# International Union of Operating Engineers
# National Hazmat Program

## Human Factors Assessment Report

## Adamant Circular Saw
## OENHP #: 2001-05, Version A

Report Issued: January 2002

International Union of Operating Engineers National Hazmat Program
International Environmental Technology and Training Center

# Human Factors Assessment Report


Frank Hanley, General President

The OENHP would like to thank the following team members for their participation in this assessment and for the professional expertise they provided:
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# Adamant Circular Saw
# (OENHP #: 2001-05, Version A)

## Table of Contents

# 1.0 EXECUTIVE SUMMARY

Florida International University's (FIU) Hemispheric Center for Environmental Technology (HCET) evaluated five saws for their effectiveness in cutting up specially prepared fiberglass-reinforced plywood crates. These crates were built as surrogates for crates that presently hold radioactive contaminated glove boxes at the Department of Energy's (DOE) Los Alamos facility. The Adamant circular saw was assessed on August 14, 2001. During the FIU test of efficacy, a team from the Operating Engineers National Hazmat Program (OENHP) evaluated the occupational safety and health issues associated with this technology. The Adamant was only used during a limited "test" on a regular plywood crate due to safety considerations of the tool for this application.

The Adamant circular saw, a counter-rotating twin-cutter, constructed with blades that work differently than conventional cutting wheels with twin blades, each rotating in opposite directions. It is used to cut wood and metals. Each blade is approximately 8 ¾ inches in diameter with a maximum cutting depth of 2 ½inches. The machine has two rotation speeds: 1,900 and 2,900 rotations per minute (rpm). The saw is operated with an interlocked, guarded trigger switch located at the end of the saw opposite the cutting blades. To operate the saw, the safety interlock must be depressed prior to powering the saw with the trigger control. The saw is supported by a handle at the front of the saw near the cutting blades. The top part of the blades is guarded near the handle, with approximately three-fourths of the face of the blades exposed.

The Adamant circular saw is an innovative technology used to cut metals and wood. Its safety features include: interlocking switch for powering the saw, overload indicator and shutoff, and an electronic brake that stops the engine immediately when the start button is released. The top part of the blades is guarded near the motor. With approximately three-fourths of the face of the blades open, the operator is exposed to the potential risk of serious and minor cuts and abrasions when using and handling the saw. There is also potential for damage to the blades if the saw is not stored properly. Without guarding on the lower part of the blades, these can be damaged if the saw is dropped or rested on the cutting blades.

Based upon the industrial hygiene sampling conducted for the other four saws demonstrated at FIU, noise levels, nuisance dust, and airborne fiberglass may be a problem when using this technology for the cutting of fiberglass-reinforced plywood crates. No industrial hygiene sampling was conducted while the Adamant saw was in use. Engineering controls should be used to eliminate these problems whenever possible. Where this is not possible, administrative controls, training, and proper personal protective equipment (PPE) should be used. Respirators should be used if engineering controls do not sufficiently control the dust or fiberglass generated. Respirators should be equipped with an organic vapor and acid gas cartridge with a High Efficiency Particulate Air (HEPA) filter, since during the demonstration, the workers complained of an odd smell, which may have been the breakdown of the fiberglass.

# 2.0 INTRODUCTION

## 2.1 OENHP Safety and Health Assessment

On August 14, 2001, three safety professionals from OENHP performed the human factors assessment in the high-bay building at FIU located at 10555 West Flagler Street, Miami, Florida, 33174. Team members included John Kovach, Jeana Harrison, and Aaron Ondo.

## 2.2 Technology Description and Operation

The Adamant circular saw was tested on a specially prepared 4 x 4 x 8 foot plywood crate at FIU in August 2001. In conjunction with FIU's evaluation of efficiency and cost, this report covers the hazard analysis and safety evaluation that the OENHP conducted during the test.

The Adamant circular saw, has a counter-rotating twin-cutter, and is constructed with blades that work differently than conventional cutting wheels with twin blades, each rotating in opposite directions. It is used to cut wood and metals. Each blade is approximately 8 ¾inches in diameter with a maximum cutting depth of 2 ½inches. The saw is operated with an interlocked, guarded trigger switch located at the end of the saw opposite to the cutting blades. To operate the saw, the safety interlock must be depressed prior to powering the saw with the trigger control. The saw is supported by a handle at the front of the saw near the cutting blades. The top part of the blades is guarded near the handle, with approximately three-fourths of the face of the blades exposed.

The machine has two rotational speeds: 1,900 and 2,900 revolutions per minute (rpm). The basic rotation speed when the machine is started is 1,900 rpm. When the button on the upper side of the handle is depressed, the speed adjusts to 2,900 rpm. The higher speed is maintained as long as the button is depressed. As soon as the button is released, the speed is returned to 1,900 rpm. The speed of the saw can be changed during the cutting process.

The machine is protected against overloading by an electronic device. If the current intensity gets too high, a diode on the handle lights. If the cutting speed is not decreased to avoid overloading, the saw will automatically shutoff.

# 3.0 METHODOLOGY

## 3.1 Methodology for Assessment of Safety Issues

The team completed a Job Hazard Analysis (JHA) after the evaluation. This is a well-established tool. The JHA systematically identifies all of the steps required to operate a piece of equipment or complete a task. The potential hazards of each step are listed and the methods to control these hazards are identified. The information from the JHA was then used to create a Technology Safety Data Sheet (TSDS). This innovative tool

is required by the Department of Energy for all of the technologies funded by the Office of Science and Technology. See Section 6.0 for completed safety analyses.

### 3.2 Methodology for Assessment of Health Issues

No industrial hygiene samples (i.e. noise levels, nuisance dust, or fiberglass) were obtained during the dismantling of the 4-foot x 4-foot x 8-foot plywood crate. Sampling was not performed due to the short demonstration time. This demonstration lasted approximately one-half hour.

## 4.0 RESULTS AND DISCUSSION

### 4.1 Safety Issues

The Adamant circular saw is an innovative technology used to cut metals and wood. Its safety features include: interlocking switch for powering the saw, overload indicator and shutoff, and an electronic brake that stops the engine immediately when the start button is released. The top part of the blades is guarded near the motor. With approximately three-fourths of the face of the blades open, the operator is exposed to the potential risk of serious and minor cuts and abrasions when using and handling the saw. There is also potential for damage to the blades if the saw is not stored properly. Without guarding on the lower part of the blades, these can be damaged if the saw is dropped or rested on the cutting blades.

### 4.2 Health Issues

No noise or air sampling was performed during this demonstration. It is recommended that both be conducted before the saw is used on a remediation site.

## 5.0 RECOMMENDATIONS

The interlocking switch, the electronic brake, and the overload indicator/shutoff are excellent features, which help to make the saw safer for the user. However, blades on this saw should be fully guarded before it is used on a remediation site. This saw has the potential to severely cut a person if it is mishandled or dropped.

Based upon other the industrial hygiene sampling conducted for four other saws used at FIU, noise levels, nuisance dust, and fiberglass may be a problem when using this technology for the cutting of fiberglass-reinforced plywood crates. Engineering controls should be used to eliminate these problems whenever possible. Where this is not possible, administrative control, training, and proper PPE should be used. Examples of engineering controls include two specialized ventilation systems: a downdraft hood and a capture hood with a flexible duct (see Section 6.4 of the Appendix for figures). With a downdraft hood, a crate would sit on the top of the hood so the dust would be pulled down into the hood. A ventilation system such as this requires specialized knowledge and should be designed by a ventilation engineer.

Fiberglass is known to be a strong skin irritant and is a possible human carcinogen. Therefore, the workers should continue to wear appropriate suits and gloves, as well as

a full-face air-purifying respirator. The respirator should be equipped with a combination organic vapor/acid gas cartridge with a particulate filter, since, during the demonstration, the workers complained of an odd smell, which may have been from the breakdown of the fiberglass.

# 6.0 APPENDIX

## 6.1 Job Hazard Analysis

**Job Hazard Analysis**
**Adamant Circular Saw (OENHP #: 2001-05, Version A)**

| Sequence of Job Steps | Potential Accident or Hazard | New Procedure or Protection |
|---|---|---|
| **Phase 1: Construction/Start-up** | | |
| Pre-operation inspection | • Saw or cord damage may cause shock | • Inspect saw for obvious damage and frayed/cut cord.<br>• Check for misalignment of blades.<br>• Check that blades are installed properly (not backward).<br>• Check for binding of moving parts.<br>• Use qualified personnel and manufacturer-authorized parts. |
| | • Failure of on/off switch may cause cuts/abrasions | • Inspect on/off switch.<br>• Use qualified personnel and manufacturer-authorized parts. |
| Powering saw | • Wrong amperage extension cord causing an electrical hazard | • Inspect extension cord to verify adequacy to handle saw amperage. |
| | • Failure of on/off switch; failure on may cause cuts or abrasions | • Remove power from the saw by using proper method to unplug tool i.e. grip plug and remove from outlet (socket). |
| | • Ungrounded outlet causing an electrical hazard | • Inspect outlet to verify proper grounding and polarity by checking the outlet with a receptacle circuit tester.<br>• Use an outlet with a ground fault circuit interrupter (GFCI). |
| | • Abnormal noise or vibration due to improper mounting of blades may cause cuts, and/or abrasions. | • Turn off the saw.<br>• Remove power to the saw.<br>• Check proper mounting of blades.<br>• Use qualified personnel and manufacturer-authorized parts. |

| Job Hazard Analysis<br>Adamant Circular Saw (OENHP #: 2001-05, Version A) | | |
|---|---|---|
| **Sequence of Job Steps** | **Potential Accident or Hazard** | **New Procedure or Protection** |
| **Phase 2: Operation** | | |
| Operation of saw in horizontal and/or vertical motions | • Exposed blades may lead to serious or minor cuts or abrasions | • Position hand properly on the handgrip.<br>• Use leather-work gloves with rubber grips on the palms and fingers to reduce slip on the handgrip.<br>• Pick up and store saw properly. |
| | • Vibration to hands during use may lead to vibration-induced nerve damage known as Raynaud's Syndrome. | • Secure working piece.<br>• Ensure that shoe is in firm contact with the cutting surface – helps to reduce vibration.<br>• Wear gloves with vibration-dampening material.<br>• Control personnel duty time. |
| | • Excessive heat at cutting edge leading to exposure to a hot surface | • Do not force tool.<br>• Inspect condition of blades and replace worn blades. |
| | • No end of cut protection may lead to serious or minor cuts or abrasions | • Secure work piece.<br>• Maintain proper work position. |
| | • Static position may cause worker fatigue | • Control personnel duty time. |
| | • Excessive exposure to noise could lead to temporary or permanent hearing loss | • Wear ear protection (ear plugs or muffs) properly while saw is in use. |
| | • Excessive sparking may lead to equipment damage and electrical hazard | • Remove power to the saw.<br>• Inspect saw periodically.<br>• Use qualified personnel and manufacturer-authorized parts. |
| **Phase 3: Maintenance (Emergency and Routine)** | | |
| Cleaning | • Exposure to energized parts | • Remove power source before beginning maintenance (use proper lockout/tagout procedures).<br>• Use qualified personnel and manufacturer-authorized parts. |
| | • Exposure to contamination | • Use safety and health information such as Material Safety Data Sheets (MSDS's) for proper procedures and necessary personal protective equipment. |

## Job Hazard Analysis
## Adamant Circular Saw (OENHP #: 2001-05, Version A)

| Sequence of Job Steps | Potential Accident or Hazard | New Procedure or Protection |
|---|---|---|
| Blade replacement | • May lead to cuts and abrasions | • Follow manufacturer's procedures.<br>• Use eye and hand protection. |
| **Phase 4: Shutdown (Emergency and Routine)** | | |
| Remove power | • Shock | • Use proper method to unplug tool i.e. grip plug and remove from socket (outlet). |
| **Phase 5: Decontamination/Decommissioning** | | |
| Wipe the saw to remove contamination | • Exposure of operator or maintenance personnel to site-specific contaminants | • Use safety and health guidance such as Material Safety Data Sheets (MSDS's) to determine proper procedures and necessary personal protective equipment.<br>• Dispose of waste using approved procedures. |

## 6.2 Technology Safety Data Sheet

**Technology Safety Data Sheet**
**Adamant Circular Saw (OENHP #: 2001-05, Version A)**

| **Section 1: Technology Identity** | | |
|---|---|---|
| Technology Name(s): | | Emergency Contact: |
| Adamant Circular Saw | | Telephone International: +46 480 47 30 50<br>E-mail: adamant@nord2000se |
| Manufacturer's Name and Address: | | Information Contact: |
| Nord 2000 Inc.<br>390 06 KALAMAR, SWEDEN | | Telephone International: +46 480 47 30 50<br>E-mail: adamant@nord2000se |
| Date Prepared: | TSDS Version Number: | Prepared By: |
| 8/23/01 | 2001-05, Version A | John Kovach, MS; Jeana Harrison; Aaron Ondo, MS; Bruce Lippy, CIH, CSP |

**Section 2: Technology Description**

The Adamant circular saw, has a counter-rotating twin-cutter, and is constructed with blades that work differently than conventional cutting wheels with twin blades, each rotating in opposite directions. It is used to cut wood and metals. Each blade is approximately 8 ¾inches in diameter with a maximum cutting depth of 2 ½inches. The saw is operated with an interlocked, guarded trigger switch located at the end of the saw opposite to the cutting blades. To operate the saw, the safety interlock must be depressed prior to powering the saw with the trigger control. The saw is supported by a handle at the front of the saw near the cutting blades. The top part of the blades is guarded near the handle, with approximately three-fourths of the face of the blades exposed.

The machine has two rotation speeds: 1,900 and 2,900 revolutions per minute (rpm). The basic rotation speed when the machine is started up is 1,900 rpm. When the button on the upper side of the handle is depressed, the speed adjusts to 2,900 rpm. The higher speed is maintained as long as the button is depressed. As soon as the button is released, the speed is returned to 1,900 rpm. The speed of the saw can be changed during the cutting process.

The machine is protected against overloading by an electronic device. If the current intensity gets too high, a diode on the handle lights. If the cutting speed is not decreased to avoid overloading, the saw will automatically shutoff.

**Section 3: Technology Pictures**

Figure 1: (Left) An operator making a horizontal cut in the plywood with the Adamant circular saw.

Figure 2: (Right) An operator using the Adamant circular saw to make a vertical cut in the plywood.

## Technology Safety Data Sheet
## Adamant Circular Saw (OENHP #: 2001-05, Version A)

| **Section 4: Safety Hazards** | |
|---|---|
| Hazard Category:<br>4 – Could result in death or permanent total disability<br>3 – Could result in permanent partial disability or injuries or occupational illness that may result in hospitalization of at least three persons<br>2 – Could result in injury or occupational illness resulting in one or more lost work days<br>1 – Could result in injury or illness not resulting in a lost work day | |
| A. Buried Utilities, Drums, and Tanks | Hazard Rating: N/A |
| • Buried utilities, drums, and tanks are not associated with this technology. | |
| B. Chemical (Reactive, Corrosive, Pyrophoric, etc) | Hazard Rating: N/A |
| • Chemical use is not associated with this technology. | |
| C. Confined Space | Hazard Rating: N/A |
| • Confined space is not a hazard associated with this technology. | |
| D. Electrical | Hazard Rating: 1 |
| • Shock due to insufficient amperage in cord and/or ungrounded outlets may occur.<br>• Performing maintenance or blade changes while machinery is energized may lead to shock. Following lockout/tagout procedures will reduce this risk.<br>• Exposure to a damaged extension cord may lead to shock. | |
| E. Explosives | Hazard Rating: N/A |
| • Explosives are not associated with this technology. | |
| F. Fire Protection | Hazard Rating: N/A |
| • The facility fire protection plan should cover this tool, as it does not present an additional fire hazard. | |
| G. Gas Cylinders | Hazard Rating: N/A |
| • Gas cylinders are not used with this technology. | |
| H. Ladders/Platforms | Hazard Rating: N/A |
| • Electrical shock is possible when used with metal ladders or platforms. | |
| I. Lockout/Tagout | Hazard Rating: 1 |
| • The facility's lockout/tagout procedures and manufacturer's recommended procedures should cover this tool. | |
| J. Mechanical Hazards | Hazard Rating: 3 |
| • Cuts or abrasions from contact with saw blades during use and blade changes are possible.<br>• Serious cuts may occur if saw blades come into contact with the operator (i.e. while resting saw on leg). | |
| K. Moving Vehicles | Hazard Rating: N/A |
| • This saw does not utilize any moving vehicles, although one will be used to move the fiberglass-reinforced crates to the decommissioning area. The workers should be aware of the normal hazards associated with moving vehicles. | |
| L. Overhead Hazards | Hazard Rating: 1 |
| • During dismantlement of the fiberglass-reinforced crates, pieces of crate could fall upon completion of a cut or when the top of the crate is removed. Workers should wear hard hats when working on crates. | |

| M. Pressure Hazards | Hazard Rating: N/A |
|---|---|
| • There are no pressure hazards associated with this technology. | |
| N. Slips/Trips/Falls | Hazard Rating: 1 |
| • Electrical cords should be properly managed during cutting operations.<br>• Work area should be kept clean and organized to eliminate possible tripping hazards. | |
| O. Suspended Loads | Hazard Rating: N/A |
| • Suspended loads are a site-specific hazard and are not part of this technology. | |
| P. Trenching/Excavation | Hazard Rating: N/A |
| • Trenching and excavation are not used for this technology. | |
| **Section 5: Health Hazards** | |
| A. Inhalation | Hazard Rating: 2 |
| Inhalation hazards are highly dependent upon the type of material being cut.<br>• General inhalation hazards associated with woodworking:<br>o Wood dust<br>o Plywood resins<br>• Inhalation hazards associated with the disassembly of fiberglass-reinforced plywood crates:<br>o Fiberglass dust (possible human carcinogen)<br>o Fiberglass resins<br>o Vapors and formaldehyde | |
| B. Skin Absorption | Hazard Rating: 2 |
| Skin absorption is largely based upon the material being cut.<br>• Fiberglass dust causes skin irritation (associated with the disassembly of fiberglass-reinforced plywood crates). | |
| C. Noise | Hazard Rating: 2 |
| A noise assessment should be conducted on-site during actual use of the technology to determine type of hearing protection required.<br>• Excessive noise from tool and cutting operations may cause hearing damage.<br>• Excessive noise from ventilation and filtration system, as well as any noise from nearby operations, may cause hearing damage. | |
| D. Heat Stress/Cold Stress | Hazard Rating: 2 |
| Heat stress is generally site-specific, although there are heat stress issues associated with this tool.<br>• Heat stress can be generated by personal protective equipment such as: Tyvek suits, full-face respirators, and gloves.<br>• Heat from hand tool during extended tool duty time may cause heat stress.<br>• Extended worker duty time could cause heat stress, especially if the worker is working in hot conditions or wearing personal protective equipment. | |
| E. Ergonomics | Hazard Rating: N/A |
| • Hand/arm vibration from the tool may cause nerve damage known as Raynaud's Syndrome.<br>• Static and awkward operating postures may cause pain in the hands and/or arms.<br>• Awkward lifting of tool may cause pain in the hands and/or arms.<br>• Unbalanced weight of saw (weight in front) may cause worker fatigue. | |
| F. Ionizing Radiation | Hazard Rating: N/A |
| • Ionizing radiation is site-specific. | |
| G. Non-ionizing Radiation | Hazard Rating: N/A |
| • Non-ionizing radiation is site-specific. | |

| H. Biological Hazards | Hazard Rating: N/A |
|---|---|
| • There are no biological hazards associated with this technology. | |
| I. Other | Hazard Rating: N/A |
| • None | |

**Section 6: Phase Analysis**

A. Construction/Start-up

- Identify hazards through a pre-job analysis to determine personal protective equipment required.
- Inspect saw for obvious damage that may cause excessive vibration and potential for electrical shock.
- Select proper blades for each job and mount them properly so that worker fatigue is minimized and the potential for overexertion is reduced.
- Check power cords for proper amperage, frays, and cuts to protect against cuts and abrasions.
- Ensure blades are straight and the teeth are sharp to reduce amount of force needed and to minimize vibration.
- Ensure blades are properly mounted to start work to avoid overextension.

B. Operation

- Maintain proper work position, do not overextend arms.
- Wear proper safety protection for hands (leather-work gloves with rubber grips), eyes, (safety glasses or goggles), and ears (ear plugs or ear muffs), and respiratory protection (depends upon the operation).
- Do not bind the blades between work pieces; do not force tool.
- Change blades only while the tool is not energized and use approved lockout/tagout procedures.
- Use proper amperage power cord and a grounded outlet.

C. Maintenance (Emergency and Routine)

- Check for damage to the saw and frayed cord.
- Perform all maintenance with the power off (unplug saw) and use approved lockout/tagout procedures.
- Conduct maintenance with qualified personnel and use manufacturer's authorized parts.

D. Shutdown (Emergency and Routine)

- Keep blades away from body while shutting down the tool.
- Grip plug and remove from socket (outlet).
- Maintain proper ergonomic position to avoid cuts and abrasions by the blades.

E. Decontamination/Decommissioning

- Use approved decontamination procedures.
- Discard unit using approved procedures.

**Section 7: Worker Protection Measures**

A. Exposure Monitoring

- Noise sampling should be conducted during the actual use of the tool to determine the actual noise levels and the proper personal protective equipment necessary.
- Air sampling should be conducted during the actual use of the tool to determine levels of site-specific contaminants in the air. Nuisance dust is associated with woodcutting and fibers are associated with the cutting of fiberglass-reinforced crates.

B. Worker Training

Worker training should include the following elements:

- Pre-job walk through
- Manufacturer's operating procedures
- Respirator training
- Personal protective equipment to be used
- Hearing conservation program, including the proper use of ear plugs
- Lockout/tagout procedures
- Electrical training
- Recognition of heat stress symptoms
- Recognition of ergonomic issues and symptoms

C. Medical Surveillance

- Audiograms must be administered if the noise levels are above 85 decibels. Workers whose personal noise sample yields results greater than 85 decibels must be placed in a hearing conservation program, which includes audiograms.

D. Engineering Controls

- Retractable lower blade guard would reduce serious injury to worker during shutdown and handling.

E. Administrative Controls

- Worker training
- Controlled duty time of personnel and the equipment

F. Personal Protective Equipment

- Gloves
- Safety glasses or goggles
- Hearing protection
- Any other site-specific equipment

**Section 8: Emergency Preparedness**

- Emergency response procedure should identify how the hazards identified in this TSDS are being addressed. Each worker should be trained and understand how to respond.

**Section 9: Comments, Lessons Learned, and Special Considerations**

- No additional comments, lessons, or special considerations.

## 6.3 Summary of All Saws

During the week of August 13-16, 2001, five saws were tested on specially prepared 4 foot x 4-foot x 8-foot plywood and fiberglass reinforced plywood crates at FIU. The following tables summarize the results of the OENHP evaluation. Table 6.3.1 summarizes the safety features for the saws tested, and table 6.3.2 summarizes the results of noise and dust measurements obtained during these operations.

Table 6.5.1. Comparison of Safety and Health Features for Saws during the Simulation.

| Saw (OENHP #) | Blade Guarding | Power Switch | Thermal Overload | Electrical Cord/Plug | Dust Control |
|---|---|---|---|---|---|
| DeWalt Reciprocating (2001-01-A) | Blade partially exposed at all times | On/off switch | No overload or thermal shutoff | Double insulated cord | No control of dust at point of cut |
| Milwaukee Worm Drive Circular (2001-02-A) | Upper and retractable lower guard | On/off switch | No overload or thermal shutoff | Grounded plug | No control of dust at point of cut |
| Porter-Cable Circular (2001-04-A) | Upper and retractable lower guard | On/off switch | No overload or thermal shutoff | Double insulated cord | Directional discharge away from worker; vacuum attachment for dust collection |
| Evolution 180 Circular (2001-03-A) | Upper guard, chip collector, retractable lower guard | On/off switch | Overload shutoff | Double insulated cord | Metal chip collector |
| Adamant Circular (2001-05-A) | Blades partially exposed at all times | Interlocking on/off switch | Stall overload, and shutoff | Grounded plug | No control of dust at point of cut |

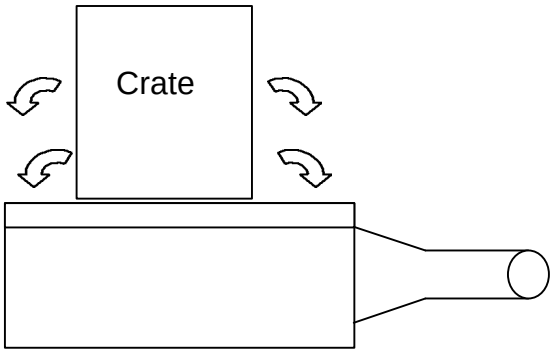
Table 6.5.2. Comparison of Industrial Hygiene Sampling Data from the Simulation.

| Saw | Nuisance Dust ($mg/m^3$) | Fiberglass Dust (f/cc) | Noise TWA - Dosimeter 1 (dBA) | Noise TWA - Dosimeter 2 (dBA) |
|---|---|---|---|---|
| DeWalt Reciprocating | 10.69 | 1.70 | 88.3 | 90.6 |
| Milwaukee Worm Drive Circular | 36.07 | Void[1] | 82.7 | 84.6 |
| Porter-Cable Circular #1 | 3.53 | 12.9 | 77.1 | 78.3 |
| Porter-Cable Circular #2 | 22.05 | Void[1] | 89.7 | 90.0 |
| Evolution 180 Circular | 3.5[2] | 1.74[2] | 69.1 | 68.8[2] / 69.8[3] |
| Average ± Standard Deviation | 15.2 ± 13.9 | 5.5 ± 6.5 | 81.4 ± 8.5 | 80.4 ± 9.7 |
| Coefficient of variation | 91.8 | 118.5 | 10.4 | 12.0 |

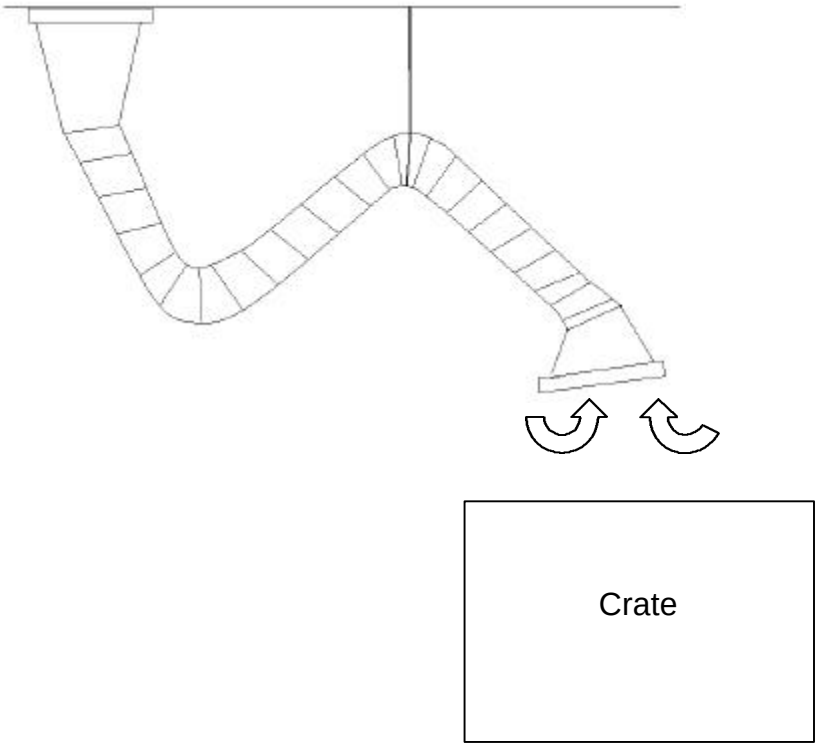
[1] Void: Filter was overloaded – sample could not be analyzed.
[2] Evolution 180 with fiberglass-reinforced plywood crate
[3] Evolution with ¼inch stainless steel only

## 6.4 Figures and Drawings

### 6.4.1 Drawing of a Downdraft Hood




### 6.4.2 Drawing of a Capture Hood



## 6.5 Industrial Hygiene Data

Certificates of Analysis for laboratory data are available upon request via the contact information in the front of this document.

### 6.5.1 Noise Sampling Data

INTERNATIONAL UNION OF OPERATING ENGINEERS
INTERNATIONAL ENVIRONMENTAL TECHNOLOGY AND TRAINING CENTER
1293 Airport Road Beaver, WV 25813
(304) 253-8674 Fax: (304) 253-1384

**Industrial Hygiene Noise Sampling Data: Noise**

| | |
|---|---|
| Project: FIU - Saws | **Calibrator** |
| Address: Hemispheric Center for Environmental Technology | Mfr.: Quest Technologies |
| Florida International University | Model: QC-10 |
| 10555 West Flagler St, CEAS 2100 | Serial No.: QE7030012 |
| C/S/Z: Miami, FL 33174 | Cal. Date: 6/6/2001 |
| Phone: 305-348-2590 Fax: 305-348-6308 | **Instrument** |
| **Sampling Data** | No. 1 |
| Name: | Mfr.: Quest Technologies |
| Job title/description: | Model: 300 |
| | Serial No.: QC 7010089 |
| | Cal. Date: 6/6/2001 |
| | Exchange Rate (3 to 6 dB): |
| | Dose Criterion (80 to 90 dB): |
| PPE Used: full face-piece respirator with G/V cartridges, Tyvek suits, ear plugs, Tyvek suits, gloves | Filter Weighting (A, B, or C): |
| | Response (Slow or Fast): |

**Calibration**

| Pre | | | | | Post | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date (M/D/Y) | Time (24H:M) | Target (dB) | Actual (dB) | Diff. (%) | Date (M/D/Y) | Time (24H:M) | Target (dB) | Actual (dB) | Diff. (%) | 1 |
| 8/13/01 | 11:35 | 114.0 | 113.1 | 0.79 | 8/13/01 | 16:00 | 114.0 | 113.1 | 0.79 | |
| 8/14/01 | 8:10 | 114.0 | 113.1 | 0.79 | 8/15/01 | 8:10 | 114.0 | 113.5 | 0.44 | |
| 8/15/01 | 8:10 | 114.0 | 113.5 | 0.44 | 8/16/01 | 8:05 | 114.0 | 113.1 | 0.79 | |
| 8/16/01 | 8:05 | 114.0 | 113.1 | 0.79 | 8/16/01 | 10:45 | 114.0 | 113.1 | 0.79 | |

**Noise Data and Information**

| Location | Type (P or A) | Date (M/D/Y) | Start (24H:M) | Stop (24H:M) | Time (min) | Lav (dB) | TWA (dB) | Lmax (dB) | Lpk (dB) | 8hr % Dose | 8 hr Proj. % Dose |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | P | 8/13/01 | 13:40 | 15:33 | 113 | 98.0 | 88.3 | 112.1 | 118.6 | 78.83 | 302.20 |
| B | P | 8/14/01 | 9:20 | 9:45 | 25 | 89.4 | 69.1 | 110.9 | 118.4 | 5.55 | 92.60 |
| C | P | 8/14/01 | 10:50 | 11:42 | 52 | 97.9 | 82.7 | 113.7 | 118.5 | 36.66 | 299.20 |
| D | P | 8/15/01 | 13:30 | 13:57 | 27 | 97.7 | 77.1 | 111.0 | 118.4 | 16.73 | 290.00 |
| E | P | 8/16/01 | 8:25 | 9:30 | 65 | 100.3 | 89.7 | 114.7 | 118.6 | 96.02 | 417.00 |

| Location | Description |
|---|---|
| A | DeWalt Reciprocating Saw |
| B | Evolution 180 Saw - used with pump #2 |
| C | Milwakee Saw - used with pump #2 |
| D | Porter Cable Saw #1 - Used with pump #3 |
| E | Porter Cable Saw #2 - Used with pump #3 |

Calibration by: Jeana M. Harrison Signature: Date:
Sampling by: Jeana M. Harrison Signature: Date:

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# Industrial Hygiene Noise Sampling Data: Noise

| | |
|---|---|
| Project: FIU - Saws | **Calibrator** |
| Address: Hemispheric Center for Environmental Technology | Mfr.: Quest Technologies |
| Florida International University | Model: QC-10 |
| 10555 West Flagler St, CEAS 2100 | Serial No.: QE7030012 |
| C/S/Z: Miami, FL 33174 | Cal. Date: 37048 |
| Phone: 305-348-2590 Fax: 305-348-6308 | **Instrument** |
| **Sampling Data** | No. 2 |
| Name: | Mfr.: Quest |
| Job title/description: | Model: 300 |
| | Serial No.: QC 7010093 |
| | Cal. Date: 6/6/2001 |
| | Exchange Rate (3 to 6 dB): |
| | Dose Criterion (80 to 90 dB): |
| PPE Used: full face-piece respirator with G/V cartridges, Tyvek suits, ear plugs, Tyvek suits, gloves | Filter Weighting (A, B, or C): |
| | Response (Slow or Fast): |

## Calibration

| Pre | | | | | Post | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date (M/D/Y) | Time (24H:M) | Target (dB) | Actual (dB) | Diff. (%) | Date (M/D/Y) | Time (24H:M) | Target (dB) | Actual (dB) | Diff. (%) | 2 |
| 8/13/01 | 11:40 | 114.0 | 114.1 | 0.09 | 8/13/01 | 16:00 | 114.0 | 113.4 | 0.53 | |
| 8/14/01 | 8:10 | 114.0 | 113.9 | 0.09 | 8/15/01 | 8:10 | 114.0 | 113.4 | 0.53 | |
| 8/15/01 | 8:10 | 114.0 | 113.4 | 0.53 | 8/16/01 | 8:10 | 114.0 | 113.9 | 0.09 | |
| 8/16/01 | 8:10 | 114.0 | 113.9 | 0.09 | 8/16/01 | 10:55 | 114.0 | 113.9 | 0.09 | |

## Noise Data and Information

| Location | Type (P or A) | Date (M/D/Y) | Start (24H:M) | Stop (24H:M) | Time (min) | Lav (dB) | TWA (dB) | Lmax (dB) | Lpk (dB) | 8hr % Dose | 8 hr Proj. % Dose |
|---|---|---|---|---|---|---|---|---|---|---|---|
| F | P | 8/13/01 | 13:40 | 15:33 | 113 | 100.3 | 90.6 | 113.4 | 119.4 | 109.50 | 420.50 |
| G | P | 8/14/01 | 9:20 | 9:45 | 25 | 89.1 | 68.8 | 110.9 | 119.2 | 53.00 | 88.74 |
| H | P | 8/14/01 | 10:50 | 11:42 | 52 | 100.1 | 84.6 | 115.3 | 119.3 | 47.48 | 403.60 |
| I | P | 8/15/01 | 13:30 | 13:57 | 27 | 99.0 | 78.3 | 111.6 | 119.2 | 19.81 | 350.80 |
| J | P | 8/16/01 | 8:25 | 10:15 | 110 | 100.7 | 90.0 | 115.1 | 119.3 | 100.40 | 442.80 |
| K | P | 8/16/01 | | | 15 | 94.8 | 69.8 | 112.5 | 118.9 | 6.12 | 196.70 |

| Location | Description |
|---|---|
| F | Dewalt Reciprocating Saw |
| G | Evolution 180 with crates - used with pump #3 |
| H | Milwakee - used with pump #3 |
| I | Porter Cable #1 - used with pump #2 |
| J | Porter Cable #2 - used with pump #4 |
| K | Evolution 180 with 1/4" stainless steel |

Calibration by: Jeana M. Harrison Signature: Date:

Sampling by: Jeana M. Harrison Signature: Date:

## 6.5.2 Air Sampling Data

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1293 Airport Road Beaver, WV 25813
(304) 253-8674 Fax: (304) 253-1384

# Industrial Hygiene Air Sampling Data: Information

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Project: FIU - Saws | | | **Contaminant(s) Sampled** | | | | **Media** | | |
| Address: Hemispheric Center for Environmental Technology | | | Dust: Total Dust (nuisance) | | | | Mfr.: SKC | | |
| Florida International University | | | Fume: | | | | Lot No.: 762 | | |
| 10555 West Flagler St, CEAS 2100 | | | Gas: | | | | Cassette: 37 mm | | |
| C/S/Z: Miami, FL 33174 | | | Mist: | | | | Filter: PVC | | |
| Phone: 305-348-2590 Fax: 305-348-6308 | | | Vapor: | | | | Pore size: 5.0 µm | | |
| **Personal Sampling Data** | | | Other: | | | | Face: (O/C) Closed | | |
| Name: | | | Analytical Method: 500 | | | | Tube: NA | | |
| Job title/description: | | | Min: Max: (L/Min) | | | | Treat.: NA | | |
| | | | Date (m/d/y) | Time (H:M) | Temp (°F) | Pres. ("Hg) | RH (%) | | |
| PPE used: full-facepiece respirator with G/V cartridges, ear plugs, Tyveck suits, gloves | | | | | | | | | |
| Ventilation: HEPA vacuum for containment | | | | | | | | | |

| Sample No. | Type P.A.B | Date (M/D/Y) | Instrument Serial No. | Pump No. | Use 24 hour Military Time (24HH:MM) | | | | | | | | Total (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Start | Stop | Start | Stop | Start | Stop | Start | Stop | |
| 111 | P | 8/13/01 | 8575 | 3 | 13:41 | 15:35 | | | | | | | 114 |
| 112 | B | 8/13/01 | | | 14:40 | 15:51 | | | | | | | 71 |
| 113 | P | 8/14/01 | 8575 | 3 | 9:20 | 9:50 | | | | | | | 30 |
| 114 | A | 8/13/01 | 8682 | 2 | 14:40 | 15:51 | | | | | | | 71 |

| | |
|---|---|
| **Sample No.** 111 | Location: Inside Permacon with DeWalt |
| Blank No. 112 | Task: Cutting fiberglass reinforced plywood boxes |
| Comments: | |

| | |
|---|---|
| **Sample No.** 112 | Location: BLANK |
| Blank No. | Task: |
| Comments: | |

| | |
|---|---|
| **Sample No.** 113 | Location: Inside Permacon with Evolution 180 |
| Blank No. | Task: Cutting fiberglass reinforced plywood boxes |
| Comments: | |

| | |
|---|---|
| **Sample No.** 114 | Location: Area outside Permacon; near inlet |
| Blank No. | Task: Cutting fiberglass reinforced plywood boxes |
| Comments: | |

Sampling by: Jeana M. Harrison Signature: Date:
Sampling by: Jeana M. Harrison Signature: Date:

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# Industrial Hygiene Air Sampling Data: Information

Project: FIU - Saws
Address: Hemispheric Center for Environmental Technology
Florida International University
10555 West Flagler St, CEAS 2100
C/S/Z: Miami, FL 33174
Phone: 305-348-2590 Fax: 305-348-6308

**Personal Sampling Data**

Name:
Job title/description:

PPE used: full-facepiece respirator with G/V cartridges, ear plugs, Tyveck suits, gloves
Ventilation: HEPA vacuum for containment

**Contaminant(s) Sampled**

Dust: Total Dust (nuisance)
Fume: 0
Gas: 0
Mist: 0
Vapor: 0
Other: 0
Analytical Method: 500
Min: 0 Max: 0 (L/Min)

**Media**

Mfr.: SKC
Lot No.: 762
Cassette: 37 mm
Filter: PVC
Pore size: 5.0 µm
Face: (O/C) Closed
Tube: NA
Treat.: NA

| Date (m/d/y) | Time (H:M) | Temp (°F) | Pres. (“Hg) | RH (%) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| Sample No. | Type P,A,B | Date (M/D/Y) | Instrument Serial No. | Pump No. | Use 24 hour Military Time (24HH:MM) Start | Stop | Start | Stop | Start | Stop | Start | Stop | Total (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | A | 8/14/01 | 8572 | 4 | 9:20 | 11:47 | | | | | | | 147 |
| 116 | B | 8/14/01 | | | 9:25 | 11:47 | | | | | | | 142 |
| 117 | P | 8/14/01 | 8575 | 3 | 10:50 | 11:48 | | | | | | | 58 |
| 118 | P | 8/15/01 | 8682 | 2 | 13:30 | 13:57 | | | | | | | 27 |

**Sample No.** 115 — Location: Outside Permacon; near inlet
Blank No. — Task: Cutting fiberglass reinforced plywood boxes
Comments:

**Sample No.** 116 — Location: BLANK
Blank No. — Task:
Comments:

**Sample No.** 117 — Location: Inside Permacon with Milwakee
Blank No. 116 — Task: Cutting fiberglass reinforced plywood boxes
Comments: Lost filtration in Permacon for 5 minutes

**Sample No.** 118 — Location: Inside Permacon with Porter Cable #1
Blank No. 119 — Task: Cutting fiberglass reinforced plywood boxes
Comments:

Sampling by: Jeana M. Harrison Signature: Date:
Sampling by: Jeana M. Harrison Signature: Date:

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# Industrial Hygiene Air Sampling Data: Information

Project: FIU - Saws

Address: Hemispheric Center for Environmental Technology
Florida International University
10555 West Flagler St, CEAS 2100
C/S/Z: Miami, FL 33174
Phone: 305-348-2590 Fax: 305-348-6308

**Personal Sampling Data**

Name:
Job title/description:

PPE used: full-facepiece respirator with G/V cartridges, ear plugs, Tyveck suits, gloves
Ventilation: HEPA vacuum for containment

**Contaminant(s) Sampled**

Dust: Total Dust (nuisance)
Fume: 0
Gas: 0
Mist: 0
Vapor: 0
Other: 0
Analytical Method: 500
Min: 0 Max: 0 (L/Min)

**Media**

Mfr.: SKC
Lot No.: 762
Cassette: 37 mm
Filter: PVC
Pore size: 5.0 µm
Face: (O/C) Closed
Tube: NA
Treat.: NA

| Date (m/d/y) | Time (H:M) | Temp (°F) | Pres. ("Hg) | RH (%) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| Sample No. | Type P,A,B | Date (M/D/Y) | Instrument Serial No. | Pump No. | Use 24 hour Military Time (24HH:MM) | | | | | | | | Total (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Start | Stop | Start | Stop | Start | Stop | Start | Stop | |
| 119 | B | 8/15/01 | | | 13:30 | 14:00 | | | | | | | 30 |
| 120 | A | 8/15/01 | 8572 | 4 | 13:35 | 14:00 | | | | | | | 25 |
| 121 | P | 8/16/01 | 8572 | 4 | 8:25 | 9:30 | 9:50 | 10:15 | | | | | 90 |
| 122 | A | 8/16/01 | 8682 | 2 | 8:30 | 10:25 | | | | | | | 115 |

**Sample No.** 119 — Location: BLANK
Blank No. — Task:
Comments:

**Sample No.** 120 — Location: Outside Permacon; near inlet
Blank No. 119 — Task: Cutting fiberglass reinforced plywood boxes
Comments:

**Sample No.** 121 — Location: Inside Permacon with Porter Cable #2
Blank No. 123 — Task: Cutting fiberglass reinforced plywood boxes
Comments:

**Sample No.** 122 — Location: Outside Permacon; near inlet
Blank No. 123 — Task: Cutting fiberglass reinforced plywood boxes
Comments:

Sampling by: Jeana M. Harrison Signature: Date:
Sampling by: Jeana M. Harrison Signature: Date:

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(304) 253-8674 Fax: (304) 253-1384

# Industrial Hygiene Air Sampling Data: Information

| | | | |
|---|---|---|---|
| Project: FIU - Saws | **Contaminant(s) Sampled** | | **Media** |
| Address: Hemispheric Center for Environmental Technology | Dust: Total Dust (nuisance) | | Mfr.: SKC |
| Florida International University | Fume: 0 | | Lot No.: 762 |
| 10555 West Flagler St, CEAS 2100 | Gas: 0 | | Cassette: 37 mm |
| C/S/Z: Miami, FL 33174 | Mist: 0 | | Filter: PVC |
| Phone: 305-348-2590 Fax: 305-348-6308 | Vapor: 0 | | Pore size: 5.0 µm |
| **Personal Sampling Data** | Other: 0 | | Face: (O/C) Closed |
| Name: | Analytical Method: 500 | | Tube: NA |
| Job title/description: | Min: 0 Max: 0 (L/Min) | | Treat.: NA |
| PPE used: full-facepiece respirator with G/V cartridges, ear plugs, Tyveck suits, gloves | Date (m/d/y) | Time (H:M) | Temp (°F) / Pres. ("Hg) / RH (%) |
| Ventilation: HEPA vacuum for containment | | | |

| Sample No. | Type P,A,B | Date (M/D/Y) | Instrument Serial No. | Pump No. | Use 24 hour Military Time (24HH:MM) Start | Stop | Start | Stop | Start | Stop | Start | Stop | Total (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 123 | B | 8/16/01 | | | 8:30 | 10:25 | | | | | | | 115 |
| | | | | | | | | | | | | | 0 |
| | | | | | | | | | | | | | 0 |
| | | | | | | | | | | | | | 0 |

| | |
|---|---|
| **Sample No.** 123 | Location: BLANK |
| Blank No. | Task: |
| Comments: | |

| | |
|---|---|
| **Sample No.** 0 | Location: |
| Blank No. | Task: |
| Comments: | |

| | |
|---|---|
| **Sample No.** 0 | Location: |
| Blank No. | Task: |
| Comments: | |

| | |
|---|---|
| **Sample No.** 0 | Location: |
| Blank No. | Task: |
| Comments: | |

Sampling by: Jeana M. Harrison Signature: Date:
Sampling by: Jeana M. Harrison Signature: Date:

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INTERNATIONAL ENVIRONMENTAL TECHNOLOGY AND TRAINING CENTER
3775 Morgantown Industrial Park Bldg 400, Morgantown, WV 26501
(304) 284-9129 Fax: (304) 284-9130

# Industrial Hygiene Air Sampling Data: Information

| | | | |
|---|---|---|---|
| Project: FIU - Saws | **Contaminant(s) Sampled** | **Media** |
| Address: Hemispheric Center for Environmental Technology | Dust: | Mfr.: Zefon |
| Florida International University | Fume: | Lot No.: 2522 |
| 10555 West Flagler St, CEAS 2100 | Gas: | Cassette: 25 mm |
| C/S/Z: Miami, FL 33174 | Mist: | Filter: MCE |
| Phone: 305-348-2590 Fax: 305-348-6308 | Vapor: | Pore size: 0.8 µm |
| **Personal Sampling Data** | Other: Fiberglass (fiber count) | Face: (O/C) open |
| Name: | Analytical Method: 7400 | Tube: na |
| Job title/description: | Min: 0.5 Max: 16 (L/Min) | Treat.: na |

| Date (m/d/y) | Time (H:M) | Temp (°F) | Pres. ("Hg) | RH (%) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

PPE used: full face-piece respirator with G/V cartridges, ear plugs, Tyvek suits, gloves

Ventilation: HEPA vacuum for containment

| Sample No. | Type P,A,B | Date (M/D/Y) | Instrument Serial No. | Pump No. | Use 24 hour Military Time (24HH:MM) Start | Stop | Start | Stop | Start | Stop | Start | Stop | Total (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B176962 | P | 8/13/01 | 8572 | 4 | 13:40 | 15:33 | | | | | | | 113 |
| B176969 | B | 8/13/01 | | | 14:40 | 15:50 | | | | | | | 70 |
| B177013 | P | 8/14/01 | 8682 | 2 | 9:20 | 9:47 | | | | | | | 27 |
| B176956 | P | 8/14/01 | 8682 | 2 | 10:50 | 11:47 | | | | | | | 57 |

**Sample No.** B176962 — Location: Inside Permacon with DeWalt Reciprocating Saw

Blank No. B176969 — Task:

Comments:

**Sample No.** B176969 — Location: BLANK

Blank No. — Task:

Comments:

**Sample No.** B177013 — Location: Inside Permacon with Evolution 180

Blank No. 177106 — Task:

Comments: Evolution saw began to smoke, therefore use was discontinued

**Sample No.** B176956 — Location: Inside Permacon with Milwakee

Blank No. 177106 — Task:

Comments:

Sampling by: Jeana M. Harrison Signature: Date:

Sampling by: Jeana M. Harrison Signature: Date:

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(304) 253-8674 Fax: (304) 253-1384

# Industrial Hygiene Air Sampling Data: Information

Project: FIU - Saws
Address: Hemispheric Center for Environmental Technology
Florida International University
10555 West Flagler St, CEAS 2100
C/S/Z: Miami, FL 33174
Phone: 305-348-2590 Fax: 305-348-6308

**Personal Sampling Data**

Name:
Job title/description:

PPE used: full face-piece respirator with G/V cartridges, ear plugs, Tyvek suits, gloves
Ventilation: HEPA vacuum for containment

**Contaminant(s) Sampled**

Dust: 0
Fume: 0
Gas: 0
Mist: 0
Vapor: 0
Other: Fiberglass (fiber count)
Analytical Method: 7400
Min: 0.5 Max: 16 (L/Min)

**Media**

Mfr.: Zefon
Lot No.: 2522
Cassette: 25 mm
Filter: MCE
Pore size: 0.8 µm
Face: (O/C) open
Tube: na
Treat.: na

| Date (m/d/y) | Time (H:M) | Temp (°F) | Pres. ("Hg) | RH (%) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| Sample No. | Type P,A,B | Date (M/D/Y) | Instrument Serial No. | Pump No. | Use 24 hour Military Time (24HH:MM) Start | Stop | Start | Stop | Start | Stop | Start | Stop | Total (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B177106 | B | 8/14/01 | | | 9:25 | 11:47 | | | | | | | 142 |
| B176951 | P | 8/15/01 | 8575 | 3 | 13:30 | 13:57 | | | | | | | 27 |
| B177168 | B | 8/15/01 | | | 13:30 | 14:00 | | | | | | | 30 |
| B176997 | P | 8/16/01 | 8575 | 3 | 8:25 | 9:30 | 9:50 | 10:15 | | | | | 90 |

**Sample No.** B177106 — Location: BLANK
Blank No. — Task:
Comments:

**Sample No.** B176951 — Location: Inside Permacon with Porter Cable #1
Blank No. B177168 — Task:
Comments:

**Sample No.** B177168 — Location: BLANK
Blank No. — Task:
Comments:

**Sample No.** B176997 — Location: Inside Permacon with Porter Cable #2
Blank No. B176957 — Task:
Comments:

Sampling by: Jeana M. Harrison Signature: Date:
Sampling by: Jeana M. Harrison Signature: Date:

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# Industrial Hygiene Air Sampling Data: Information

Project: FIU - Saws
Address: Hemispheric Center for Environmental Technology
Florida International University
10555 West Flagler St, CEAS 2100
C/S/Z: Miami, FL 33174
Phone: 305-348-2590 Fax: 305-348-6308

**Personal Sampling Data**
Name:
Job title/description:
PPE used:
Ventilation:

**Contaminant(s) Sampled**
Dust: 0
Fume: 0
Gas: 0
Mist: 0
Vapor: 0
Other: Fiberglass (fiber count)
Analytical Method: 7400
Min: 0.5 Max: 16 (L/Min)

**Media**
Mfr.: Zefon
Lot No.: 2522
Cassette: 25 mm
Filter: MCE
Pore size: 0.8 µm
Face: (O/C) open
Tube: na
Treat.: na

| Date (m/d/y) | Time (H:M) | Temp (°F) | Pres. ("Hg) | RH (%) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| Sample No. | Type P,A,B | Date (M/D/Y) | Instrument Serial No. | Pump No. | Use 24 hour Military Time (24HH:MM) Start | Stop | Start | Stop | Start | Stop | Start | Stop | Total (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B176957 | B | 8/16/01 | | | 8:30 | 10:25 | | | | | | | 115 |
| | | | | | | | | | | | | | 0 |
| | | | | | | | | | | | | | 0 |
| | | | | | | | | | | | | | 0 |

**Sample No.** B176957 — Location: BLANK
Blank No. — Task:
Comments:

**Sample No.** 0 — Location:
Blank No. — Task:
Comments:

**Sample No.** 0 — Location:
Blank No. — Task:
Comments:

**Sample No.** 0 — Location:
Blank No. — Task:
Comments:

Sampling by: Jeana M. Harrison Signature: Date:
Sampling by: Jeana M. Harrison Signature: Date:

## 6.6 Acronym List

| | |
|---|---|
| ACGIH | American Conference of Governmental Industrial Hygienists |
| AIHA | American Industrial Hygiene Association |
| cfm | Cubic feet per minute |
| dBA | Decibels in A-weighted scale |
| DOE | Department of Energy |
| f/cc | Fibers per cubic centimeter |
| FIU | Florida International University |
| HCET | Hemispheric Center for Environmental Technology |
| HEPA | High Efficiency Particulate Air |
| IUOE | International Union of Operating Engineers |
| JHA | Job Hazard Analysis |
| $mg/m^3$ | Milligrams per cubic meter |
| MSDS | Material Safety Data Sheet |
| NETL | National Energy Technology Laboratory |
| NIOSH | National Institute for Occupational Safety and Health |
| NMAM | NIOSH Manual of Analytical Methods |
| OENHP | Operating Engineers National Hazmat Program |
| OSHA | Occupational Safety and Health Administration |
| PEL | Permissible Exposure Limit |
| PPE | Personal protective equipment |
| REL | Recommended Exposure Limit |
| sp. wg. | Static pressure water gauge |
| TLV | Threshold Limit Value |
| TSDS | Technology Safety Data Sheet |
| TWA | Time-weighted average |