legally enforceable, 8-hour, time-weighted average concentrations allowed during a work shift; concentrations below OSHA PEL are not expected to cause adverse health effects in the majority of workers.

3) **Additive Formula Calculation:**

“\*” = % PEL calculated using OSHA additive formula: (concentration of contaminant 1 divided by OSHA PEL for contaminant 1) + (concentration of contaminant 2 divided by OSHA PEL for contaminant 2):

$$(n\text{-propanol: } 91.0/200) + (n\text{-propyl acetate: } 27.0/200) = 45.5 + 13.5 = 59.0$$

**TABLE 6 - AREA SAMPLING RESULTS**

**Area Sample  
Laminator Work Station**

**ACME Printing Corporation, Inc.  
Sampling Date: July 23, 2014  
Sampling Conducted by: Sam "IH" Sampler**

<b>LOCATION</b>	<b>SAMPLE TYPE</b>	<b>ANALYTE</b>	<b>RESULT (ppm)</b>	<b>OSHA PEL (ppm)</b>	<b>(% PEL) &gt;PEL?</b>
Laminator Work Station	Area	Ozone	<0.013	0.1	(<1.25) No

**NOTES:**

1) **Abbreviations:**

ppm = part of analyte per million parts of air  
OSHA = Occupational Safety & Health Administration  
PEL = Permissible Exposure Limit  
% PEL = what percent the measured concentration is of the PEL

2) **Definitions:**

PEL - legally enforceable, 8-hour, time-weighted average concentrations allowed during a work shift; OSHA PEL are not expected to cause adverse health effects in the majority of workers.

3) **NOTE:** It was determined after sampling that the laminator unit was not operational on the day of sampling. Accordingly, the above data is of no significance from an exposure perspective.