NIOSH HEALTH HAZARD EVALUATION REPORT

HETA #2004-0146-2947
Transportation Security Administration-Miami International Airport
Miami, Florida

December 2004

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

PREFACE

The Hazard Evaluation and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (NIOSH) conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health (OSHA) Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employers or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

HETAB also provides, upon request, technical and consultative assistance to federal, state, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease. Mention of company names or products does not constitute endorsement by NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Lisa J. Delaney, Mark Methner, and Randy L. Tubbs of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS). Field assistance was provided by Amee Patel of HETAB. Analytical support was provided by DataChem Laboratories and Ardith Grote of the Division of Applied Research and Technology. Desktop publishing was performed by Shawna Watts. Review and preparation for printing were performed by Ellen Galloway.

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Highlights of the NIOSH Health Hazard Evaluation

Evaluation of exposure to contaminants and noise in the checked bag screening area

In March and June 2004, NIOSH conducted a health hazard evaluation at the Miami International Airport Transportation Security Administration (TSA) baggage screening area. We measured levels of air contaminants and noise in baggage areas during screening.

What NIOSH Did

- We collected air samples for carbon monoxide, oxides of nitrogen, diesel exhausts, and hydrocarbons.
- We measured noise levels.
- We talked with employees about their health concerns and work area.

What NIOSH Found

- All air samples were within recommended levels.
- The noise levels were below OSHA regulations.
- Housekeeping in the ramp area was poor.
- Airline tugs in use at the airport run on several different types of fuel sources.
- Airline employees often leave tugs idling when not in use, causing emissions to build up in the baggage area.

What TSA Managers Can Do

- Improve housekeeping practices.
- Work with airlines to make sure tugs are maintained according to manufacturer's operating procedures.
- Work with airlines to make sure they train employees to turn off tugs when not in use.
- Offer flat spectrum, moderate attenuation hearing protection devices (HPDs).
- Have an annual hearing test program for employees wearing HPDs.
- Encourage screeners to take breaks in passenger areas inside the airport.

What the TSA Employees Can Do

- Wash hands with soap and water or use an alcohol-based hand rub before eating and drinking.
- Take breaks in passenger areas of the airport.

CDC Workplace Safety and Health

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HETA Report # 2004-0146-2947

NIOSH

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Transportation Security Administration
Miami International Airport
Miami, Florida
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SUMMARY

On February 20, 2004, the National Institute for Occupational Safety and Health (NIOSH) received a health hazard evaluation (HHE) request from the Transportation Security Administration (TSA) at the Miami International Airport in Miami, Florida. The HHE request concerned potential health hazards from exposure to contaminants found in exhaust emissions of tug and jet engines and noise from tugs, jets, conveyor systems, and baggage carousels in the checked baggage screening area. Reported health problems included headaches, dizziness, and respiratory distress. An initial site visit was made on March 25, 2004; on June 5-6, 2004, NIOSH investigators conducted area and personal breathing zone (PBZ) air sampling for carbon monoxide (CO), nitrogen dioxide (NO_2), nitric oxide (NO), diesel exhaust particulate (measured as elemental carbon [EC]), and volatile organic compounds (VOCs). Full-shift personal noise monitoring was also conducted.

Concentrations of EC, a surrogate for diesel exhaust, ranged from 5.9 micrograms per cubic meter (µg/m^3) to 19.2 µg/m^3. No evaluation criteria exist for EC alone, although the California Department of Health Services recommends keeping levels below 20 µg/m^3. PBZ concentrations of NO_2 determined using sorbent tubes ranged from <0.1 part per million (ppm) to 0.12 ppm and PBZ concentrations of NO ranged from <0.05 ppm to 0.10 ppm. These results were very similar to the NO_2 results obtained from real-time personal exposure monitors; full-shift time-weighted average (TWA) exposures were all non-detectable and 15-minute short-term exposures ranged from 0.1 ppm to 0.4 ppm. One employee's instantaneous exposure of 4.9 ppm approached the Occupational Safety and Health Administration (OSHA) ceiling limit of 5 ppm.

All personal full-shift TWA exposures for CO ranged from 2 ppm to 7 ppm and 15-minute short-term exposures ranged from 5 ppm to 32 ppm. One employee working at the concourse C International to International (CITI) bag area measured an instantaneous peak exposure of 333 ppm. This employee's TWA and short-term exposure limit (STEL) exposures were 7 ppm and 32 ppm respectively. The employee's exposure to CO exceeded the NIOSH Ceiling limit of 200 ppm.

VOCs were identified via thermal desorption tubes and quantified via charcoal tubes. One thermal desorption sample collected in Ramp A had significantly more VOC's present than any other sample. Only low levels of any contaminants were detected on all other samples. Compounds identified were

isopropanol, benzene, ethyl benzene, xylenes, toluene, isooctane, and trimethyl benzenes. Charcoal tube analysis found low levels of isopropyl alcohol and toluene. Airborne concentrations of benzene, ethyl benzene, xylenes, isooctane, and total hydrocarbons were either not detected or were below the laboratory limit of quantification.

The OSHA Permissible Exposure Limit (PEL) for noise of 90 A-weighted decibels (dBA) and the OSHA Action Level [85 dBA] were not exceeded in any of the 13 dosimeter samples. There were four instances where the 8-hr TWA exposures exceeded the NIOSH criterion, once on Saturday in area F2 and three times on Sunday in the EITI area (1) and at Area 62 (2). OSHA previously performed a noise survey in Area 62 and found 8-hr TWA levels of 88 dBA. These results were not confirmed in the NIOSH evaluation.

The NIOSH investigators determined that a hazard does not exist from exposure to EC, CO, CO_2, NO_2, NO, or VOCs. The sampling results indicate that none of the chemicals were detected at concentrations exceeding occupational exposure limits. Therefore, an inhalation hazard to those compounds did not exist at the time of the NIOSH visit. The measured noise levels found little evidence of a serious noise problem. Recommendations for maintaining the air quality and reducing employees' noise exposures are provided in the Recommendations Section of this report.

Keywords: SIC 4581 (Airports, Flying Fields, and Terminal Services) diesel exhaust, nitrogen dioxide, nitric oxide, carbon monoxide, noise, airport, screeners, TSA, headache, dizziness, respiratory problems

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INTRODUCTION

On February 20, 2004, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Transportation Security Administration (TSA) to conduct a health hazard evaluation (HHE) at the Miami International Airport (MIA) in Miami, Florida. The request specifically asked NIOSH to evaluate health hazards from exposure to contaminants found in the emissions of tug and jet engines and to evaluate the noise levels generated from tugs, jets, conveyor belts, and baggage carousels in the checked baggage screening area. The request indicated that some employees had experienced health problems possibly related to the work environment including headaches, dizziness, and respiratory distress. In response to this request, NIOSH investigators conducted an initial site visit on March 25, 2004. During a follow-up site visit on June 5-6, 2004, NIOSH investigators conducted area and personal breathing zone (PBZ) air sampling for carbon monoxide (CO), nitrogen dioxide (NO_2), nitric oxide (NO), diesel exhaust (measured as elemental carbon [EC]), and volatile organic compounds (VOCs). Full-shift personal noise monitoring was also conducted.

BACKGROUND

MIA is the 15th busiest airport in the United States and ranks 3rd in international passenger travel. MIA serves nearly 29.6 million passengers each year. The terminal includes eight concourses with 107 gates constructed in a horseshoe configuration. There are 52 commercial and commuter airlines currently operating out of the airport.

A current capital improvement program will expand the terminal from 4.7 million square feet to 7.4 million square feet. A new 47-gate linear Concourse A-D terminal (North Terminal Development) is under construction that will extend the existing Concourse D by 1,100 feet west; Concourses B and C will be demolished. This new facility is planned for completion in 2005. Expansion beyond the North Terminal Development focuses on improvements to areas between D and H terminal and the expansion of the terminal area east of H with the development of the South Terminal Program, including Concourse J.

On November 19, 2001, the Aviation and Transportation Security Act (ATSA) [49 CFR[1] Parts 1500 et al.], which established TSA within the Department of Transportation, was signed into law. The law required TSA to hire and train federal security employees to inspect all passengers and property for explosives and incendiaries before boarding and loading onto the airplane. This rulemaking transferred the Federal Aviation Administration rules governing civil aviation security to TSA. A deadline of December 31, 2002, was established for airports and TSA to implement this law.

Approximately 171 full- and part-time screeners are employed by TSA in the bag areas. Full-time employees work an 8-hour shift and part-time employees work a 4-hour shift.

Approximately 80% of all passenger bags are screened in the ramp area. The rest are screened at the passenger terminal level. After passengers check bags at the ticketing counter, a series of conveyor belts deliver bags to the various baggage areas. The conveyor belts deposit bags onto carousels where TSA employees manually load them onto a belt-driven conveyor that routes each bag through an Explosive Detection System (EDS) machine. Some bags may undergo additional testing using an Explosive Trace Detection (ETD) system. After examination the bags are loaded onto carousels or are transported via a conveyor system to airline personnel who transfer the bags to carts attached to tugs. Once this task is complete, tugs transport the bags to the aircraft.

Below the passenger concourse level, TSA baggage screening areas are located throughout the ramp area. The bags screened in each area roughly correspond to the closest airline ticketing counter in the above concourse. For example, screeners working in Bag Area H1, H2, and H3 screen bags for airlines departing from concourse H and G. Sixteen L3 3DX™ 6000 EDS machines are used to screen the majority of bags. Approximately 5% of bags are screened by computed tomography X-ray (CTX) machines. All areas sampled during the NIOSH study utilized the EDS machines. Approximately 15,000 to 30,000 bags are screened by each EDS machine monthly. The baggage area was originally designed as a location for airline employees to pick up and drop off checked passenger bags using ground service tugs. Large personal fans are utilized to cool employees. None of the areas are served by a functioning heating, ventilating, and air-conditioning system.

Each airline is responsible for maintaining and operating its own tugs. The fuel source powering the tugs varies by airline but includes diesel, gasoline, propane, and electric.

In December 2003, the TSA at MIA was inspected by the Department of Labor, Occupational Safety and Health Administration (OSHA). As a result of that inspection, Area 62 ("Big Bertha") was issued a serious citation for failing to provide a continuing, effective hearing conservation program to the employees because of two 8-hour TWA noise dosimeter readings of 88.2 and 88.0 dBA. In response to the OSHA citation, TSA mandated that all employees in Area 62 wear hearing protection devices (HPDs) while working. They requested OSHA, in a letter dated April 19, 2004, allow them to defer instituting a hearing conservation program until the results of this NIOSH HHE were submitted to TSA.

METHODS

Upon receipt of the HHE request, additional information regarding suspected environmental contaminants was obtained from the TSA Occupational Safety and Health manager and local TSA MIA management. During the initial site visit and subsequent telephone conversations with management and employees, the main areas of concern were identified and an environmental monitoring strategy was developed. The monitoring methodology is described below.

On June 5, 2004, air sampling was conducted on the morning shift employees working in Area 62; Area H1, H2, and H3; and Area F1 and F2. Noise monitoring was conducted in Area 62 and F2. On June 6, 2004, air sampling was conducted on the afternoon shift employees working in Ramp A and Concourse C-International to International (CITI). These areas were selected based on high baggage volume in the area, employee and management concerns, and location and design of the baggage area. Noise monitoring was conducted in Area 62, H3, and Concourse E-International to International (EITI).

Diesel Exhaust (Elemental Carbon)

Full-shift PBZ samples for elemental carbon (EC), a surrogate for diesel exhaust particulate, were collected on 37-millimeter quartz fiber filters (closed face) using SKC® AirChek® 2000 sampling pumps. Seven screeners were monitored on June 5, 2004, and six screeners were monitored on June 6, 2004. Flow rates of approximately 2.5 liters per minute (Lpm) were used to obtain the samples. The sampling pumps were calibrated before and after each sampling event against a primary standard (BIOS® Dry-Cal) to verify flow rate. The filters were placed as close as possible to the workers' breathing zone and connected via Tygon® tubing to the sampling pump. Screeners wore the sampling pump and filter for the entire work shift. After collection, the samples were sent to the NIOSH contract laboratory (DataChem, Salt Lake City, Utah) and analyzed in accordance with NIOSH Method 5040.[2] With this technique, a representative punch out of the filter is heated and analyzed with a thermal optical analyzer.

Nitrogen Dioxide (NO_2) and Nitric Oxide (NO)

Full-shift PBZ samples for NO_2 and NO were collected on sorbent tubes containing oxidizer plus a triethanolamine-treated molecular sieve in tandem using SKC® Pocket Pumps®. Five screeners were monitored on June 5, 2004, and seven screeners were monitored on June 6, 2004. One area sample was collected for NO_2 and NO on the second day of sampling. Flow rates of approximately 0.025 Lpm were used to collect the samples. Each sampling pump was calibrated before and after each sampling event against a primary standard (BIOS® Dry Cal) to verify flow rate. The sorbent tubes were placed as close as possible to the workers' breathing zone and connected via Tygon® tubing to the sampling pump. Screeners wore the sampling pump and filter for the entire work shift. After collection, the samples were sent to the NIOSH contract laboratory (DataChem, Salt Lake City, UT) and analyzed in accordance with NIOSH Method 6014. Quantification was achieved via visible absorption spectrophotometry.[2]

In addition to sorbent tube sampling, NO_2 concentrations were measured using the Biosystems Toxilog Ultra, a direct reading instrument equipped with electrochemical sensors that log average exposures, maximum 15-minute short-term exposures, and maximum peak exposures. These instruments were operated in a passive diffusion mode with a 30-second sampling interval. They were clipped to the belt of each worker for personal monitoring and worn for the entire work shift. Three screeners were monitored on each day of sampling. Stored data were downloaded to a laptop computer after sampling. Calibration of these monitors was accomplished before and after sampling according to the manufacturer's specifications.

Carbon Monoxide (CO)

CO exposures were evaluated using two types of instrumentation: the Biosystems Toxilog Ultra and the Q-TRAK Plus indoor air quality monitor model 8552/8554. The Toxilog Ultra is a real-time, data-logging, passive CO monitor that logs average exposures, maximum 15-minute short-term exposures, and maximum peak exposures. These instruments were operated in a passive diffusion mode with a 30-second sampling interval. Eight personal samples were collected on June 5, 2004, and nine personal samples were collected on June 6, 2004. Personal samples were collected by attaching the instrument to the belt of each worker; for area samples the monitor was placed at a fixed location within a designated work area. All monitors operated for the entire work shift.

The Q-TRAK device measures CO in real-time and these measurements were compared with those from the Toxilog Ultras. Instantaneous measurements of CO were taken throughout the baggage area during the work shift. The Q-TRAK was also used to identify sources of the contamination in the area. Instrument calibration for both the Toxilog Ultras and the Q-TRAK was completed according to the manufacturers' recommendations.

Emissions Analyzer

Concentrations of hydrocarbons, CO, oxides of nitrogen, and CO_2 were measured in the exhaust of gas and propane powered tugs using a Ferret 14 Gaslink LT Emissions Analyzer. All measurements were collected while tugs idled. The exhaust of two gas powered tugs (Area 62 and Ramp A) and one propane-powered tug (Ramp A) were measured.

Volatile Organic Compounds (VOCs)

Area air samples that screen for VOCs were collected on both days of sampling. The samples were collected on thermal desorption (TD) tubes attached by Tygon® tubing to SKC® Pocket Pumps® calibrated at a flow rate of 0.05 Lpm. The TD tubes, used for qualitative identification of VOCs, contain three beds of sorbent material: a front layer of Carbopack Y™, a middle layer of Carbopack B™, and a back section of Carboxen 1003™. The TD tubes were analyzed by the NIOSH laboratory in a Perkin-Elmer ATD 400 automatic thermal desorption system. The thermal unit was interfaced directly to an HP5890A gas chromatograph with an HP5970 mass selective detector according to the NIOSH method 2549.[2]

To analyze specific VOCs, (based on the results of the TD samples), full-shift area air samples were collected on charcoal tubes attached by Tygon® tubing to SKC® Pocket Pumps® calibrated at a flow rate of 0.05 Lpm. Charcoal tube samples were collected simultaneously, in a side-by-side configuration, with the TD tubes. The charcoal tubes were sent to DataChem Laboratories, Inc. (Salt Lake City, UT) to be quantitatively analyzed for hydrocarbons of interest (identified on the TD tubes) using a Hewlett-Packard model 5890A gas chromatograph equipped with a flame ionization detector according to NIOSH methods 1300, 1400, 1501, and 1550 with modifications.[2]

Noise

A number of TSA employees were selected to wear noise monitoring devices at the beginning of their work shift on each of the two days of sampling at MIA. Because of the OSHA citation, Area 62 ("Big Bertha") was emphasized in the NIOSH evaluation. However, additional areas were also analyzed for employees' noise exposures, including areas H3, F2, and EITI. The meters were worn for the entire work shift, through lunch and breaks. The meters were removed at the end of the shift. Area noise measurements were taken throughout Area 62 while TSA employees were screening baggage. The analyzer was placed on a tripod with the microphone located at ear level for a standing employee.

Quest® Electronics Model Q-300 Noise Dosimeters were used to collect the daily noise exposure measurements from the employees that had volunteered to be in the NIOSH evaluation. The dosimeter was secured on the worker's belt and the dosimeter's microphone attached to their shirt, halfway between the collar and the point of their shoulder. A windscreen provided by the manufacturer of the dosimeter was placed over the microphone during recordings. The noise information was downloaded to a personal computer for interpretation with QuestSuite® Professional computer software and the dosimeters reset for the next day. The dosimeters were calibrated before and after the work shift according to the manufacturer's instructions.

The spectral area noise measurements were made with a Larson-Davis Laboratory Model 2800 Real-Time Analyzer and a Larson-Davis Laboratory Model 2559 ½" random incidence response microphone. The analyzer allows for the analysis of noise into its spectral components in a real-time mode. The ½"-diameter microphone has a frequency response range (± 2 decibels [dB]) from 4 Hertz (Hz) to 21 kilohertz (kHz) that allows for the analysis of sounds in the region of concern. One-third octave bands consisting of center frequencies from 25 Hz to 20 kHz were integrated for 30 seconds and stored in the analyzer for later analysis.

EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for the assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects even though their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy). In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increases the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: (1) NIOSH Recommended Exposure Limits (RELs),[3] (2) the American Conference of Governmental Industrial Hygienists' (ACGIH®) Threshold Limit Values (TLVs®),[4] and (3) the U.S. Department of Labor, OSHA Permissible Exposure Limits (PELs).[5] Employers are encouraged to follow the OSHA limits, the NIOSH RELs, the ACGIH TLVs, or whichever are the more protective criteria.

OSHA requires an employer to furnish employees a place of employment that is free from recognized hazards that are causing or are likely to cause death or serious physical harm [Occupational Safety and Health Act of 1970, Public Law 91–596, sec. 5(a)(1)]. Thus, employers should understand that not all hazardous chemicals have specific OSHA exposure limits such as PELs and short-term exposure limits (STELs). An employer is still required by OSHA to protect their employees from hazards, even in the absence of a specific OSHA PEL.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended STEL or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from higher exposures over the short term.

Diesel Exhaust (Elemental Carbon)

Diesel engines function by combusting liquid fuel without spark ignition. Air is compressed in the combustion chamber, fuel is introduced, and ignition is accomplished by the heat of compression. The emissions from diesel engines consist of a complex mixture, including gaseous and particulate fractions. The composition of the mixture varies greatly with fuel and engine type, load cycle, maintenance, tuning, and exhaust gas treatment. The gaseous constituents include carbon dioxide, CO, NO, NO_2, sulfur dioxide (SO_2), and organic compounds (e.g., ethylene, formaldehyde, methane, benzene, phenol, acrolein, and polynuclear aromatic hydrocarbons).[6,7,8,9] The particulate fraction (soot) is composed of solid carbon cores, produced during the combustion process, which tend to combine to form chains of particles or aggregates, the largest of which are in the respirable range (more than 95% are less than 1 micron in size).[10] Estimates indicate that as many as 18,000 different substances resulting from the combustion process may be adsorbed onto these particulates.[11] The adsorbed material contains 15%**B**65% of the total particulate mass and includes compounds such as polynuclear aromatic hydrocarbons, a number of which are known mutagens and carcinogens.[4,5,12,13]

Many of the individual components of diesel exhaust are known toxins. The following health effects have been associated with some of the components of diesel exhaust: (1) pulmonary irritation from oxides of nitrogen; (2) irritation of the eyes and mucous membranes from SO_2, phenol, sulfuric acid, sulfate aerosols, and acrolein; and (3) cancer in animals from polynuclear aromatic hydrocarbons. Several studies confirm an association between exposure to whole diesel exhaust and lung cancer in rats and mice.[5] Limited epidemiological evidence suggests an association between occupational exposure to diesel exhaust emissions and lung cancer.[14] The agreement of current toxicological and epidemiological evidence led NIOSH in 1988 to recommend that whole diesel exhaust be regarded as a potential occupational carcinogen,@ as defined in OSHA's Cancer Policy (Identification, Classification, and Regulation of Potential Occupational Carcinogens,@ 29 CFR 1990).[5] Accordingly, NIOSH recommends that exposures be controlled to the lowest feasible concentration. Although OSHA and ACGIH have exposure limits for some of the individual components of diesel exhaust (i.e., NO_2, xylene, and CO), exposure limits have not been established for whole diesel exhaust. The California Department of Health Services' Hazard Evaluation System & Information Service (HESIS) recommends exposures to diesel exhaust particles (measured as EC) be kept below 20 micrograms per cubic meter ($\mu g/m^3$). This value was based on a risk assessment performed by the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment that determined exposures to diesel particulate over a working lifetime of 20 $\mu g/m^3$ would create an excess lung cancer risk of one in a thousand.[15]

Nitrogen Dioxide (NO_2)

NO_2 gas is an irritant to the mucous membranes and its inhalation may cause severe coughing, which can be accompanied by mild or transient headache. The following health effects were observed in humans exposed to NO_2 for 60 minutes: at 100 parts per million (ppm), pulmonary edema and death; at 50 ppm, pulmonary edema, with possible subacute or chronic lesions in the lungs; and, at 25 ppm, respiratory irritation and chest pain.[16,17] The effects of chronic low concentration exposures are not well characterized in humans. NO_2 would be expected to have an irritant effect upon the general mucosal surfaces and on the lower respiratory tract.[16] Chronic exposures to 0.2 ppm with daily excursions to 0.8 ppm in mice were shown to cause decreased pulmonary function. NO_2 has not been shown to have teratogenic, mutagenic, or directly carcinogenic effects.[17] The NIOSH REL for NO_2 is 1 ppm as a 15-minute STEL.[3] The OSHA ceiling concentration is 5 ppm.[5] The ACGIH TLV-TWA is 3 ppm and the TLV-STEL is 5 ppm.[4]

Nitric Oxide (NO)

NO is a colorless gas that converts spontaneously in air to NO_2. The oxidation rate occurs more rapidly at higher NO concentrations.[18] Therefore, it is difficult to identify the effects of NO exposures without considering the concomitant effects of NO_2. NO is a component of photochemical smog with ambient air concentrations reaching as high as 2.65 ppm.[19] The most common occupational exposures to NO occur when it is formed as a by-product in the preparation of nitrosylcarbonyls and nitric acid, tobacco smoke, and from combustion of propane, diesel, and gasoline engines.[16] In humans exposed to NO between 10 ppm and 40 ppm, significant lung vasodilation effects were observed.[17] A comparative analysis of inhaled and exhaled breath in humans after exposure to NO at concentrations of 5, 1, 0.5, and 0.33 ppm showed 85% to 93% retention in the body.[18]

Animal studies indicate that NO has an affinity for ferrous hemoglobin, which normally transports oxygen in the blood; the two substances react to form nitrosyl hemoglobin, a compound that is incapable of oxygen transport.[18] This toxic action resembles that of carbon monoxide. Exposures to mice to 5000 ppm for 6 to 8 minutes and to 2500 ppm for 12 minutes were lethal.[17]

Both NIOSH and OSHA have established an exposure criterion of 25 ppm for NO.

Carbon Monoxide (CO)

CO is a colorless, odorless, tasteless gas produced by incomplete burning of carbon-containing materials such as gasoline or propane fuel. The initial symptoms of CO poisoning may include headache, dizziness, drowsiness, and nausea with symptoms advancing to vomiting, loss of consciousness, and collapse if prolonged or high exposures are encountered. If the exposure level is high, loss of consciousness may occur without other symptoms. Coma or death may occur if high exposures continue.[4,17,20,21,22,23] The display of symptoms varies widely from individual to individual, and may occur sooner in susceptible individuals such as young or aged people, people with preexisting lung or heart disease, or those living at high altitudes.

The NIOSH REL for CO is 35 ppm for an 8-hour TWA exposure, with a ceiling limit of

200 ppm which should not be exceeded.[20,18] The ACGIH recommends an 8-hour TWA TLV of 25 ppm.[4] The OSHA PEL for CO is 50 ppm for an 8-hour TWA exposure.[5] The immediately dangerous to life or health concentration (IDLH) is 1200 ppm. The IDLH exposure condition poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment.@[24]

Volatile Organic Compounds (VOCs)

VOCs are a large class of organic chemicals (i.e., containing carbon) that have a sufficiently high vapor pressure to allow some of the compound to exist in the gaseous state at room temperature. VOCs are emitted in varying concentrations from numerous indoor sources including carpeting, fabrics, adhesives, resins, solvents, paints, cleaners, waxes, cigarettes, and combustion sources.

Noise

Noise-induced loss of hearing is an irreversible, sensorineural condition that progresses with exposure. Although hearing ability declines with age (presbycusis) in all populations, exposure to noise produces hearing loss greater than that resulting from the natural aging process. This noise-induced loss is caused by damage to nerve cells of the inner ear (cochlea) and, unlike some conductive hearing disorders, cannot be treated medically.[25] While loss of hearing may result from a single exposure to a very brief impulse noise or explosion, such traumatic losses are rare. In most cases, noise-induced hearing loss is insidious. Typically, it begins to develop at 4000 or 6000 Hz (the hearing range is 20 to 20000 Hz) and spreads to lower and higher frequencies. Often, material impairment has occurred before the condition is clearly recognized. Such impairment is usually severe enough to permanently affect a person's ability to hear and understand speech under everyday conditions. Although the primary frequencies of human speech range from 200 to 2000 Hz, research has shown that the consonant sounds, which enable people to distinguish words such as "fish" from "fist," have still higher frequency components.[26]

The A-weighted decibel (dBA) is the preferred unit for measuring sound levels to assess worker noise exposures. The dBA scale is weighted to approximate the sensory response of the human ear to sound frequencies near the threshold of hearing. The decibel unit is dimensionless, and represents the logarithmic relationship of the measured sound pressure level to an arbitrary reference sound pressure (20 micropascals, the normal threshold of human hearing at a frequency of 1000 Hz). Decibel units are used because of the very large range of sound pressure levels which are audible to the human ear. Because the dBA scale is logarithmic, increases of 3 dBA, 10 dBA, and 20 dBA represent a doubling, tenfold increase, and hundredfold increase of sound energy, respectively. Noise exposures expressed in decibels cannot be averaged by taking the simple arithmetic mean.

The OSHA standard for occupational exposure to noise (29 CFR 1910.95)[27] specifies a maximum PEL of 90 dBA for a duration of 8 hours per day. The regulation, in calculating the PEL, uses a 5 dB time/intensity trading relationship, or exchange rate. This means that a person may be exposed to noise levels of 95 dBA for no more than 4 hours, to 100 dBA for 2 hours, etc. Conversely, up to 16 hours exposure to 85 dBA is allowed by this exchange rate. The duration and sound level intensities can be combined in order to calculate a worker's daily noise dose according to the formula:

$$\text{Dose} = 100 \text{ X } (C_1/T_1 + C_2/T_2 + ... + C_n/T_n),$$

where C_n indicates the total time of exposure at a specific noise level and T_n indicates the reference duration for that level as given in Table G-16a of the OSHA noise regulation. During any 24-hour period, a worker is allowed up to 100% of his daily noise dose. Doses greater than 100% are in excess of the OSHA PEL.

The OSHA regulation has an additional action level (AL) of 85 dBA; an employer shall administer a continuing, effective hearing conservation program when the 8-hour TWA value exceeds the AL. The program must include monitoring, employee notification, observation, audiometric testing, hearing protectors, training, and record keeping. All of these requirements are included in 29 CFR 1910.95, paragraphs (c) through (o). Finally, the OSHA noise standard states that when workers are exposed to noise levels in excess of the OSHA PEL of 90 dBA, feasible engineering or administrative controls shall be implemented to reduce the workers' exposure levels.

NIOSH, in its Criteria for a Recommended Standard,[28] and the ACGIH,[4] propose exposure criteria of 85 dBA as a TWA for 8 hours, 5 dB less than the OSHA standard. The criteria also use a more conservative 3 dB time/intensity trading relationship in calculating exposure limits. Thus, a worker can be exposed to 85 dBA for 8 hours, but to no more than 88 dBA for 4 hours or 91 dBA for 2 hours. Twelve-hour exposures have to be 83 dBA or less according to the NIOSH REL.

RESULTS

Air Sampling Results

The results of the air sampling for diesel exhaust (EC) are shown in Table 1. EC results ranged from 5.93 µg/m^3 to 19.2 µg/m^3. The two highest exposures of 19.2 µg/m^3 and 17.8 µg/m^3 occurred in the Ramp A area. Mean concentrations by area are provided in Table 1. The overall mean EC concentration for all areas of the airport was 12.3 µg/m^3 with a standard deviation of 3.7.

PBZ concentrations measured for NO_2 and NO ranged from <0.10 ppm to 0.12 ppm and from <0.05 ppm to 0.10 ppm, respectively. The minimum detectable concentrations (MDCs) for NO_2 and NO were 0.10 ppm and 0.05 ppm, respectively, assuming an average sample volume of 34 liters of air. Full-shift TWA exposures for NO_2 measured using the Toxilog Ultras were all non-detectable and 15-minute short-term exposures ranged from 0.1 ppm to 0.4 ppm. Instantaneous peak concentrations ranged from 0.2 ppm to 4.9 ppm. The results from the Toxilog Ultra sampling for NO_2 are shown in Table 2. The highest NO_2 concentrations as measured by the Toxilog Ultras were from the employee working in the F1 Area. A graph of the instantaneous NO_2 measurements during this employee's shift is shown in Figure 1.

Personal full-shift TWA exposures for CO ranged from 2 ppm to 7 ppm and 15-minute short-term exposures ranged from 5 ppm to 32 ppm. The results from the Toxilog Ultra sampling for CO are shown in Table 3. One employee working in the East Lane of the CITI area had a measured instantaneous peak exposure of 333 ppm at 3:45 p.m. A graph of the instantaneous CO measurements during this employee's shift is shown in Figure 2. The employee's TWA and 15-minute short-term exposures were 7 ppm and 32 ppm, respectively. Full-shift and 15-minute short-term concentrations of CO collected on screeners working in the same and adjacent lanes on the same day were similar; however, their peak exposures were lower. Personal full-shift TWA exposures for CO in the CITI area (excluding the screener with the high peak exposure) ranged from 5 ppm to 6 ppm and 15-minute short-term exposures ranged from 37 ppm to 61 ppm.

Area instantaneous CO samples were collected using the Q-TRAK in various areas within the bag screening operation during both days of sampling. CO concentrations taken in the work areas of employees ranged from 2 ppm to 7.2 ppm. CO concentrations taken near passing tugs or idling tugs ranged from 8.2 ppm to 28 ppm. The results from area Q-TRAK CO sampling are shown in Table 4.

One thermal desorption sample collected in Ramp A had significantly more VOCs present than any other sample. Only low levels of any contaminants were detected on any of the other samples. Compounds identified on the TD tubes for quantitative analysis on the charcoal tubes were isopropanol (IPA), benzene, ethyl benzene, xylenes, toluene, isooctane, and trimethyl benzenes. Full-shift area samples for isopropyl alcohol (0.110 parts per billion [ppb] to 0.350 ppb) and toluene (0.007 ppb to 0.015 ppb) were detected at very low levels. Full-shift area samples for benzene, ethyl benzene, isooctane, xylenes, and total hydrocarbons were detected in trace amounts or were non-detected.

Noise

Several workers were observed wearing HPDs during the two-day survey. All of the baggage screeners in Area 62 were found to have HPDs, with close to 100% of the employees wearing them throughout the work shift. TSA provided Howard Leight® Airsoft® earplugs to employees to meet the mandatory use of HPDs in this area stipulated in the agency's letter to the OSHA area office. A few baggage screeners wore their personal ear muffs instead of the earplugs. In the H3 area, employees were offered Howard Leight® Laser Lite® earplugs. Two or three of the screeners were observed wearing these HPDs during their work shift. Screeners in the EITI area generally had the Airsoft earplugs available for use.

Five TSA baggage screeners wore noise dosimeters on Saturday during their work shift and eight wore dosimeters on Sunday. The employees worked in one of the surveyed areas in the airport (Area 62, F2, H3, or EITI) and they worked on all aspects of screening passenger baggage in their assigned area. The noise exposure results for each individual are shown in Table 5. The Quest dosimeters collect data so that one can directly compare the information with the three different noise criteria used in this survey, the OSHA PEL and AL, and the NIOSH REL. The OSHA criteria use a 90 dBA criterion and 5-dB exchange rate for the PEL and AL. The difference between the two is the threshold level employed, with a 90 dBA threshold for the PEL and an 80 dBA threshold for the AL. The threshold level is the lower limit of noise values included in the calculation of the criteria; values less than the threshold are ignored by the dosimeter. The NIOSH criterion differs from OSHA in that the criterion is 85 dB(A), the threshold is 80 dBA, and it uses a 3-dB exchange rate. The devices calculate the percent daily dose for the time that the meter was accumulating data as well as an extrapolated value for an 8-hr work shift. The data in the table are reported as the percent daily dose for each noise criteria as an 8-hr TWA. The OSHA criteria were never exceeded during the 2 days of the NIOSH survey. There were four instances where the 8-hr TWA exposures exceeded the NIOSH 85 dBA criterion, once on Saturday in area F2 and three times on Sunday in the EITI area (1) and at the Carrousel 62 area (2).

As was noted earlier in this report, OSHA performed a noise survey in Area 62 and found 8-hr TWA levels of 88 dBA. These results were not confirmed in the NIOSH evaluation. The individual readouts from the dosimeters worn by employees in the "Big Bertha" area are shown in Figures 3-10. A noise map of the "Big Bertha" area was made using the area noise measurements collected on June 5 and is shown in Figure 11. All eight of the personal noise measurements fall between 82 and 84 dBA TWA when calculated according to the OSHA AL criterion. The area measurements were also consistently in the 80 – 83 dBA range.

The results of the personal noise exposures for employees in the other three areas surveyed at the airport are shown in Figures 12-16. The 8-hr TWA levels calculated according to the NIOSH REL in the EITI baggage area ranged from 84 to 86 dBA, from 83 to 85 dBA in the H3 area, and at 87 dBA for the one sample collected in the F2 area.

Workplace Observations

Some information from the airlines regarding the year, make, model of tugs; fuel and engine type; preventive maintenance schedules; and emission testing results were not available to the NIOSH researchers. This information was necessary to aid in characterizing a potential source of air contaminants as well as in selecting appropriate sampling methods. American Airlines management reported that all their tugs are gasoline powered and undergo in-house, periodic maintenance checks based on hourly usage. After 300 hours of use (approximately 90 days) the oil and oil filters are changed. After 600–800 hours of use a more extensive check, which includes a check of the wheels, brakes and ignition system (i.e., spark plugs, distributor cap, distributor rotor, and ignition wires) is completed. Based on NIOSH observations during the days of sampling, a combination of gas, diesel, and propane tugs was in operation in the F, H, Carousel 62, and Ramp A areas; gas tugs were in operation in the CITI area; and electric tugs were in operation in the EITI area. A range of concentrations of airborne contaminants was measured in the exhaust of the tugs. Of particular concern, one tug measured concentrations of hydrocarbons and CO of 140 ppm and 130,000 ppm respectively. Tug exhaust measurements are provided in Table 6. Tugs are frequently left idling near TSA screeners while airline employees load and unload bags. Employees reported on the days of our survey that airline employees were more likely than usual to turn off tugs.

Vinyl gloves and HPDs are available to all employees. No formal written hearing protection program or respiratory protection program is in place at the airport for TSA screeners. IPA is the only chemical used by TSA employees; they use it to periodically clean the table tops where manual bag inspection and ETD processing occurs.

Due to security measures and lack of adequate space, employee break areas consisted of tables and chairs located in the bag area next to the EDS machines. Not all bag screening areas are located near restrooms, therefore some employees must return to the terminal to use the restroom. Employees do not have ready access to soap and water to wash before eating. Employees were observed spraying their hands with the IPA in lieu of hand washing with soap and water.

In general, housekeeping in the ramp area was poor. Many areas were cluttered with items that create a trip hazard. Oil leaking from tugs may also cause a slip hazard. Cracks on floors and uneven walking surfaces also create a trip hazard for employees. In addition, empty metal carts pulled by tugs pass over cracks in the concrete floor resulting in “cart bounce,” which creates unnecessary noise. In particular, a large crack in the floor was noted in the tug path in Area H3. Employees also reported a rodent problem in the area.

Baggage screening equipment was installed in a quick manner in order to meet the TSA screening deadline set forth in the ATSA. As a result, some of the screening equipment located a short distance from bag delivery/pick-up carousels requires additional bag lifting and handling by employees. The concrete barricades in the F2 area installed prior to TSA moving in to the area are still up, creating a trip hazard and interfering with work activities. In addition, some EDS areas are located very close to tug traffic paths posing a safety hazard to employees.

DISCUSSION

PBZ concentrations for EC ranged from 5.9 µg/m^3 to 19.2 µg/m^3. The mean concentration for all EC samples collected in the airport was 12.3 µg/m^3. Two employees' exposures of 19.2 µg/m^3 and 17.8 µg/m^3 to diesel exhaust (EC) approached the CA HESIS recommendation of 20 µg/m^3. Both employees worked in the Ramp A area on Sunday afternoon (June 6). Based on the experience of the NIOSH investigators and compared to other NIOSH diesel exhaust studies,[29,30] the measured EC levels are not considered unusually high. The variation in exposures to diesel exhaust is likely due to the presence or absence of diesel powered tugs. Each airline owns and operates its own tugs and the fuel source varies among airlines.

Also, Ramp A and Area 62 were relatively enclosed compared to the F, H, and CITI areas which were open to the tarmac. The lack of natural ventilation may contribute to increased EC concentrations in the area.

PBZ concentrations of NO_2 ranged from <0.1 ppm to 0.12 ppm and PBZ concentrations of NO ranged from <0.05 ppm to 0.10 ppm. Full-shift TWA exposures to NO_2 measured using the Toxilog Ultras were all non-detectable and 15-minute short-term exposures ranged from 0.1 ppm to 0.4 ppm. Instantaneous peak concentrations ranged from 0.2 ppm to 4.9 ppm. One employee's instantaneous exposure of 4.9 ppm (F1 area) approached the OSHA ceiling limit of 5 ppm. The next highest instantaneous exposure of 0.8 ppm was measured in the CITI area.

Personal full-shift TWA exposures to CO ranged from 2 ppm to 7 ppm and 15-minute short-term exposures ranged from 5 ppm to 32 ppm. One employee working in the East Lane of the CITI area had a measured instantaneous peak exposure of 333 ppm at 3:45 pm. This employee's TWA and 15-minute short-term exposures were 7 ppm and 32 ppm respectively. This employee loaded baggage onto the EDS machine during the time of his peak exposure. His work location was closest to the tug driving aisle and airline baggage unloading area. NIOSH investigators did not observe tugs left idling in the CITI area. The employee's exposure to CO exceeded the OSHA ceiling limit of 200 ppm. Full-shift and 15-minute short-term concentrations of CO collected on one screener working in the same lane and 3 screeners working in the adjacent lanes (West Lane) on the same day were similar; however, their peak exposures were lower. Area measurements near passing tugs or idling tugs using the Q-TRAK ranged from 8.2 ppm to 28 ppm. In general, tug exhaust emissions were considered the primary source of CO in the bag screening areas. The high peak exposures were probably associated with employees being in close proximity to a passing or idling tug.

Thermal desorption sampling for hydrocarbons did not identify any unusual compounds. Full-shift area samples for IPA and toluene (the most prominent compounds detected) were well below any occupational exposure limits.

None of the evaluated chemicals were detected at concentrations exceeding occupational exposure limits. This air sampling shows that no inhalational hazard currently exists in the bag areas. However, exposures to tug exhaust emissions could increase if tugs are not properly maintained or if they do not operate under the same conditions found on the day of the NIOSH survey (i.e., tugs were shut off while loading/unloading). The results from the emissions analyzer document that tugs are emitting a variety of contaminant levels which may be a function of both the tug's maintenance frequency and its design. TSA management is working with the airlines to ensure that each airline follows manufacturer-recommended maintenance procedures for the tugs. Recently, airline employees have been instructed to turn off the tug engines when loading/unloading baggage and to follow all speed limit and driving rules in the area. TSA employees reported that airline employees often leave the tugs idling while loading/unloading bags or when exiting the tug for short durations. Leaving the engine running unnecessarily contributes to increased airborne contaminants in the environment.

Some of the baggage areas (F, H, EITI, and CITI) are open to the ramp/tarmac. Depending on the outdoor environmental conditions, the bag screening area can be naturally ventilated by strong winds. Alternatively, calm winds and certain directional wind flows do not provide natural ventilation to these areas.

In this NIOSH evaluation, the Area 62 was not found to be a location where mandatory use of HPDs is warranted when the daily noise exposures are compared to the OSHA criteria. The results from both days of noise sampling did not exceed a 50% noise dose for the employees' 8-hr shift. The short-term area samples collected in the area confirmed noise levels between 80 and 83 dBA. However, two of eight dosimeter samples in the Area 62 did exceed a 100% noise dose when the NIOSH criterion was utilized. Inspection of the dosimeter data shows similar patterns between all surveyed employees as well as across the 2 survey days. On the first day, the results from all four dosimeters (Figures 3-6) show little variation while the screeners are working in this area. The 1-minute noise levels are generally between 80 and 85 dBA. Whenever the employee leaves the area for breaks, the noise drops to 70–75 dBA. A similar pattern was seen on the second day of the survey, but there was more variability in the noise levels measured in the work area. There are also a few 1-minute periods where the noise was measured in excess of 100 dBA which explains why two employees had noise doses in excess of 100% of the NIOSH REL. The break time exposures on the second day were the same as on the first, with noise levels dropping to 70–75 dBA.

The employees' noise exposure patterns in the other surveyed areas are more variable than those measured in the Area 62. The REL 8-hr TWA values were generally in the mid-80 dBA range, with two employees having noise doses greater than 100% in the F2 and EITI baggage areas. In the dosimeter data, the break times in the H3 area do not fall to levels near 70–75 dBA as seen in Area 62 and in the F2 area. In the H3 area, it was observed that the employees do not leave the immediate area when on a break; rather they sit at a table adjacent to the screening machines. Thus, they rarely had noise exposures that fell below 75 dBA. In the EITI area, both employees surveyed have a large amount of time during the work shift when exposure levels are between 85 and 90 dBA.

Noise exposures for 4 of 13 employees exceeded the NIOSH REL. Therefore, the TSA should conduct additional noise exposure analysis to determine whether employees are consistently exposed to these excessive noise levels. If so, TSA should implement a full hearing conservation program as outlined in the NIOSH criteria document.[28] In the interim, employees who wish to wear HPDs while performing their duties should use different devices. When observing the tasks that the baggage screeners must perform during their shift, it was noted that communication between employees is often necessary. Whenever a piece of luggage is opened by TSA, information on the airline's baggage claim ticket has to be relayed to the person operating the EDS for record keeping purposes. Many times, the TSA screeners removed an earplug to help them hear the information. Other times, the screeners performing the inspection carried bags back to the EDS operators so they could see the necessary information. This led to unnecessary carrying or dragging of bags that were often heavy. The HPDs furnished by TSA offer more protection to the employees than is necessary. The Howard Leight plugs have a noise reduction rating (NRR) of 27 and 32 dB.[31] The spectral shape of these earplugs is characterized as having more attenuation at the higher sound frequencies as compared to the lower frequencies. Even after derating the ear plugs to account for the variability in attenuation found in evaluations of HPDs worn in work situations as opposed to the laboratory-derived ratings, these ear plugs provide more than the necessary level of protection.[32] There are HPDs on the market that are characterized as flat spectrum, moderate attenuation devices, sometimes referred to as "musician earplugs."[33] They offer levels of attenuation from 9 – 25 dB and tend to lower sound equally over the entire spectrum. Thus, they do not have the characteristic shape of increasingly higher attenuation of sound in the high frequencies. They function more as a volume control of the sound in the work space, delivering more of the important communication signal to the employee wearing this kind of HPD. If TSA continues to allow baggage screeners to either voluntarily wear HPDs or mandates their use in specific areas at MIA, then NIOSH recommends that whenever employees wear HPDs as part of their job, they should receive medical surveillance in the form of annual audiometric tests to insure that the devices are working properly and the hearing levels of the employees are not changing.[34]

CONCLUSIONS

An inhalational health hazard to tug and aircraft exhaust emissions did not exist at the time of the NIOSH visit. Exposures, however, could increase if tugs are not properly maintained or sit in idle mode for extended periods of time, or if tug traffic increases. Weather conditions may also affect contaminant concentrations in the areas that are open to the tarmac. Even though the contaminant levels were below relevant occupational exposure limits, it is important to continue to work with the airlines to ensure that tugs are maintained according to standard operating procedures (e.g., routine engine tune-ups, oil and oil filter changes). TSA employees and many airline employees share the same work environment and, thus, exposures. Good communication and cooperation with the airlines will help to ensure this is accomplished.

The NIOSH evaluation of the Area 62 failed to confirm the findings of the OSHA inspection conducted earlier. The 8-hr TWA noise doses for employees working at this location never exceeded a 50% dose, the OSHA action level for instituting a hearing conservation program. This conclusion is based on the data collected from eight employees who worked on “Big Bertha” on the morning and afternoon shifts of two different days. Thus, it appears that the mandatory use of HPDs in this area is not warranted.

There were a few instances where the NIOSH REL of 85 dBA for an 8-hr TWA was exceeded during the survey. However, there were other samples from the same area that did not exceed a 100% noise dose. Thus, TSA should plan to conduct additional noise exposure monitoring on its employees at MIA to see if the baggage screeners are consistently subjected to noise levels that could increase their risk of occupational hearing loss.

There were baggage screeners observed during the evaluation who wore HPDs on their own accord. If they feel more comfortable wearing the devices as a way of protecting their hearing, they should not be discouraged from this practice. However, the employees should be offered the flat spectrum, moderately attenuating devices that are available to improve signal-to-noise ratios and thus communication between employees. These employees should also be included in an annual audiometric testing program to make sure that their hearing ability does not deteriorate from year to year.

RECOMMENDATIONS

1. TSA should supply flat spectrum, moderate attenuation HPDs as a choice of protection from the occupational noise for their employees. These devices will offer sufficient attenuation from the exposures measured in the baggage screening areas and help improve communication between employees wearing the devices.

2. For employees who do wear HPDs at MIA, an annual audiometric testing program similar to the requirements set forth in the OSHA hearing conservation regulation should be instituted.[27]

3. Employees working in the H3 screening area should be encouraged to leave the work area during breaks to give their ears a rest and lower their 8-hr TWA noise exposure levels. These employees are near the quieter, cooler passenger area so that little break time would be lost in transit.

4. Housekeeping should be improved in the area. Trash or debris should be thrown away. TSA items should be appropriately stored and free from walkways to avoid trip hazards.

5. Break tables should be cleaned and employees should be encouraged to wash their hands with soap and water or use an alcohol-based hand rub prior to eating or drinking. Employees should be discouraged from using

IPA, provided for surface cleaning, as a substitute for alcohol-based hand rubs.

6. TSA should evaluate the locations of the EDS machines relative to the baggage carousels and airline pickup locations to identify ways to improve work efficiency and to reduce manual lifting and baggage handling.

7. Ensure that tugs are maintained and operated according to standard operating procedures. Good communication and cooperation with the airlines will help to ensure this is accomplished. It may be beneficial to engage both TSA and airline management to work toward the common goal of improving the air quality in the bag area.

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Table 1
TSA - Miami International Airport
Diesel Exhaust (Elemental Carbon) Results
HETA 2004-0146-2947
Miami, Florida
June 5-6, 2004

Employee Location	Sample Duration (min)	Concentration (µg/m^3)	Mean Concentration (µg/m^3) per area
June 5, 2004			
Area 62	430	15.3	11.5
Area 62	418	10.0	
Area 62	413	9.2	
Area H1	432	12.0	10.3
Area H2	426	11.4	
Area H3	441	7.5	
Area F1	398	5.9	N/A
June 6, 2004			
Ramp A	450	19.2	16.4
Ramp A	420	14.0	
Ramp A	444	17.8	
Ramp A	431	14.4	
CITI	456	10.0	11.6
CITI	449	13.1	
All airport average			12.3

µg/m^3 = micrograms per cubic meter
N/A = not applicable
SD = standard deviation

Table 2
TSA - Miami International Airport
Personal Toxilog Ultra Nitrogen Dioxide Results
HETA 2004-0146-2947
Miami, Florida
June 5-6, 2004

Employee Work Location	TWA (ppm)	Short-term exposure (ppm)	Peak (ppm)
June 5, 2004			
F1	0	0.4	4.9
H1	0	0.1	0.5
Area 62	0	0.1	0.3
June 6, 2004			
Ramp A	0	0.1	0.3
Ramp A	0	0.1	0.2
CITI (East Lane)	0	0.2	0.8
NIOSH (STEL)	-	1	
OSHA (C)	-	5	

ppm = parts per million
TWA = Time-Weighted Average = average airborne concentration of a substance during a normal 8- to 10-hour workday
Short-term exposure = 15-minute TWA exposure
Peak = Highest measured concentrations during the work day
NIOSH STEL = National Institute for Occupational Safety and Health Short-Term Exposure Limit
OSHA C = Occupational Safety and Health Administration Ceiling Value that should not be exceeded at anytime

Table 3
TSA - Miami International Airport
Personal Toxilog Ultra Carbon Monoxide Results
HETA 2004-0146-2947
Miami, Florida
June 5-6, 2004

Employee Work Location	TWA (ppm)	STE (ppm)	Peak (ppm)
June 5, 2004			
H1	2	5	10
H2	3	10	40
H3	2	12	98
F2	3	11	38
Area 62	7	23	45
Area 62	7	18	32
Area 62	7	21	37
Area 62	7	18	68
June 6, 2004			
CITI (East Lane)	5	11	37
CITI (East Lane)	7	32	333
CITI (West Lane)	6	13	42
CITI (West Lane)	6	12	37
CITI (West Lane)	6	11	61
Ramp A	6	20	55
Ramp A	5	20	50
Ramp A	5	19	45
Ramp A	6	20	63
NIOSH	REL 35		Ceiling 200
OSHA	PEL 50	-	

ppm = parts per million
TWA = Time-Weighted Average = average airborne concentration of a substance during a normal 8- to 10-hour workday
STE = 15-minute TWA exposure
Peak = Highest measured concentrations during the work day
NIOSH REL = National Institute for Occupational Safety and Health Recommended Exposure Limit
NIOSH C = Ceiling Value that should not be exceeded at anytime
OSHA PEL = Occupational Safety and Health Administration Permissible Exposure Limit

Table 4
TSA-Miami International Airport
Area Q-TRAK Plus Carbon Monoxide Results
HETA 2004-0146-2947
Miami, Florida
June 5-6, 2004

Work Location	Activity Description	Time	CO (ppm)
June 5, 2004			
Area 62	Light tug activity nearby	5:46 a.m.	11
Area 62	Light tug activity nearby	8:10 a.m.	8.2
Area 62	Light tug activity nearby	10:00 a.m.	8.5
H3 Area	TSA break area	11:15 a.m.	3
H1- EDS machine near terminal	Bag Screening	11:23 a.m.	3.6
H1- EDS machine near ramp	Bag Screening	11:24 a.m.	2.6
H2- EDS machine near ramp	Bag Screening	11:25 a.m.	2
H2- EDS machine near terminal	Bag Screening	11:29 a.m.	2.9
F1 EDS machine near terminal	Bag Screening	11:32 a.m.	3.1
F2 EDS machine near ramp	Bag Screening	11:36 a.m.	3
June 6, 2004			
CITI	TSA break area	1:07 p.m.	6.4
CITI (West Lane)	Bag Screening	1:09 p.m.	6.5
CITI (East Lane)	By tug path with no tug activity	1:12 p.m.	6.9
CITI (East Lane)	By tug path with no tug activity	1:14 p.m.	7.2
CITI (West Lane)	Bag Screening	5:27 p.m.	10.2
CITI (West Lane)	Gas powered tug passing by	5:26 p.m.	13.6
CITI	TSA break area	5:29 p.m.	10.5
CITI (West Lane)	Bag Screening	5:30 p.m.	11.3
CITI (West Lane)	Two gas powered tugs nearby	5:40 p.m.	28

ppm = parts per million
EDS = Explosive Detection System
CITI = Concourse C- International to International

Table 5
TSA-Miami International Airport
Personal Noise Dosimeter Data
HETA 2004-0146-2947
Miami, Florida
June 5-6, 2004

Worker Location	Sample Time hh:mm	8-hr PEL % Dose	8-hr AL % Dose	8-hr REL % Dose
June 5, 2004				
Area 62 - #1	07:01	1.7	33.4	60.9
Area 62 - #2	07:05	2.2	33.1	62.2
Area 62 - #3	07:02	4.8	41.4	89.6
Area 62 - #4	06:44	3.1	32.7	66.4
F2	07:04	7.7	30.8	152.3
June 6, 2004				
Area 62 - #5	07:01	11.0	41.6	157.7
Area 62 - #6	07:04	5.5	39.9	88.7
Area 62 - #7	07:00	6.1	39.8	139.2
Area 62 - #8	07:09	4.0	34.3	77.3
H3 - #1	07:47	2.2	22.7	58.3
H3 - #2	07:48	6.9	38.9	98.2
EITI - #1	06:53	9.8	39.2	115.6
EITI - #2	06:57	6.4	31.3	84.6

EITI = Concourse E- International to International

Dosimeter data for TSA employees working at the EDS baggage screening machines. Sampling time is reported as the hours and minutes that the worker wore the device. All percent dose criteria, permissible exposure limit (PEL), action level (AL), and recommended exposure limit (REL), have been extrapolated to an 8-hr time-weighted average for each worker.

Table 6
TSA-Miami International Airport
Tug Emissions Results
HETA 2004-0146-2947
Miami, Florida
June 5-6, 2004

Location	Time	Sample location	Hydrocarbon (ppm)	CO (%)	NOx (ppm)	CO_2 (%)
June 5, 2004						
Area 62	6:40 a.m.	Near gas tug exhaust	95	ND	ND	0.7
Area 62	6:30 a.m.	Ambient air	90	0	0	0
June 6, 2004						
Ramp A	2:00 p.m.	Near gas tug exhaust	26	0.04	52	10.7
Ramp A	2:40 p.m.	Near propane tug exhaust	140	0.13	20	12
Ramp A	6:40 p.m.	Ambient air	70	0	0	0

ppm = parts per million
CO = carbon monoxide
NOx = oxides of nitrogen
CO_2 = carbon dioxide
ND = Non-detected

Figure 1
TSA-Miami International Airport
Instantaneous NO_2 Results for Screener Working in Area F1
HETA 2004-0146-2947
Miami, Florida
June 5, 2004

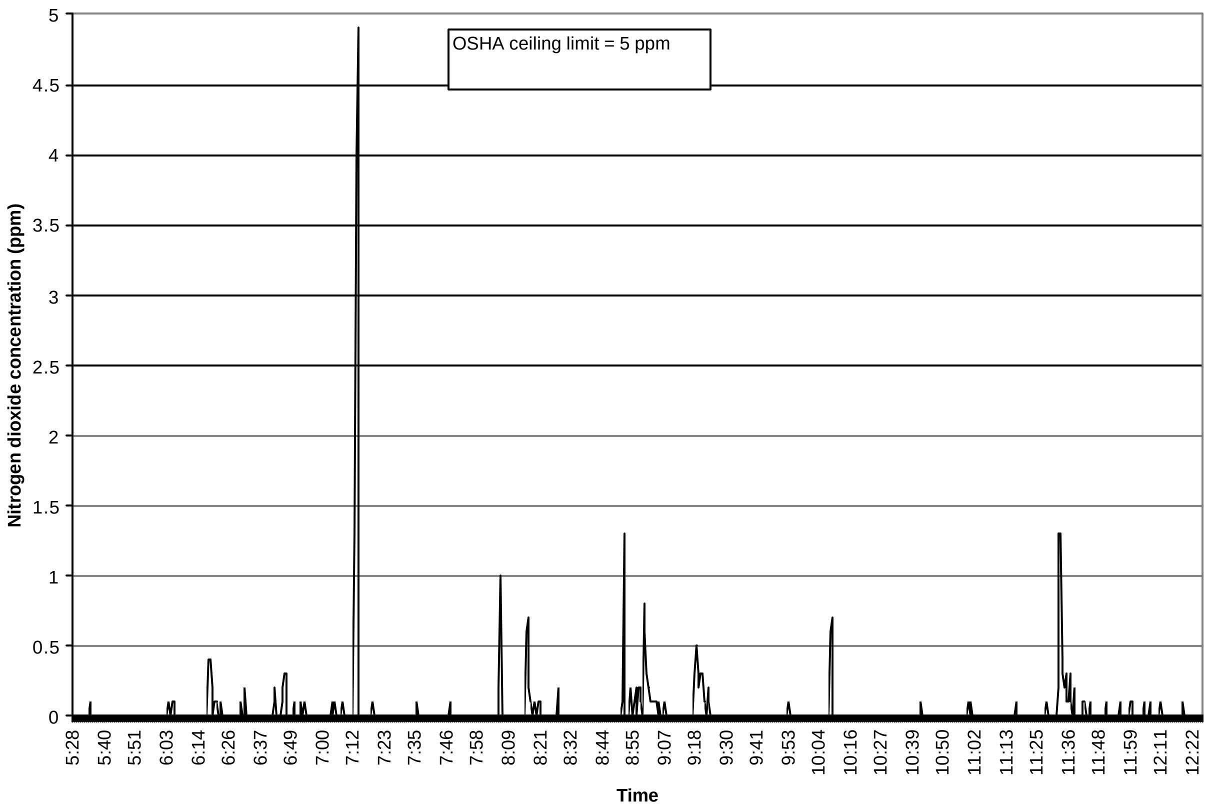


Figure 2
TSA-Miami International Airport
Instantaneous CO Results for Screener Working in CITI
HETA 2004-0146-2947
Miami, Florida
June 6, 2004

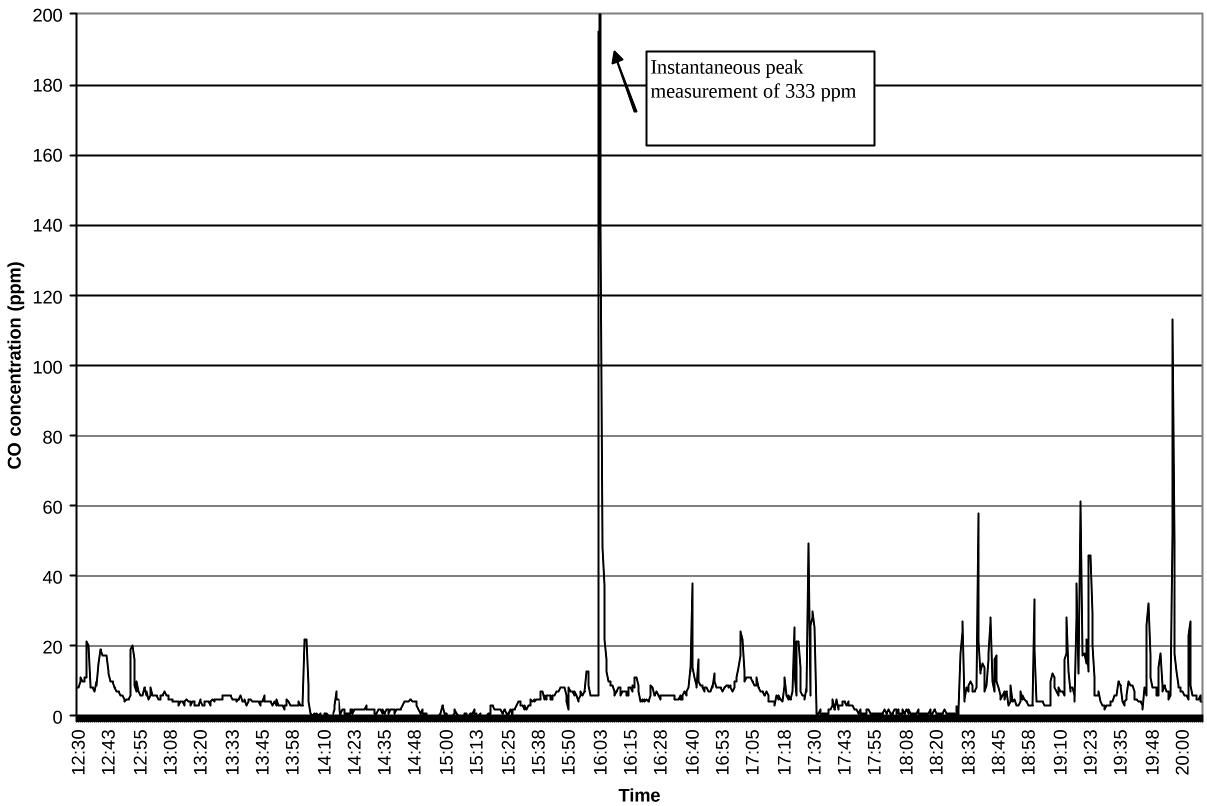


Figure 3
Area 62 Baggage Screener #1
Miami International Airport
HETA 2004-0146
June 5, 2004

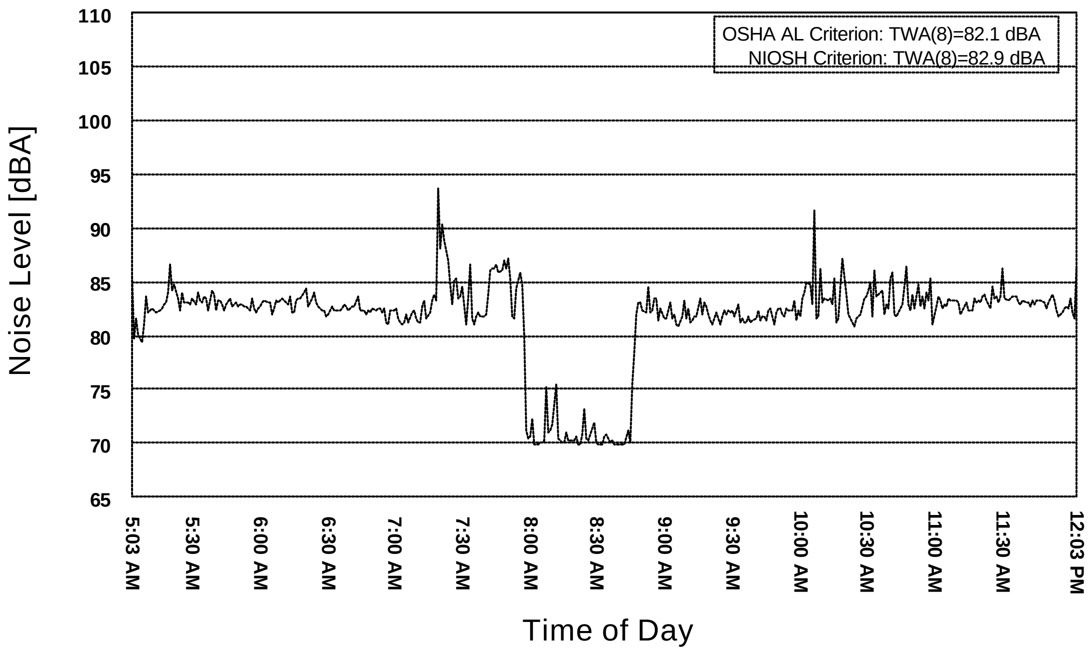


Figure 4
Area 62 Baggage Screener #2
Miami International Airport
HETA 2004-0146
June 5, 2004

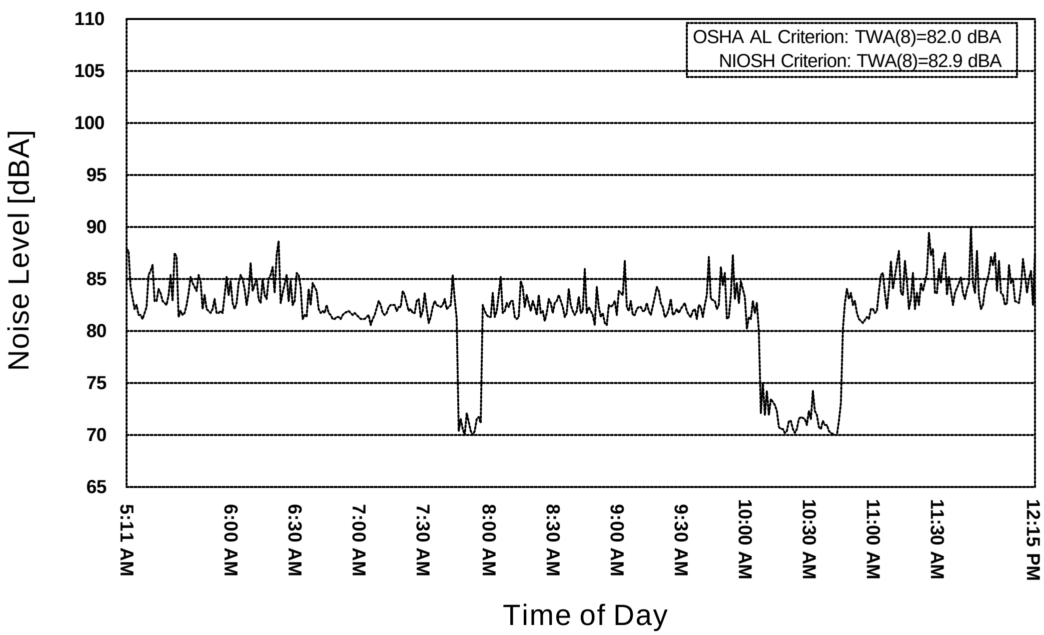


Figure 5
Area 62 Baggage Screener #3
Miami International Airport
HETA 2004-0146
June 5, 2004

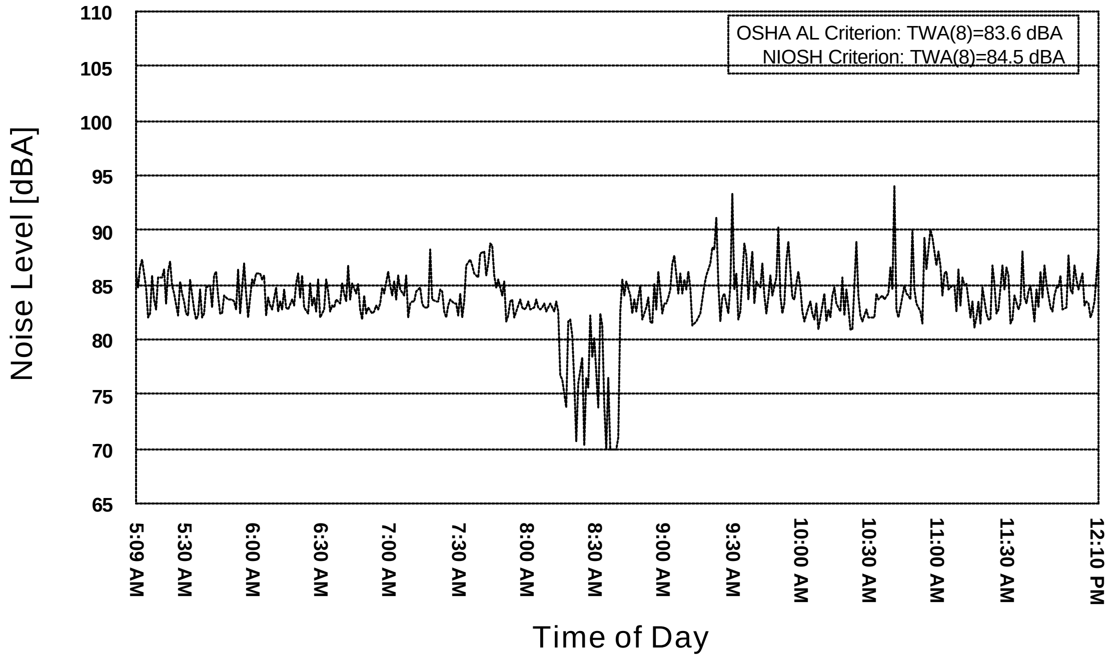


Figure 6
Area 62 Baggage Screener #4
Miami International Airport
HETA 2004-0146
June 5, 2004

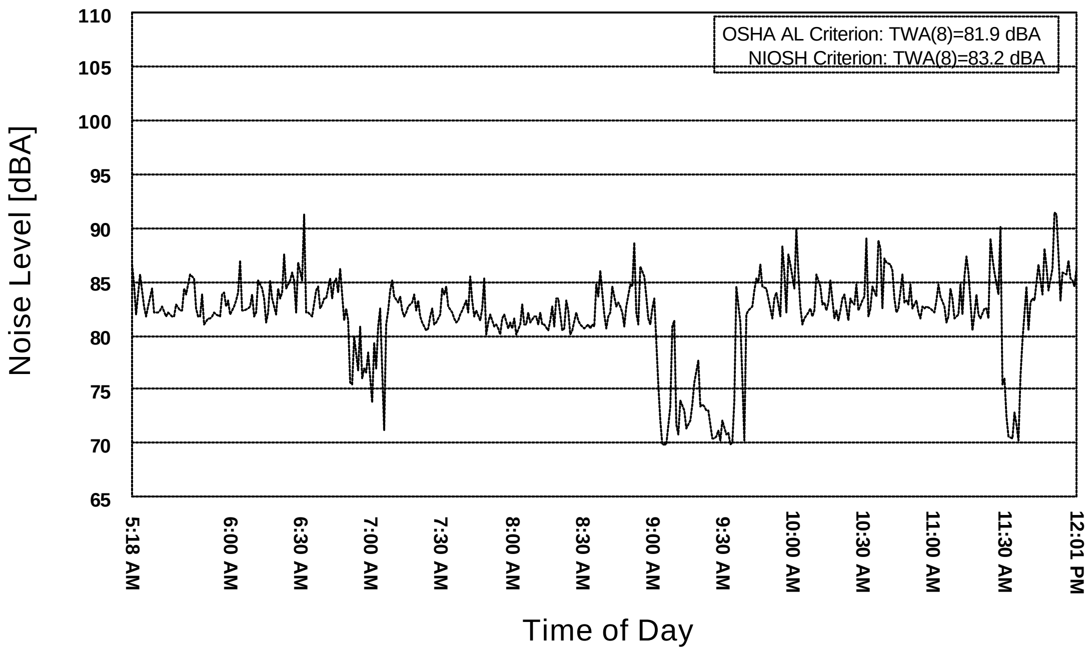


Figure 7
Area 62 Baggage Screener #5
Miami International Airport
HETA 2004-0146
June 6, 2004

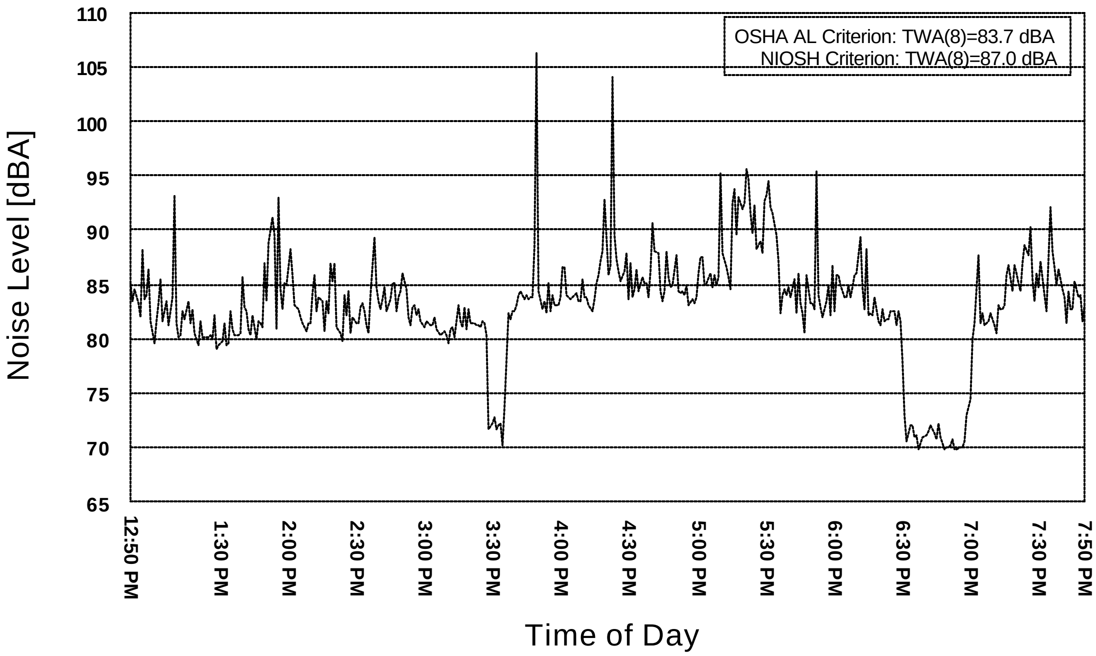


Figure 8
Area 62 Baggage Screener #6
Miami International Airport
HETA 2004-0146
June 6, 2004

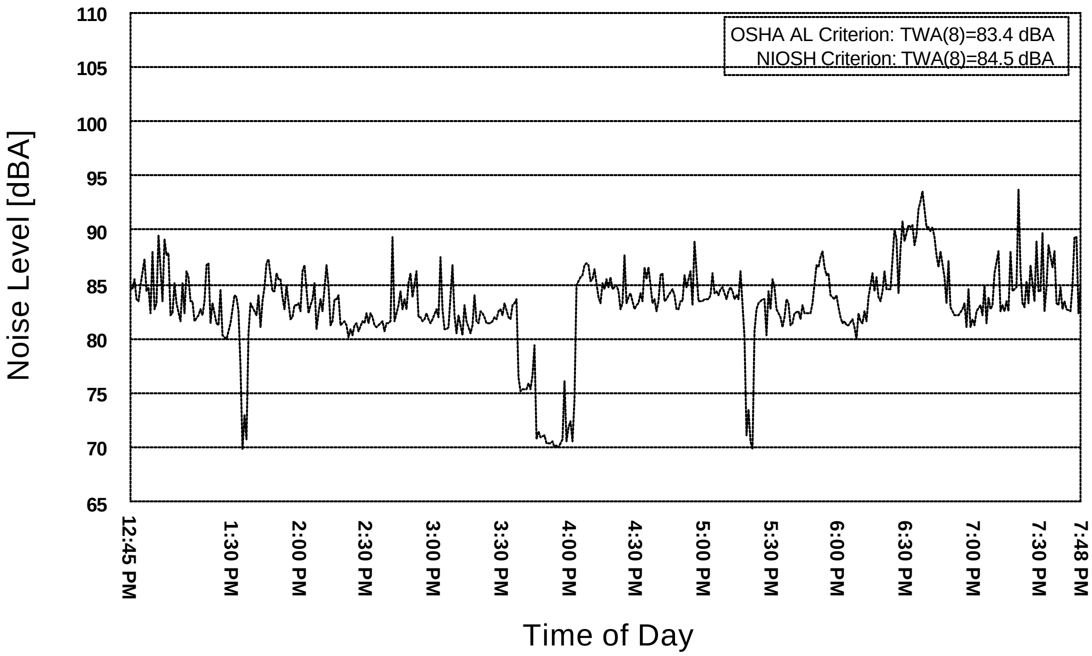


Figure 9
Area 62 Baggage Screener #7
Miami International Airport
HETA 2004-0146
June 6, 2004

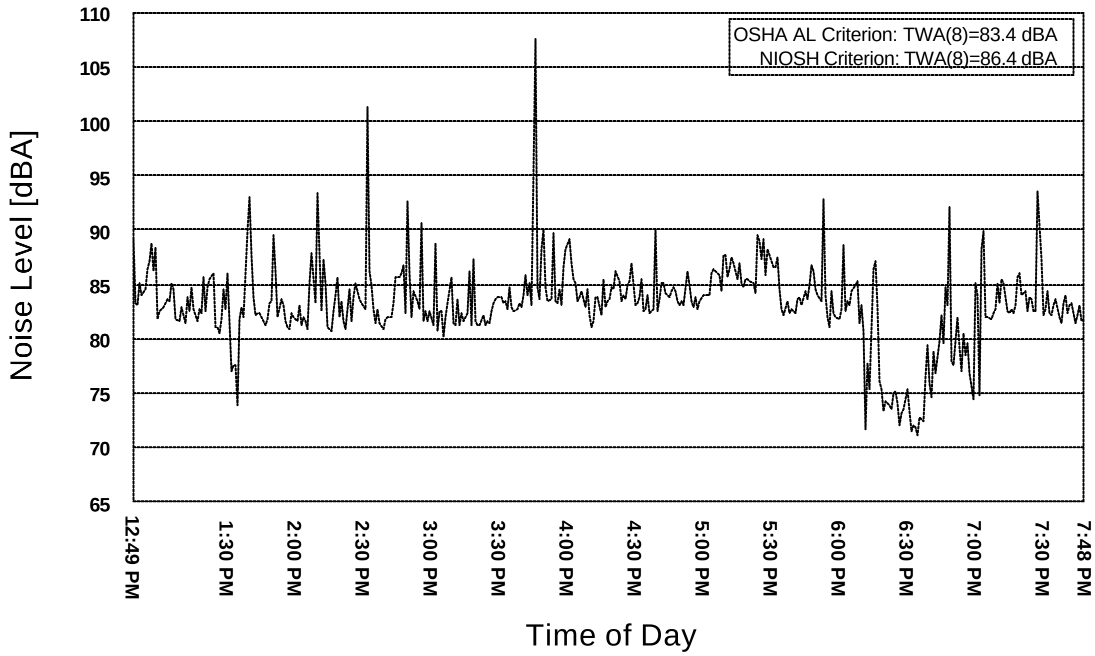


Figure 10
Area 62 Baggage Screener #8
Miami International Airport
HETA 2004-0146
June 6, 2004

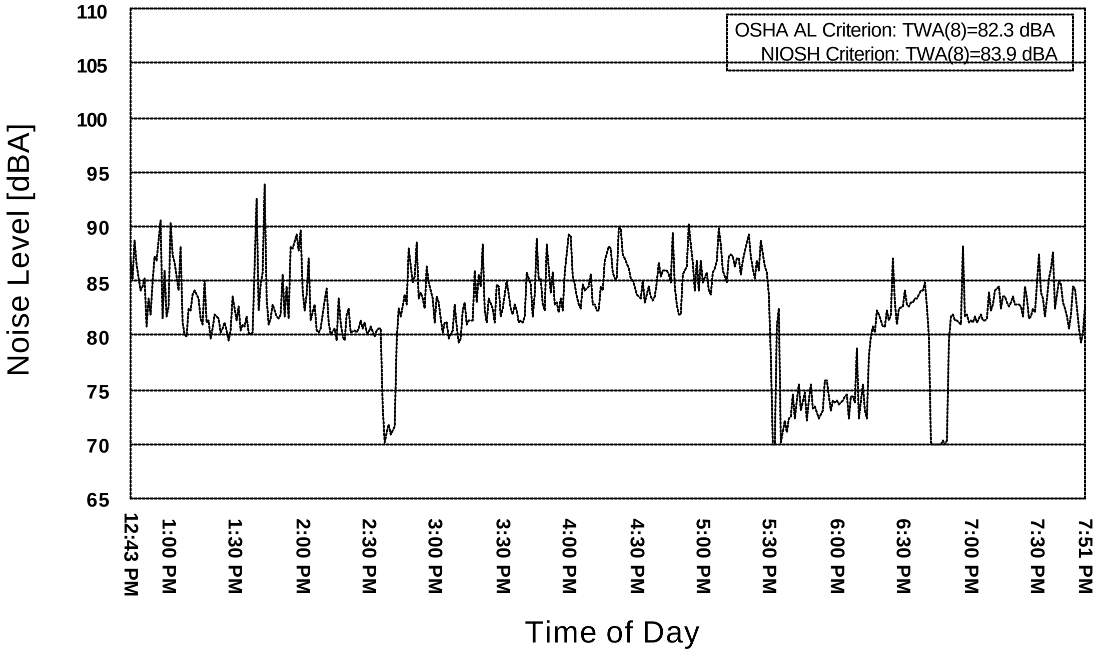
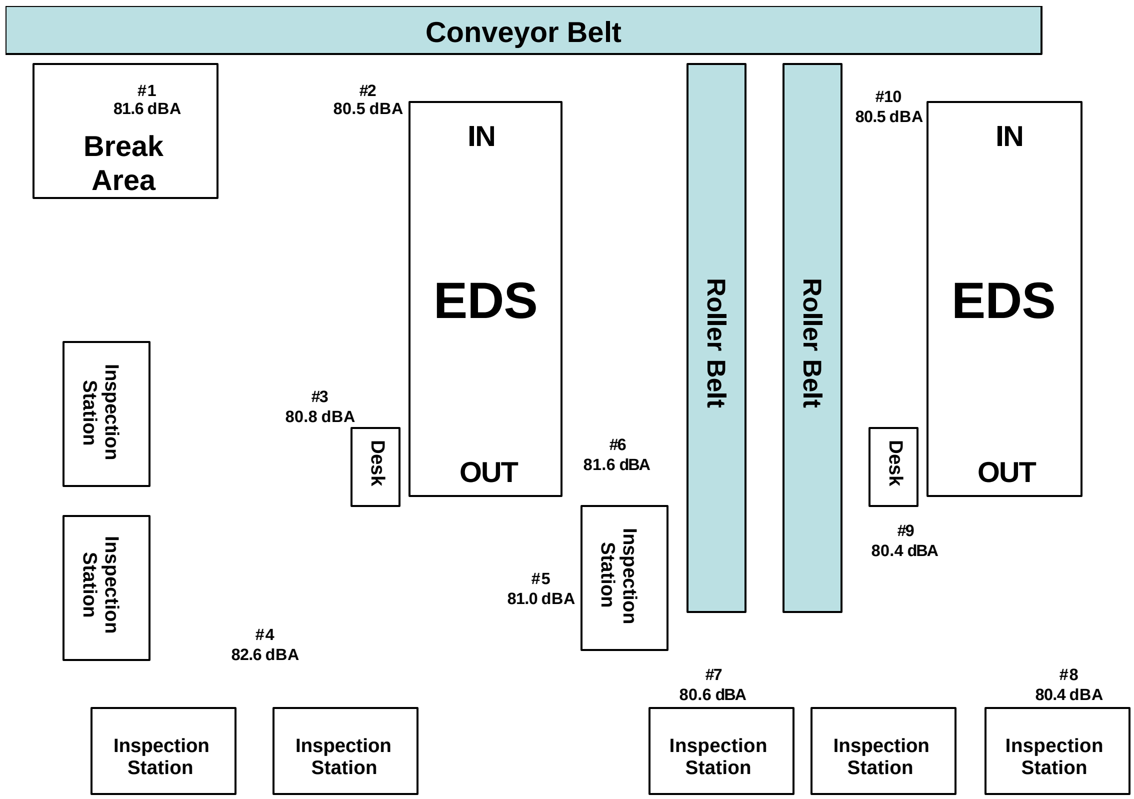


Figure 11
Area 62 (Big Bertha) Noise Map
Miami International Airport
HETA 2004-0146
June 5, 2004



Area noise measurements made in Area 62 (Big Bertha). Thirty-second integrated sound pressure levels were made at each of the 10 locations on the map noted by "#".

Figure 12
Area EITI Baggage Screener #1
Miami International Airport
HETA 2004-0146
June 6, 2004

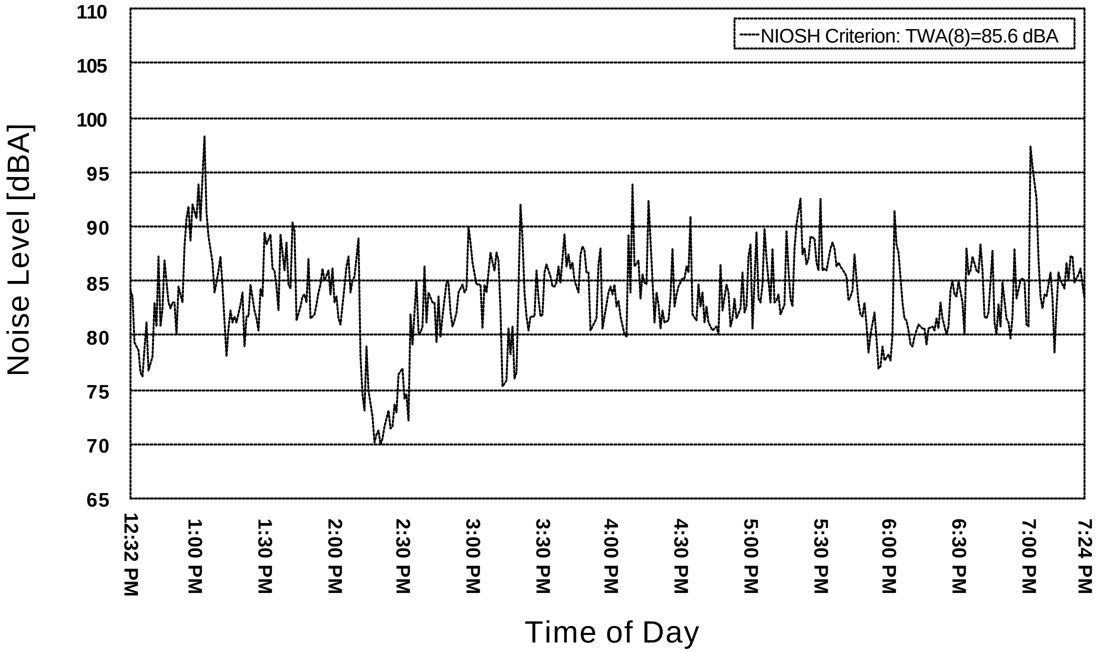


Figure 13
Area EITI Baggage Screener #2
Miami International Airport
HETA 2004-0146
June 6, 2004

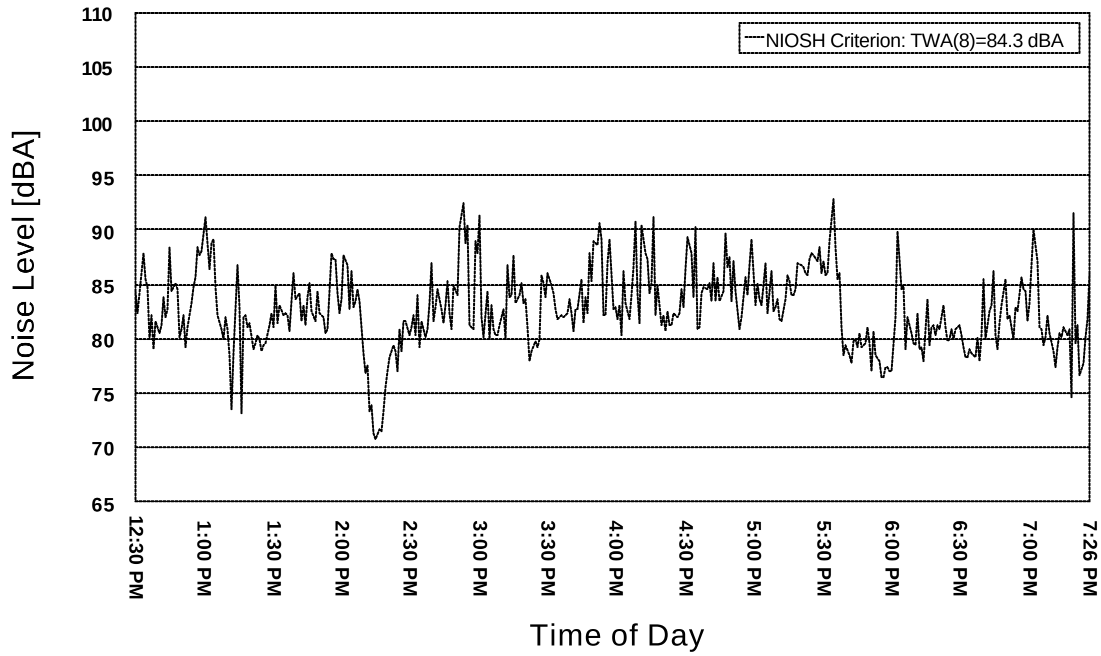


Figure 14
Area H3 Baggage Screener #1
Miami International Airport
HETA 2004-0146
June 6, 2004

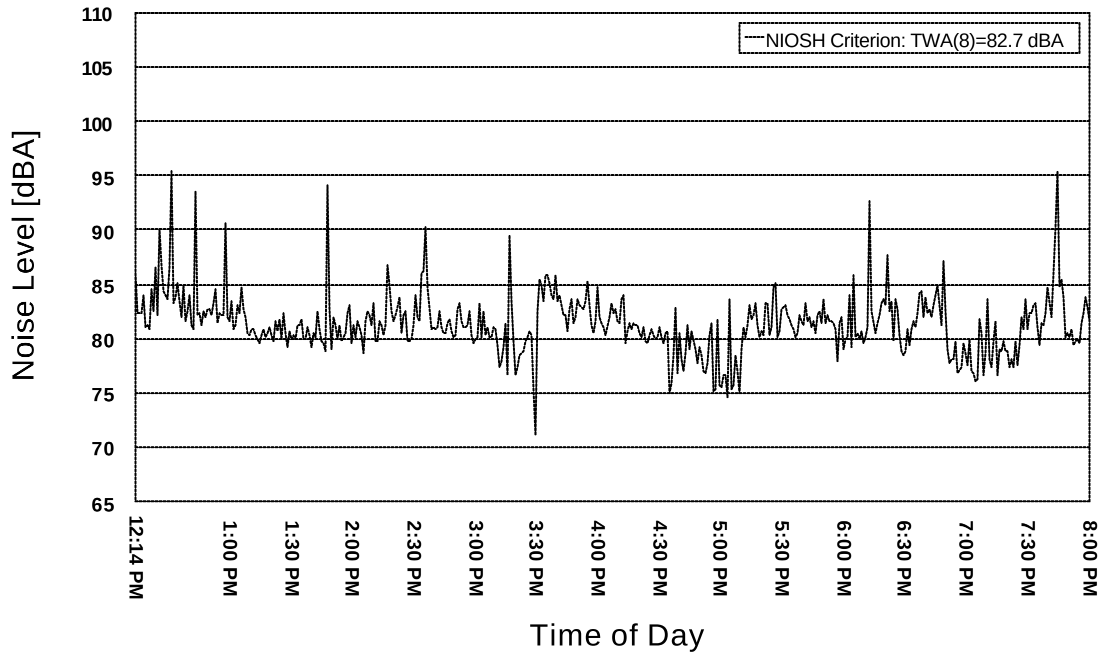


Figure 15
Area H3 Baggage Screener #2
Miami International Airport
HETA 2004-0146
June 6, 2004

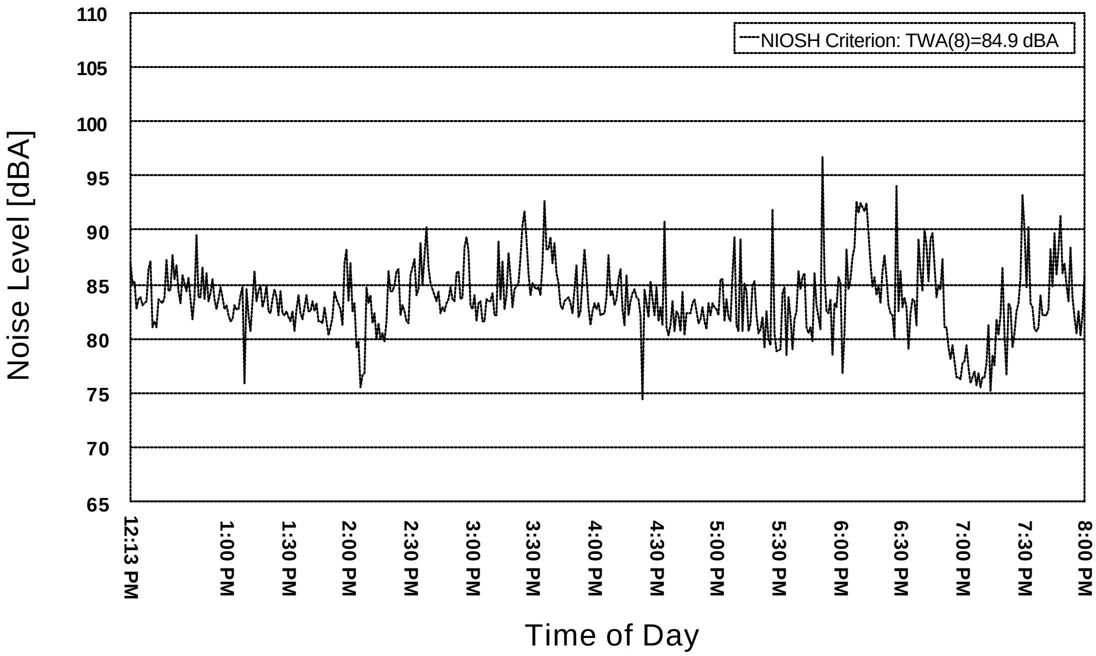
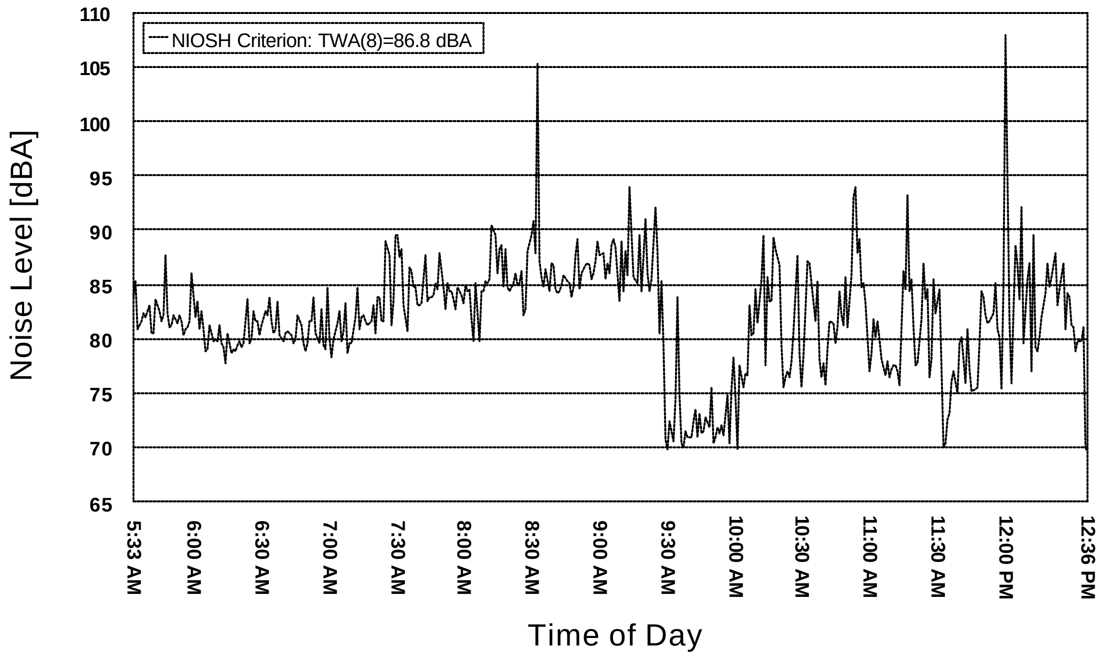


Figure 16
Area F-2 Baggage Screener #1
Miami International Airport
HETA 2004-0146
June 5, 2004



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