Indoor Air Quality and Noise Monitoring

Tony Kuehn CSP, OHST, ALCM

Director Health and Safety Services

Integrated Loss Control

Developed and Presented by:
Integrated Loss Control, Inc.

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Indoor Air Quality and Noise Monitoring

Why Monitor for Indoor Air Quality & Noise?

During this webinar you will learn about indoor air quality (IAQ) and noise monitoring, including:

- When and where sampling is necessary,
- How to develop an industrial hygiene sampling plan,
- How to educate employees or other essential parties on some sampling methods and results, and
- How to follow up on the results of the IAQ survey noise monitoring by comparing to Occupational Exposure Levels (OELs) and suggested controls.

Indoor Air Quality and Noise Monitoring

When is Noise Monitoring Required?

- OSHA 1910.95 requires determination of baseline levels
- Periodic
- When changes in operations occur
- New machines, operations are introduced

Indoor Air Quality and Noise Monitoring

How Is Noise Monitoring Conducted?

- Sound Level meter (location mapping)
- Audiodosimeters (8 hour Time-Weighted Average TWA)

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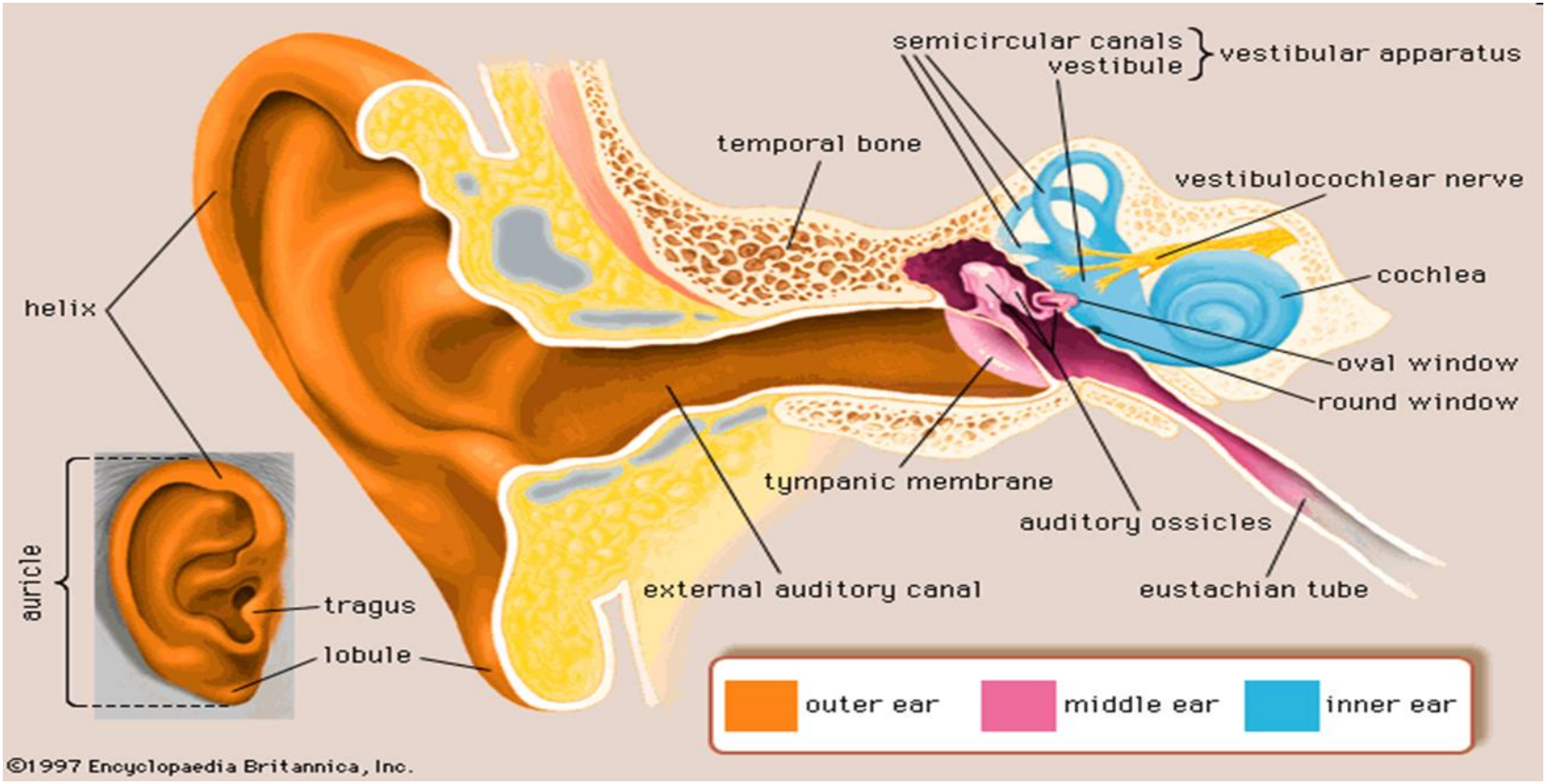
Indoor Air Quality and Noise Monitoring

What is the level of concern?

- 85 Decibels (Action Level) 8 hour Time-Weighted Average TWA
- 90 Decibels (PEL) 8 hr TWA
- Peaks of 115 Decibels or Higher
- G-16a Table

Indoor Air Quality and Noise Monitoring



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Indoor Air Quality and Noise Monitoring

IAQ exposure is just about everything.

When is Indoor Air Monitoring Required?

- Regulatory for certain chemical standards (e.g. asbestos, lead, cadmium)
- OSHA 1910.1000 (PEL list) determination requirements to evaluate baseline levels (based on SDS, process information, anticipated exposures)
- STELs, Peak, Excursion Limits
- Periodic
- When changes in operations occur
- New machines, operations are introduced

Indoor Air Quality and Noise Monitoring

When is Indoor Air Monitoring Required:

- Regulatory (previous slide)
- Best Practices
- Liability Protection
- Employee Comfort

Indoor Air Quality and Noise Monitoring-Polling Question

When Do You Perform Monitoring??

A) Whenever employees complain of odors or exposures

B) Our insurance carrier decides when to monitor, they provide the service

C) When we can afford it as part of a new operation

D) As part of an on-going industrial hygiene monitoring plan/ program to evaluate exposures, and lack of exposures.

Indoor Air Quality and Noise Monitoring

Exposure:

Definition of “exposure”

Methods to determine exposure

- Your five senses
- Industrial Hygiene Monitoring
- Safety Data Sheets/Material Safety Data Sheets

Indoor Air Quality and Noise Monitoring-Polling Question

What are the four primary exposure routes, or how does something get into the body to cause harm??

Indoor Air Quality and Noise Monitoring-Polling Question

A. Air, Water, Sunlight and Earth

B. The Mouth, the Nose, Hands and Eyes

C. Bathroom, Locker Room, Spray Booth and Dip Tank

D. Nobody Really Knows

E. All of the above

Indoor Air Quality and Noise Monitoring-Polling Question

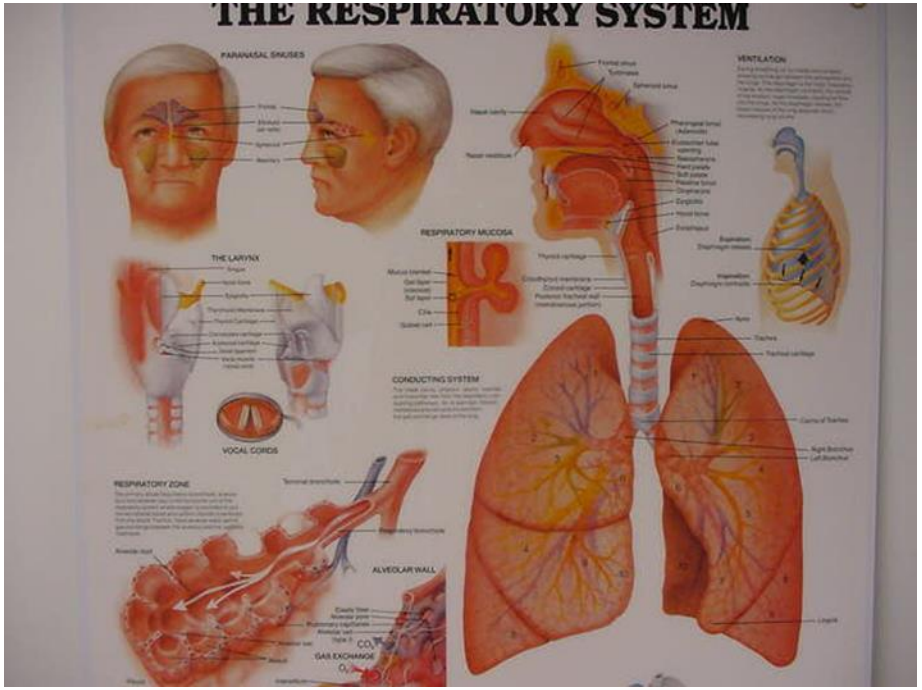
Routes of Exposure

- Inhalation
- Absorption
- Ingestion
- Skin/ Eye Contact

Indoor Air Quality and Noise Monitoring

Routes of Exposure

- Inhalation
- Absorption
- Ingestion
- Skin/ Eye Contact



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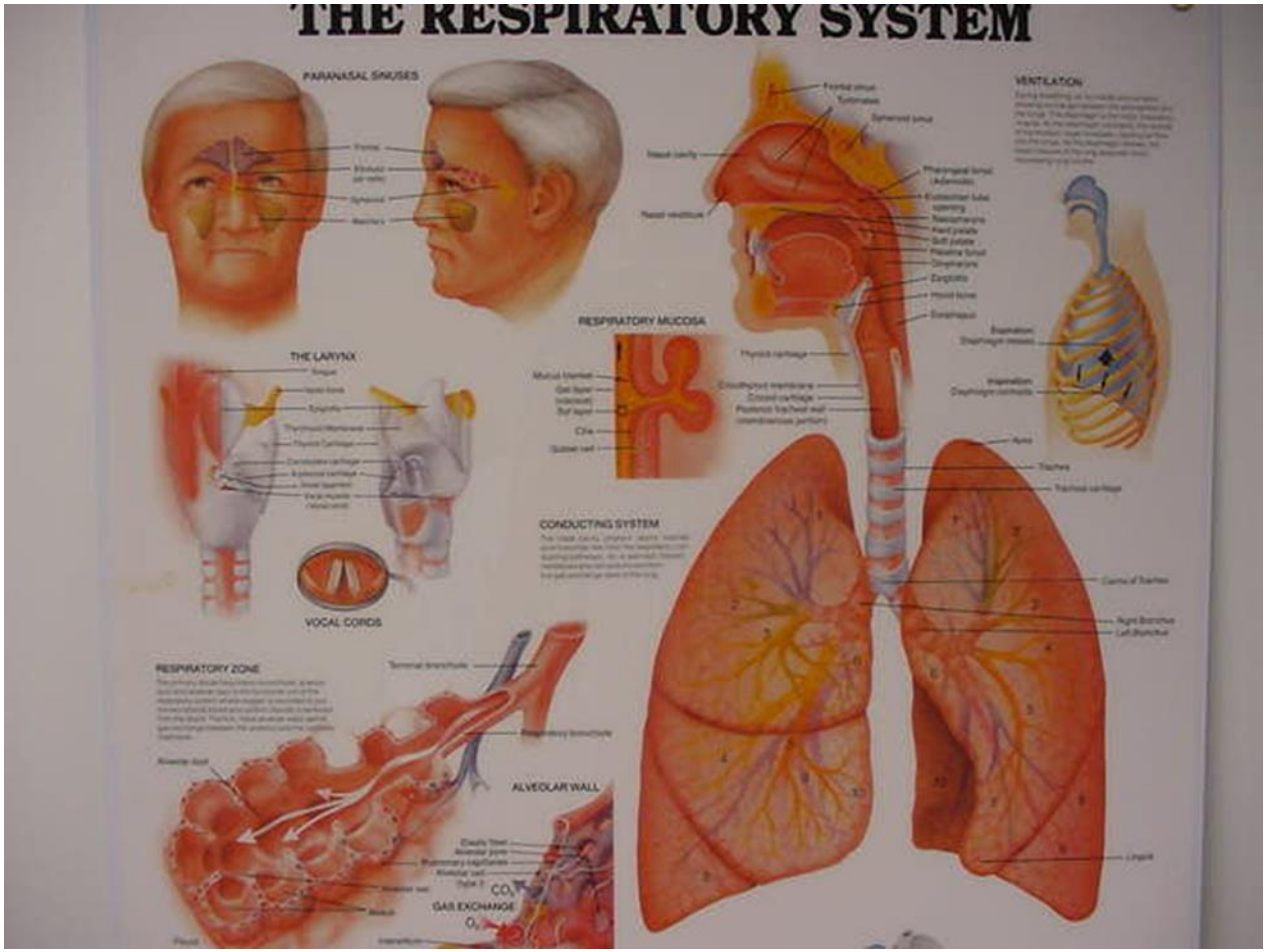
Indoor Air Quality and Noise Monitoring



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Indoor Air Quality and Noise Monitoring

When is Indoor Air Monitoring Required? Review Substance List


HOME

Safety Data Sheet (SDS) Inventory Spreadsheet

Version 3.0

ABC Client

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Location	Manufacturer	Product Name	Product ID No.	Revised/ Issued Date	Date of this Entry	Is there MSDS?	Labeling	EHS Form	Comments	Combustible Dust	REACH (SVHC)	RoHS	PPE
Use to Search ---													
Example	3M	Super Glue Gel	21-8716-5	04/06/09	04/30/10	yes	see SDS	yes	used for sticking things together	no	no	yes	see SDS

Settings & Links | SDS Inventory | MSDS Inventory | Archives

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Indoor Air Quality and Noise Monitoring

How Is Indoor Air Quality (IAQ) Monitoring Conducted?

- Review SDS/MSDS; operations info to determine contaminants, fugitive emissions, etc. that may be present
- Direct Reading Meter, spot checking, mapping
- Full shift (8 hour Time-Weighted Average TWA)
- Short Term Exposure Limits (15 minute exposures not to exceed more than 3 times in a shift)
- Ceiling Limits (not to be exceeded at any time)

Indoor Air Quality and Noise Monitoring

How Is Indoor Air Quality (IAQ) Monitoring Conducted?

- Direct Reading Meter
- Personal Sampling Pump and Filter
- Personal Sampling Pump, Filter and Cyclone (Respirable Dusts)
- Personal Sampling Pump and Adsorbent Tube
- Diffusion Badge
- Impinger
- Visual Air Current Tube
- Photo Supplement

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Indoor Air Quality and Noise Monitoring

What are we looking for?

- Dusts (Respirable, Total)
- Fibers
- Fumes (Recondensed Metals)
- Mists
- Vapors
- Gases
- Liquids
- Molds, Spores and Bacteria
- Physical Energy may be evaluated in coordination with or as a stand-alone exposure

Indoor Air Quality and Noise Monitoring

Why are we conducting monitoring??

1. Specific OSHA Chemical Standard (lead, hexavalent chromium, cadmium)
2. OSHA Z-1 Table 1910.1000
3. Hearing Conservation Standard 1910.95
4. Employee Complaints, Concerns, Expressed to Management or Safety Committee
5. Baseline Monitoring, Unknown Exposure Levels
6. Establishing Job knowledge for New and Existing Job Classes
7. To support the Engineering Controls Development
8. To Support the Respiratory Protection Program (respirator selection, APF)
9. Operational Changes, Re-sampling
10. OSHA citation follow-up

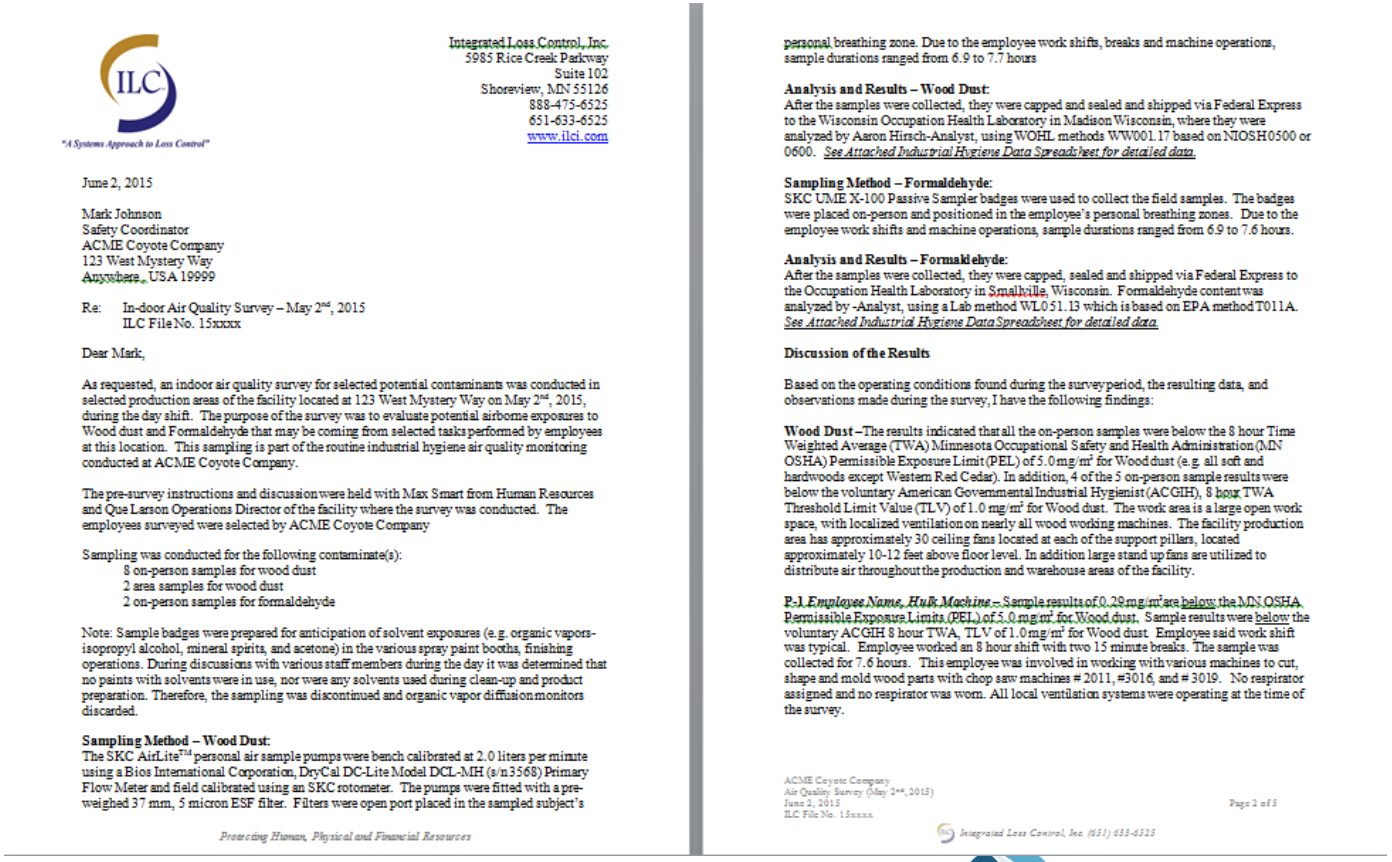
Indoor Air Quality and Noise Monitoring

What will be done with the results of monitoring?

This question needs to be answered before monitoring is conducted....

Indoor Air Quality and Noise Monitoring

Example IAQ Report



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5985 Rice Creek Parkway
Suite 102
Shoreview, MN 55126
888-475-6525
651-633-6525
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June 2, 2015

Mark Johnson
Safety Coordinator
ACME Coyote Company
123 West Mystery Way
Anywhere, USA 19999

Re: In-door Air Quality Survey – May 2nd, 2015
ILC File No. 15xxxx

Dear Mark,

As requested, an indoor air quality survey for selected potential contaminants was conducted in selected production areas of the facility located at 123 West Mystery Way on May 2nd, 2015, during the day shift. The purpose of the survey was to evaluate potential airborne exposures to Wood dust and Formaldehyde that may be coming from selected tasks performed by employees at this location. This sampling is part of the routine industrial hygiene air quality monitoring conducted at ACME Coyote Company.

The pre-survey instructions and discussion were held with Max Smart from Human Resources and Que Larson Operations Director of the facility where the survey was conducted. The employees surveyed were selected by ACME Coyote Company

Sampling was conducted for the following contaminate(s):
- 8 on-person samples for wood dust
- 2 area samples for wood dust
- 2 on-person samples for formaldehyde

Note: Sample badges were prepared for anticipation of solvent exposures (e.g. organic vapors-isopropyl alcohol, mineral spirits, and acetone) in the various spray paint booths, finishing operations. During discussions with various staff members during the day it was determined that no paints with solvents were in use, nor were any solvents used during clean-up and product preparation. Therefore, the sampling was discontinued and organic vapor diffusion monitors discarded.

Sampling Method – Wood Dust:
The SKC AirLite™ personal air sample pumps were bench calibrated at 2.0 liters per minute using a Bios International Corporation, DryCal DC-Lite Model DCL-MH (s/n 3568) Primary Flow Meter and field calibrated using an SKC rotometer. The pumps were fitted with a pre-weighed 37 mm, 5 micron ESF filter. Filters were open port placed in the sampled subject's

Protecting Human, Physical and Financial Resources

personal breathing zone. Due to the employee work shifts, breaks and machine operations, sample durations ranged from 6.9 to 7.7 hours

Analysis and Results – Wood Dust:
After the samples were collected, they were capped and sealed and shipped via Federal Express to the Wisconsin Occupation Health Laboratory in Madison Wisconsin, where they were analyzed by Aaron Hirsch-Analyst, using WOHL methods WW001.17 based on NIOSH 0500 or 0600. *See Attached Industrial Hygiene Data Spreadsheet for detailed data.*

Sampling Method – Formaldehyde:
SKC UME X-100 Passive Sampler badges were used to collect the field samples. The badges were placed on-person and positioned in the employee's personal breathing zones. Due to the employee work shifts and machine operations, sample durations ranged from 6.9 to 7.6 hours.

Analysis and Results – Formaldehyde:
After the samples were collected, they were capped, sealed and shipped via Federal Express to the Occupation Health Laboratory in Smallville, Wisconsin. Formaldehyde content was analyzed by -Analyst, using a Lab method WL0 51.13 which is based on EPA method T011A. *See Attached Industrial Hygiene Data Spreadsheet for detailed data.*

Discussion of the Results

Based on the operating conditions found during the survey period, the resulting data, and observations made during the survey, I have the following findings:

Wood Dust – The results indicated that all the on-person samples were below the 8 hour Time Weighted Average (TWA) Minnesota Occupational Safety and Health Administration (MN OSHA) Permissible Exposure Limit (PEL) of 5.0 mg/m³ for Wood dust (e.g. all soft and hardwoods except Western Red Cedar). In addition, 4 of the 5 on-person sample results were below the voluntary American Governmental Industrial Hygienist (ACGIH), 8 hour TWA Threshold Limit Value (TLV) of 1.0 mg/m³ for Wood dust. The work area is a large open work space, with localized ventilation on nearly all wood working machines. The facility production area has approximately 30 ceiling fans located at each of the support pillars, located approximately 10-12 feet above floor level. In addition large stand up fans are utilized to distribute air throughout the production and warehouse areas of the facility.

P-1 Employee Name, Hulk Machine – Sample results of 0.29 mg/m³ are below the MN OSHA Permissible Exposure Limits (PEL) of 5.0 mg/m³ for Wood dust. Sample results were below the voluntary ACGIH 8 hour TWA, TLV of 1.0 mg/m³ for Wood dust. Employee said work shift was typical. Employee worked an 8 hour shift with two 15 minute breaks. The sample was collected for 7.6 hours. This employee was involved in working with various machines to cut, shape and mold wood parts with chop saw machines # 2011, #3016, and # 3019. No respirator assigned and no respirator was worn. All local ventilation systems were operating at the time of the survey.

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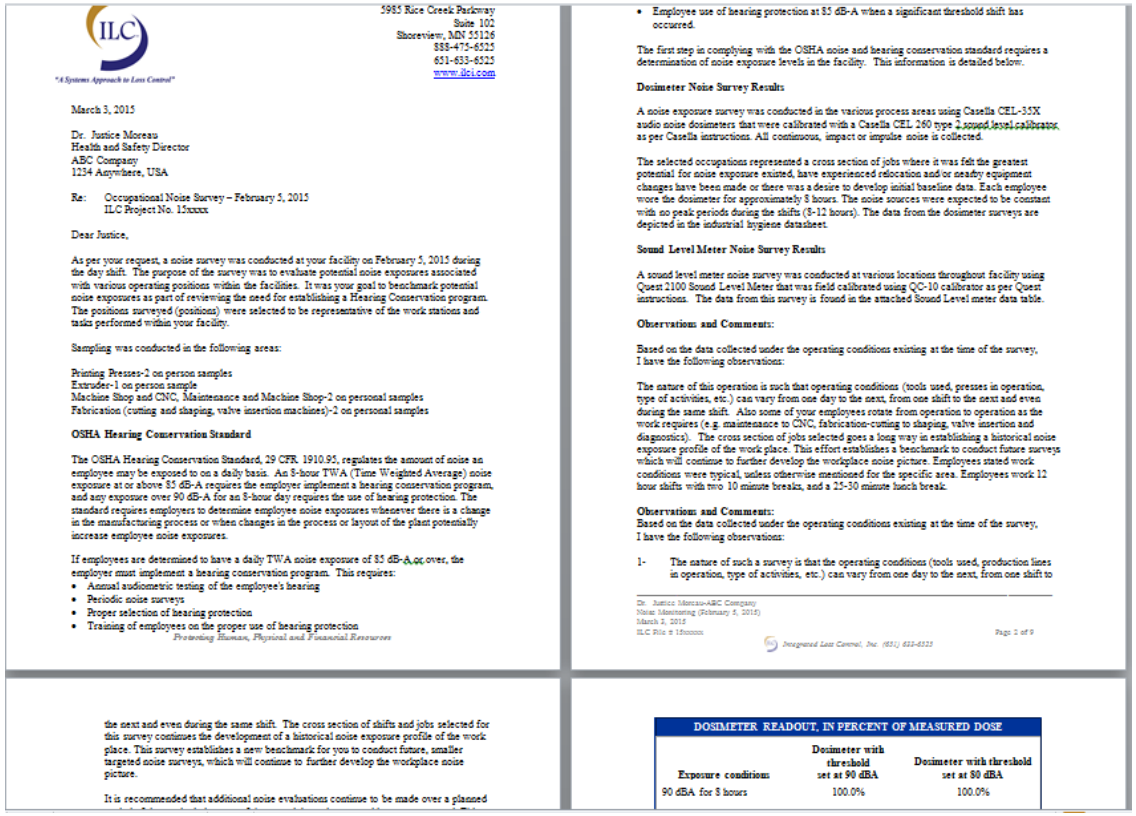
Indoor Air Quality and Noise Monitoring Results

Example audiodosimeter/SLM noise reports….



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"A Systems Approach to Loss Control"

March 3, 2015

Dr. Justice Moreau
Health and Safety Director
ABC Company
1234 Anywhere, USA

Re: Occupational Noise Survey – February 5, 2015
ILC Project No. 15xxxx

Dear Justice,

As per your request, a noise survey was conducted at your facility on February 5, 2015 during the day shift. The purpose of the survey was to evaluate potential noise exposures associated with various operating positions within the facilities. It was your goal to benchmark potential noise exposures as part of reviewing the need for establishing a Hearing Conservation program. The positions surveyed (positions) were selected to be representative of the work stations and tasks performed within your facility.

Sampling was conducted in the following areas:

Printing Presses-2 on person samples
Extruder-1 on person sample
Machine Shop and CNC, Maintenance and Machine Shop-2 on personal samples
Fabrication (cutting and shaping, valve insertion machines)-2 on personal samples

OSHA Hearing Conservation Standard

The OSHA Hearing Conservation Standard, 29 CFR. 1910.95, regulates the amount of noise an employee may be exposed to on a daily basis. An 8-hour TWA (Time Weighted Average) noise exposure at or above 85 dB-A requires the employer implement a hearing conservation program, and any exposure over 90 dB-A for an 8-hour day requires the use of hearing protection. The standard requires employers to determine employee noise exposures whenever there is a change in the manufacturing process or when changes in the process or layout of the plant potentially increase employee noise exposures.

If employees are determined to have a daily TWA noise exposure of 85 dB-A or over, the employer must implement a hearing conservation program. This requires:

- Annual audiometric testing of the employee's hearing
- Periodic noise surveys
- Proper selection of hearing protection
- Training of employees on the proper use of hearing protection

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- Employee use of hearing protection at 85 dB-A when a significant threshold shift has occurred.

The first step in complying with the OSHA noise and hearing conservation standard requires a determination of noise exposure levels in the facility. This information is detailed below.

Dosimeter Noise Survey Results

A noise exposure survey was conducted in the various process areas using Casella CEL-35X audio noise dosimeters that were calibrated with a Casella CEL 260 type 2 sound level calibrator, as per Casella instructions. All continuous, impact or impulse noise is collected.

The selected occupations represented a cross section of jobs where it was felt the greatest potential for noise exposure existed, have experienced relocation and/or nearby equipment changes have been made or there was a desire to develop initial baseline data. Each employee wore the dosimeter for approximately 8 hours. The noise sources were expected to be constant with no peak periods during the shifts (8-12 hours). The data from the dosimeter surveys are depicted in the industrial hygiene datasheet.

Sound Level Meter Noise Survey Results

A sound level meter noise survey was conducted at various locations throughout facility using Quest 2100 Sound Level Meter that was field calibrated using QC-10 calibrator as per Quest instructions. The data from this survey is found in the attached Sound Level meter data table.

Observations and Comments:

Based on the data collected under the operating conditions existing at the time of the survey, I have the following observations:

The nature of this operation is such that operating conditions (tools used, presses in operation, type of activities, etc.) can vary from one day to the next, from one shift to the next and even during the same shift. Also some of your employees rotate from operation to operation as the work requires (e.g. maintenance to CNC, fabrication-cutting to shaping, valve insertion and diagnostics). The cross section of jobs selected goes a long way in establishing a historical noise exposure profile of the work place. This effort establishes a benchmark to conduct future surveys which will continue to further develop the workplace noise picture. Employees stated work conditions were typical, unless otherwise mentioned for the specific area. Employees work 12 hour shifts with two 10 minute breaks, and a 25-30 minute lunch break.

Observations and Comments:
Based on the data collected under the operating conditions existing at the time of the survey, I have the following observations:

1- The nature of such a survey is that the operating conditions (tools used, production lines in operation, type of activities, etc.) can vary from one day to the next, from one shift to

Dr. Justice Moreau-ABC Company
Noise Monitoring (February 5, 2015)
March 3, 2015
ILC File # 15xxxxx
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the next and even during the same shift. The cross section of shifts and jobs selected for this survey continues the development of a historical noise exposure profile of the work place. This survey establishes a new benchmark for you to conduct future, smaller targeted noise surveys, which will continue to further develop the workplace noise picture.

It is recommended that additional noise evaluations continue to be made over a planned

DOSIMETER READOUT, IN PERCENT OF MEASURED DOSE

Exposure conditions	Dosimeter with threshold set at 90 dBA	Dosimeter with threshold set at 80 dBA
90 dBA for 8 hours	100.0%	100.0%

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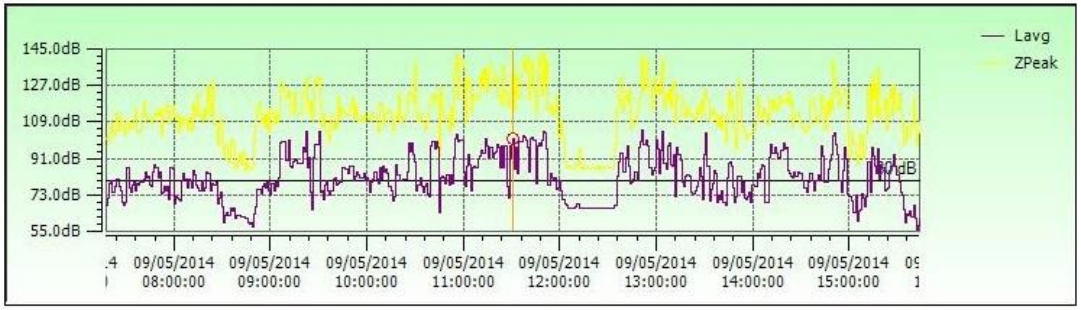
Indoor Air Quality and Noise Monitoring

Casella CEL Ltd.

CASELLA insight

Report On CEL-35X

Instrument Model	**CEL-350**		
Serial Number	3921002	TWA (T2=90)	87.8 dB
Person	Unallocated	Zpeak	143.5 dB
Location	Unallocated	Cal (before) SPL	114.02 dB
Site	Unallocated	Overload	Yes
Start Date & Time	5/9/2014 7:17:50 AM	Proj Dose (Q5 C=90 T1=80)	79.7%
Duration	08:27:14 HH:MM:SS	Proj Dose (Q5 C=90 T2=90)	69.6%
Lavg (Q5 T1=80)	88.4 dB		
Lavg (Q5 T2=90)	87.4 dB		
TWA (T1=80)	88.8 dB		
Notes	Employee#1- Fabrication, Welding Area disassembly/truck bustel project		



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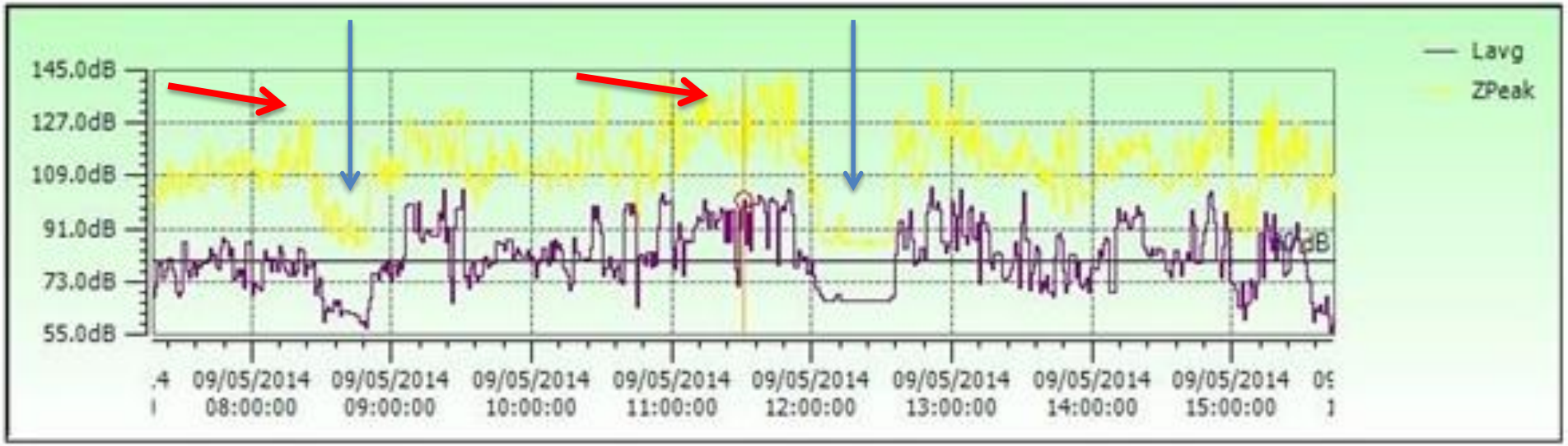
Indoor Air Quality and Noise Monitoring

Notes

Employee#1- Fabrication, Welding Area disassembly/truck bustel project



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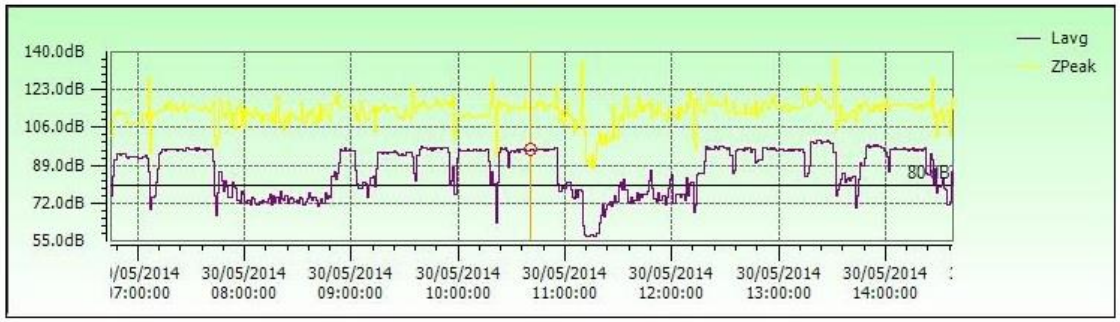
Indoor Air Quality and Noise Monitoring

Casella CEL Ltd.

Report On CEL-35X

Instrument Model	**CEL-350**		
Serial Number	3901560	TWA (T2=90)	91.3 dB
Person	Unallocated	Zpeak	137 dB
Location	Unallocated	Cal (before) SPL	114 dB
Site	Unallocated	Overload	No
Start Date & Time	5/30/2014 6:45:02 AM	Proj Dose (Q5 C=90 T1=80)	127.5%
Duration	07:54:35 HH:MM:SS	Proj Dose (Q5 C=90 T2=90)	121.8%
Lavg (Q5 T1=80)	91.8 dB		
Lavg (Q5 T2=90)	91.4 dB		
TWA (T1=80)	91.7 dB		
Notes	Employee #2- Router Room Bldg 1		



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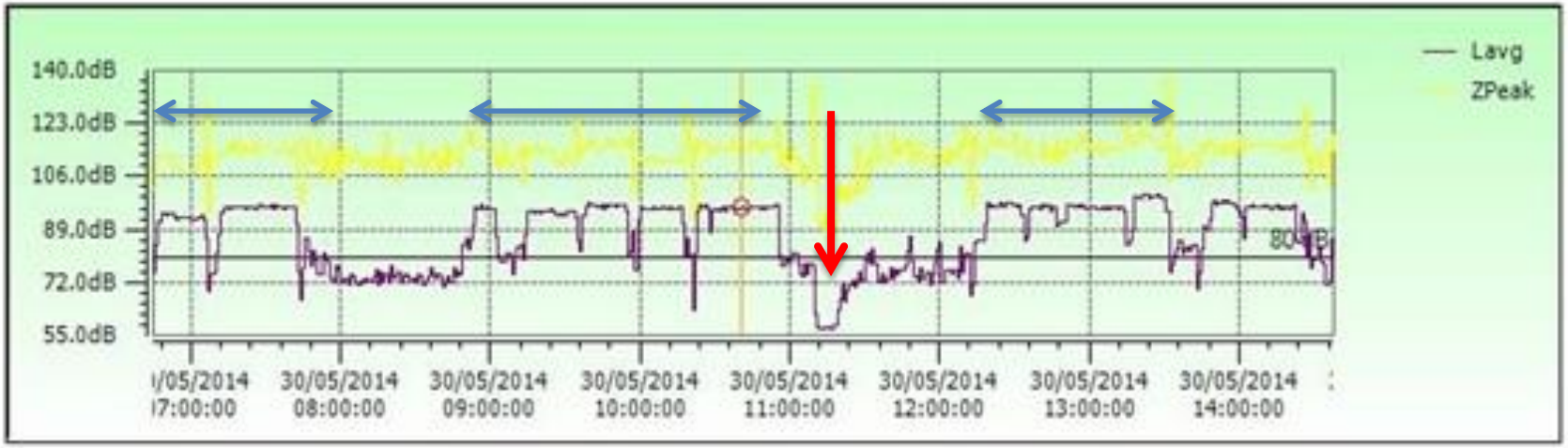
Indoor Air Quality and Noise Monitoring



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Indoor Air Quality and Noise Monitoring Results

OSHA G-16A table

TABLE G-16 - PERMISSIBLE NOISE EXPOSURES (1)

Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

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Polling Question

What types of IAQ concerns do you have?

a) Air borne dusts
b) Solvent Vapors
c) Mold and Bacteria
d) I just need to know how to monitor for the bad things
e) All the above

MN OSHA Z-1A table, ACGIH booklet

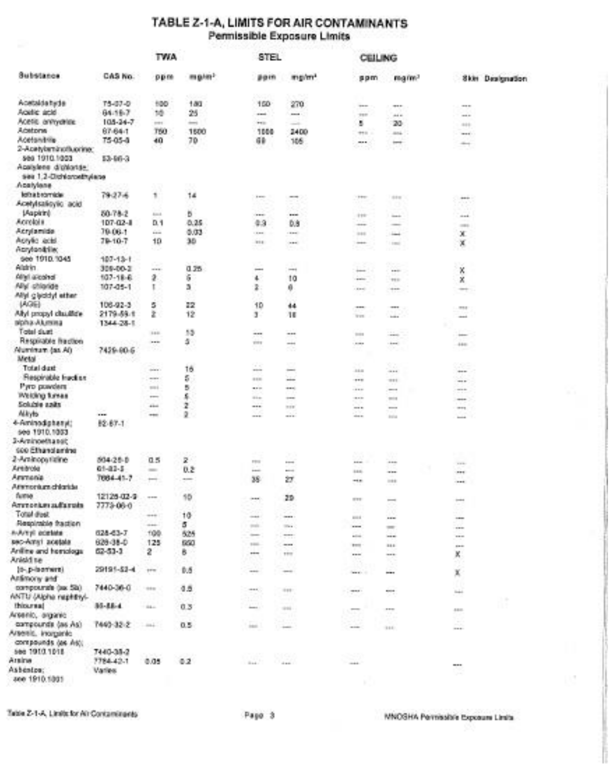
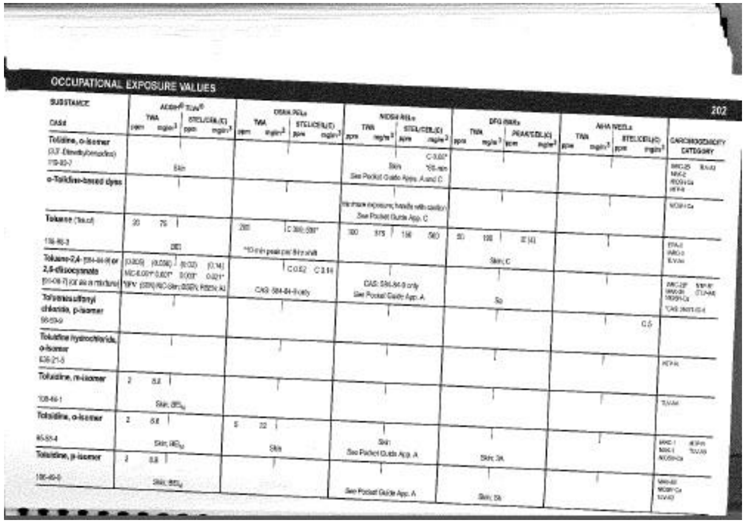


TABLE Z-1-A, LIMITS FOR AIR CONTAMINANTS
Permissible Exposure Limits

Table Z-1-A, Limits for Air Contaminants — Page 3 — MNOSHA Permissible Exposure Limits



OCCUPATIONAL EXPOSURE VALUES — 202

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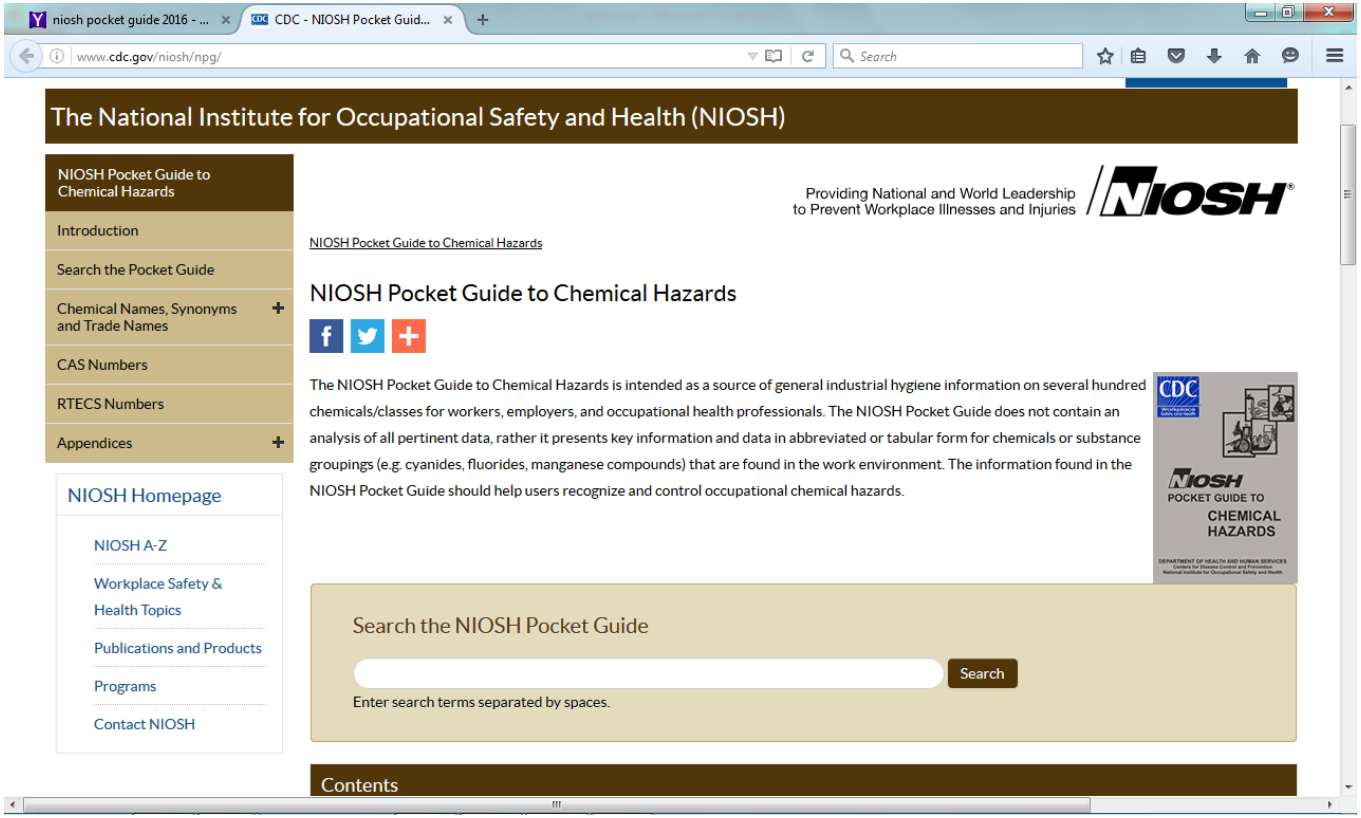
Indoor Air Quality and Noise Monitoring Results

NIOSH Pocket Guide



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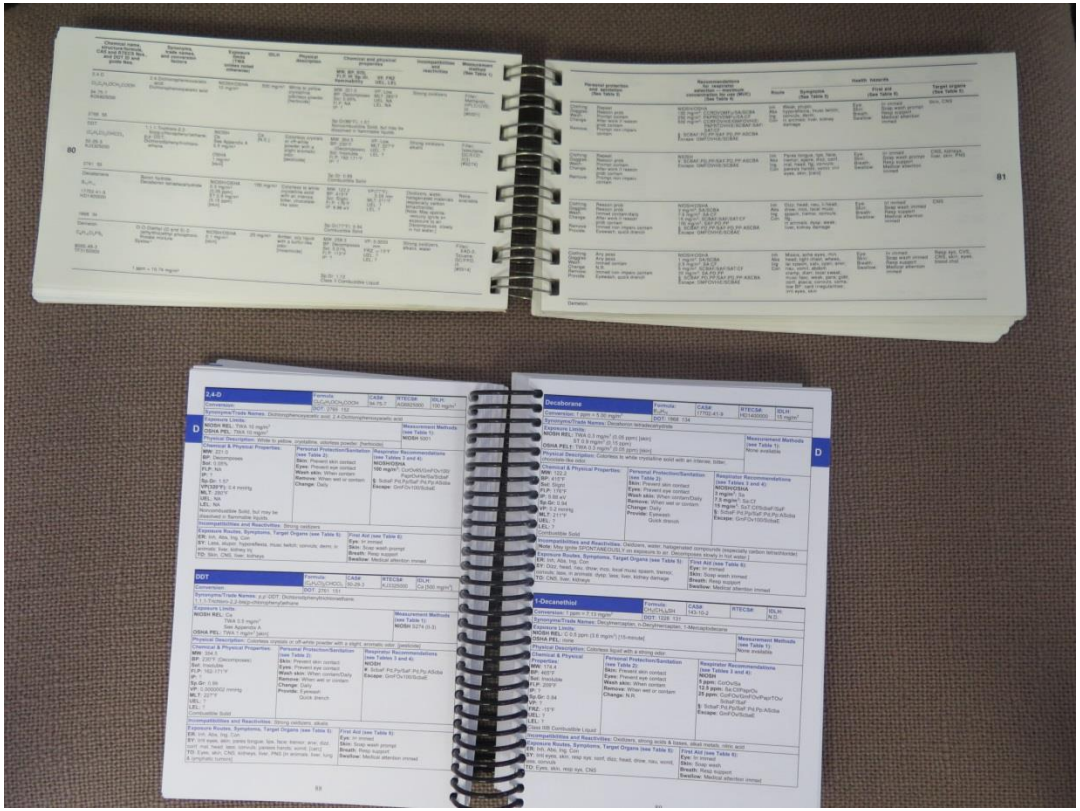
Indoor Air Quality and Noise Monitoring Results

NIOSH Pocket Guide



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Indoor Air Quality and Noise Monitoring Results

Example IH spreadsheet-solvents lead

HOME

ABC Client
Industrial Hygiene Surveillance Monitoring Program
Data Tracking – Version 9.0

Any data highlighted in red has exceeded an established limit.
Any data highlighted in orange is at 80% of the established limit.

Project Number	Date	Shift	Hours Worked	Sample #	Job Title	Area/Equipment	Department	Employee Name	Contaminant	Survey Results			Unit of measure	Action Limit (if applicable)	Permissible Exposure Limit (PEL)				Comments	Notes or Additional Comments
										TWA	STEL	Other			TWA	STEL	Ceiling	Other (NIOSH, ACGIH,		
00000s	07/01/15	Day	8	P-1	Job 1	Foaming		Employee 1	Acetone	0.770			ppm		750.000				TWA results ok, unless otherwise noted.	
00000s	07/01/15	Day	8	P-1	Job 1	Foaming		Employee 1	Benzene	1.500			ppm	0.500	1.000				Over TWA-PEL. Evaluate. Engineering and/or PPE is required.	
00000s	07/01/15	Day	8	P-1	Job 1	Foaming		Employee 1	Bromopane (1-)	<0.13			ppm		nr			0.100	Not Regulated.	Due to the limits on the sampling method, the actual concentration is likely lower than what was reported.
00000s	07/01/15	Day	8	P-1	Job 1	Foaming		Employee 1	Lead,Inorganic Fume & Dust	0.040			mg/m3		0.050			0.050	This is within 80% of TWA-PEL.	

Index | Detailed Reports | Air Quality | Noise - Dosimeters | Noise- Sound Level Meter (SLM) | Carbon Monoxide | ILC

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Indoor Air Quality and Noise Monitoring Results

Example IH spreadsheet-Carbon Monoxide

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ABC Client
Industrial Hygiene Surveillance Monitoring Program
Carbon Monoxide Monitoring - Version 9.0

Sampling Date	Monitor Mfg. / Model	Monitor Serial No.	Job Title	Area/Equipment	Department	Employee Name	Pretest Calibration (Yes, No, N/A)	Time - ON	Time - OFF	Total Time	STEL	TWA	Peak	Ceiling	PEL	Comments	Person Conducting Survey
7/1/2015	ToxiRae3	G0110xxx		Assembly 2		Area Sample	No						<1		35	Direct Read-zero calib 6/29/15, CO calib 5/28/15	Tony Kuehn-ILC
7/1/2015	ToxiRae3	G0110xxx		Assembly 3		Area Sample	No						6 - 7		35	Direct Read-zero calib 6/29/15, CO calib 5/28/15	Tony Kuehn-ILC

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Indoor Air Quality and Noise Monitoring Results

Example IH spreadsheet-Noise 8 Hr TWA

HOME

ABC Client
Industrial Hygiene Surveillance Monitoring Program
Noise Monitoring - Version 9.0

Any data highlighted in red is at or above the Action Limit.
Any data highlighted in orange is within 80% of the Action Limit.
Click on the Project Number to view the report
Click on the Employee Name to view the Summary Graph

Project Number	Date	Shift	Hours Worked	Sample #	Job Title	Area/Equipment	Department	Employee Name	HPD Worn	Percent Dose	TWA	Averaged-BA	Comments
000000b	06/24/15	Day	4.75	n/a	Job 2		Dept 1	Employee 2	Yes	8.8	68.9	< 80.00	Results OK. Continue Routine Monitoring.
000000b	07/28/15	Day	5.25	n/a	Job 3		Dept 2	Employee 3	Yes	68.1	84.4	87.0	Include in Hearing Protection Program.

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Indoor Air Quality and Noise Monitoring Results

Example IH spreadsheet-Noise SLM mapping

HOME

ABC Client
Industrial Hygiene Surveillance Monitoring Program
Sound Level Meter Reading - Version 9.0

Click on the highlighted Project Number to view the Report

Project Number	Date	Location	Average Sound Pressure (dba)	Average Per Test	Comment(s)
00000b	6/24/2015	1-301 D-4	79	79.0	Equipment running, not all punches
00000b	6/24/2015	1-301 D-4			
00000b	6/24/2015	1-301 D-4			
00000b	6/24/2015	2-301 D-6	73	73.0	Unit 368 operating
00000b	6/24/2015	2-301 D-6			
00000b	6/24/2015	2-301 D-6			
00000b	6/24/2015	3-301 D-8	78	78.7	Unit 368 operating
00000b	6/24/2015	3-301 D-8	82		
00000b	6/24/2015	3-301 D-8	76		
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Developed and Presented by:
Integrated Loss Control, Inc.

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Indoor Air Quality and Noise Monitoring Results

- The results need to be communicated to the employees
- Certain individual standards require reporting in a specific timeline
- 1910.1020-Medical Records

Indoor Air Quality and Noise Monitoring Results

The results have been generated-

Now what do we do??

- Regulatory Requirements (resampling, implement controls)
- Take Action (hierarchy of controls)
- Repeat to Confirm
- Archive in Case of Workers Compensation, Liability Claim
- No Action Necessary, Unless Conditions Change

Indoor Air Quality and Noise Monitoring –Polling Question

Taking Action-What Do You Do at Your Facility?

A. Perform Engineering Study to change the operation

B. Wait for 3rd party recommendations

C. Address all exposures with PPE, respirators or HPD

D. Utilize OSHA VPP program consulting division

E. Punt if results are high

Indoor Air Quality and Noise Monitoring Results

Taking Action

- Hierarchy of Controls
  - Avoidance
  - Engineering
  - Substitution
  - Administrative
  - PPE (the last line of defense)

Indoor Air Quality and Noise Monitoring Actions

Taking Action cont.

- Hierarchy of Controls
  - Avoidance (change the production process or eliminate by third party transfer)

Indoor Air Quality and Noise Monitoring Actions

Taking Action cont.

- Hierarchy of Controls
  - Engineering
    - Localized Ventilation Systems
    - Automatic Spraying Operations (enclosed hoods)
    - Wet Process vs Dry Process
    - Robotic Tasks
    - Distancing (noise falls off as the square of the distance)
    - Barrier walls, absorptive materials
    - Enclosure, Separate Room

Indoor Air Quality and Noise Monitoring Actions

Taking Action cont.

- Hierarchy of Controls
  - Substitution
    - Different Chemicals (less toxic)
    - Different Machines (less emission, reduced noise)
    - Better Maintenance

Indoor Air Quality and Noise Monitoring Actions

Taking Action cont.

- Hierarchy of Controls
  - Administrative
    - Training in Machine Use
    - Work task reviews, body positioning
    - Better Maintenance
    - Task Rotation-(cannot be used to reduce chemical PELs)

Indoor Air Quality and Noise Monitoring Actions

Taking Action cont.

- Hierarchy of Controls
  - Personal Protective Equipment (PPE)
    - While other controls are being examined, equipment ordered, installed, etc.
    - Prior to training being completed
    - When other controls are not feasible
    - Secondary forms of protection
    - Voluntary (for comfort)

Questions?