

# Task 5: Investigating Air Emission Impacts on the Community

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## Particle Deposition from Airport Activities

Prepared for: **Broward County Aviation Department**

Fort Lauderdale, Florida

November 2006



*~~ Task 5: Particle Deposition from Airport Activity ~~*

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Prepared for

**Broward County Aviation Department**

Ft. Lauderdale, Florida

Prepared by

**Clean Airport Partnership, Inc.**

**Environmental Consulting Group, Inc.**

November 2006

**Final Report**

## **ACKNOWLEDGEMENTS**

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Cover Photo: National Oceanic and Atmospheric Administration Global Monitoring Division photomicrograph of jet engine exhaust particles.

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## ACRONYMS

APU – Auxiliary Power Unit

AQS – Air Quality System

BCAD – Broward County Aviation Department

BCC – Broward County Board of County Commissioners

CAP – Clean Airport Partnership, Inc.

EPA – US Environmental Protection Agency

EDMS – Emissions and Dispersion Modeling System

FAA – US Federal Aviation Administration

FDEP – Florida Department of Environmental Protection

FLL – Ft. Lauderdale-Hollywood International Airport

GSE – Ground Support Equipment

PM – Particulate Matter

SAE – Society of Automotive Engineering

SCAQMD – South Coast Air Quality Management District

SEM – Scanning electron microscope

TPH – Total petroleum hydrocarbons





## 1. Executive Summary

### 1.1. *Introduction*

For several years the citizens of Broward County have periodically complained about experiencing a build up of particulate matter (PM) being deposited on their homes, cars, boats, and lawn furniture. Many residents have identified aircraft operating in and out of Ft. Lauderdale International Airport (FLL) as likely sources of the material.

Studies of PM deposition have been conducted in the past, both at FLL and other airports, but none looked specifically for particles that could be identified as coming directly from aircraft. As a result there has been a lingering concern by some citizens that they are being exposed to potentially harmful PM.

### 1.2. *Purpose and Scope*

The purpose of this project was to look specifically for PM associated with aircraft operations both on and off the airport. Research into previous airport PM studies was conducted to define how PM from aircraft can be identified. Sample collection sites included areas off both ends of the main runway at FLL, residential and public facilities under active flight paths, and a public facility away from most aircraft activity. The collected material was sent to laboratories to analyze visually (using scanning electron microscope) and chemically (using traditional laboratory tools).

### 1.3. *Conclusion*

Results of the analyses found no evidence that aircraft are contributing PM to the material that is the source of community complaints. While there is no doubt that particles are settling out of the air, contaminating buildings and equipment left outside, it is unlikely that a significant portion of the material is coming from aircraft activity. Our research team is recommending that Broward County conduct additional sampling and testing with a goal to determine the composition of the material, potential risks, and the sources of the emissions to the extent possible.

### 1.4. *Report Organization*

Section 2 of this report describes the several previous projects conducted at FLL and other airports that have investigated PM emissions and deposition in local communities. It describes the sampling procedures and analytical

methods used to evaluate the samples and presents the results of the analyses. Finally, the report summarizes the project teams' conclusions and recommendations for additional efforts that may be needed to ease community concerns over PM deposition. The appendices present references used, information about the nature of the complaints received from the community, and shows examples of the photographic evidence that was the primary basis for the report's conclusions.

## 2. Aircraft Operations at FLL

### 2.1. Introduction

Since the 1980's, many residents in the vicinity of FLL have voiced concerns regarding an "oily, filmy" deposit regularly found on cars, furniture, and flat surfaces outdoors. There is also a widespread belief that this pollution is caused by discharge from commercial aircraft. In response to these concerns, both BCAD and the Florida Department of Natural Resources undertook independent studies in 1992 and 1993 respectively, to determine the sources and severity of the pollution. Both studies speculated that the deposition was caused by a mix of urban sources, but reached no conclusion regarding the relative contribution of various sources, the composition of the material, or the relative health risk posed.

To help resolve these questions, CAP proposed to conduct a deposition study to evaluate whether particulate matter from aircraft or other airport activity is the source of oily, filmy deposits that are the cause of community complaints.

CAP's proposed deposition protocol included sampling on the airport proper as well as within the Ft. Lauderdale community. Sampling took place off both ends of the main commercial jet runway (9L/27R) and adjacent to a primary taxiway north of Terminal 1. Community samples were collected in neighborhoods where complaints have been lodged in the past as well as one location away from the airport to serve as a "control" to evaluate deposition from the general urban background.

Several airports have conducted deposition studies in the past, including FLL. In all cases, the results have shown no deposition from aviation sources or have been inconclusive. Several of these projects are described in Section 2.3 and an annotated bibliography in Appendix A provides a reference to the studies reviewed prior to beginning this project. While the findings from these studies may indicate that there is no discernable link between aviation PM sources and any deposited materials, it may also be indicative of the difficulty in sampling and measuring aviation PM.

Research has found that particles emitted from jet engines are very small, in the 0.25-micrometer range (about the size of a bacteria). At this small size, there is virtually no settling of particles and they move freely with the ambient air. Other factors are at work, however, that must also be

considered. Both non-volatile and volatile materials are emitted from jet engines. The non-volatile (solid) particles tend to be black carbon, and the volatile particles (gases that condense as they cool when mixing with ambient air) are unburned or partially burned hydrocarbons and sulfates. The sulfates are produced by the small amounts of sulfur in the fuel. Volatile nitrates have been hypothesized to be present but have not been found in recent research on jet exhaust, however, this issue has not been definitively resolved.

Both the non-volatile particles and the volatile particles agglomerate or “clump” together making larger particles, which could settle out of the air. Particle agglomeration is especially challenging for researchers who are trying to gather jet exhaust samples to analyze without modifying the state in which it exits the engine. Recent research by government and university researchers has confirmed the small size and generally round particles that come from aircraft engines. The photomicrograph on the report cover comes from the National Oceanic and Atmospheric Administration Global Monitoring Division research group.

## **2.2. Particle Emissions from Airports**

Aircraft are the largest fuel consumers at airports and are assumed to be the source of most particle emissions from airports. Aircraft are also visible throughout the community as they arrive and depart from the airport. However, there are other aviation sources of emissions including auxiliary power units (APU) (small power generation turbines on aircraft), ground support equipment (GSE) (e.g., baggage tugs, cargo loaders, aircraft tow tractors), airport construction equipment, and stationary sources at airports such as emergency generators, boilers, and fire training facilities among others. On the basis of fuel burn this equipment is likely to represent a smaller share of particle emissions than aircraft. In addition to these combustion sources, particles also can come from aircraft tires and brake pads.

A source of aviation particle emissions that is often rumored is fuel being dumped from aircraft. Investigations have shown that this is highly unlikely. In the past, fuel dumping was necessary when large aircraft (e.g., DC-10s and B-747s) would have to make an emergency landing immediately after takeoff when their fuel tanks were full. Landing in that condition, the aircraft would exceed its maximum safe landing weight. Few modern aircraft are

faced with this due to improved design. In fact, few modern aircraft even have the capability of dumping fuel. An informal survey of the station managers of the airlines that operate at FLL confirmed that fuel is essentially never dumped. Some airlines still have operating procedures for fuel dumping if the need (and capability) should arise in an emergency and they call for flying offshore to dump the fuel over the ocean, avoiding all inland communities. We surveyed the airline station managers, asked BCAD staff, and looked for FAA reports of fuel dumping and found no evidence that fuel dumping takes place at or near FLL.

There are also numerous sources of particle emissions that are found off the airport in communities such as Ft. Lauderdale. These sources include diesel truck exhaust, automobile exhaust, fungus, pollen, utility or industrial emissions, wind-blown dust and dirt, and sea spray.

### **2.3. Prior Airport Particle Emission Studies**

The CAP team reviewed research into aircraft particle emissions when planning the test protocol prior to beginning data collection on this project. Significant progress in understanding aviation PM emissions has occurred in the past decade. Research in academia on aircraft combustors has evaluated PM composition, size, and mass and the relationship between particles and visible smoke. NASA has conducted several projects to develop and test new measurement and monitoring instruments and testing protocols. FAA has reviewed the body of research on PM emissions from aircraft engines to develop a technique to estimate PM emissions, and the Society of Automotive Engineers (SAE) has evaluated the state of technology for measuring carbon particle emissions from aircraft engines. Several of these research thrusts are currently being advanced to develop and evaluate sampling systems, to characterize the particles, and to understand particle generation in the engine and its further evolution in the exhaust plume. Research is just beginning to explore whether aviation particles have unique impacts on human health and the environment. Databases to make research findings available to scientists and analysts are in the early planning and development stages. These databases will eventually be used in conjunction with sophisticated computer models to assess the extent to which PM emissions from aircraft engines contribute to overall community PM emissions and ambient air quality. Within the next few years these tools should be capable of quantifying PM emissions from FLL activities.

An important consideration in understanding the environmental impacts of aviation PM emissions is appreciating the distinction between non-volatile particles and volatile particles. The non-volatile particles are small carbonaceous particles formed by combustion processes within the engine. The volatile particles are formed by condensation of trace gases after the exhaust leaves the engine. The condensing gases include unburned and partially oxidized fuel, sulfur species from sulfur compounds in the fuel, and engine lubricating oil. Some of the volatile material forms discrete particles while some condenses onto the non-volatile particles. Understanding these processes is crucial in developing the ability to predict the changes in PM mass loading, composition, and size in the ambient atmosphere and the subsequent impacts.

While basic research into aircraft particulate emissions has shown much progress, studies at airports and in communities investigating particle deposition have been less definitive.

A South Coast Air Quality Management District (SCAQMD) study of **Los Angeles International Airport** found brake lining dust, which they attributed primarily to cars since it was highest near the parking lots. They also found soot from bunker fuel, which was assumed to come from ships offshore or in the Ports of Los Angeles or Long Beach.

The Rhode Island Department of Environmental Management began a study last year of small particle emissions in the vicinity of **T.F. Green Airport** in Warwick, RI. They collected particles off both ends of the runway, adjacent to a taxi/idle area on the airport, and in areas where there have been complaints from the nearby community. Preliminary results of their work do not show a direct connection between the particles they are collecting and the airport or any other source. They are typical of the urban environment.

Two studies conducted by **Seattle-Tacoma International Airport** in 1995 collected residue samples from neighborhoods near the airport in response to citizen complaints. The black residue was found to be primarily fungus in addition to smaller amounts of insect particles, minerals, soil, and soot. The soot particle sizes were indicative of wood burning and motor vehicle exhaust rather than aircraft.

Soot assessment studies were conducted at **Boston Logan International Airport** (1997), **Charlotte/Douglas International Airport** (1998), and

**Chicago O'Hare International Airport** (1999). The Logan study concluded that the "community samples contained heavy petroleum hydrocarbons (heavy fuel oil or lubricating oils) not present in jet engine soot or jet fuel; and that the soot deposition in the communities probably came from general urban pollution sources, rather than aircraft sources." The Charlotte and O'Hare studies came to similar conclusions and the particles were more similar to "urban dust reference samples and to exhaust samples from diesel and gasoline-powered motor vehicles" than to aircraft exhaust or jet fuel.

These studies typically collected deposition material and analyzed it for petroleum hydrocarbons and jet fuel. To supplement this approach in our study at FLL, the CAP team chose to look specifically for small carbon particles using a scanning electron microscope as well as conducting chemical analysis for petroleum hydrocarbons and lubricating oils associated with the particles.

During our project research we located some of the first photographs published of known aircraft particulate emissions, which gave us a specific particle shape and size to look for in the material we were collecting. Exhibits 2.1, 2.2, and 2.3 show examples of the published photomicrographs from others' research activities, all at essentially the same scale.



Exhibit 2.1: NOAA ESRL Global Monitoring Division photo from SASS/SNIF III field experiment (photo 1)

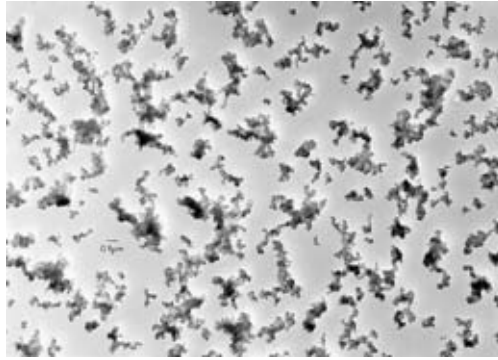


Exhibit 2.2: NOAA ESRL Global Monitoring Division photo from SASS/SNIF III field experiment (photo 2)

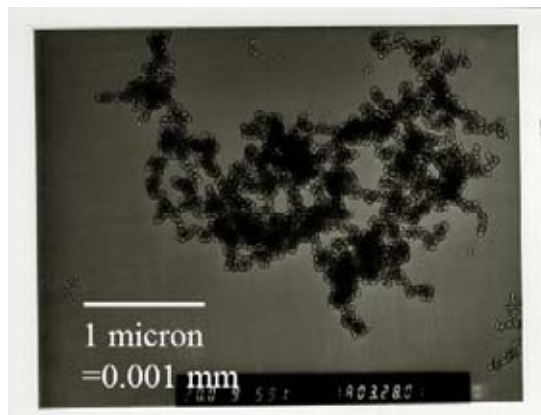


Exhibit 2.3: Fractal soot agglomerate built from "mono-disperse" primary particles, D.J Holve, Process Metrix, proprietary report (figure 1)

As part of our research we also investigated air quality monitoring for small particulates (PM<sub>2.5</sub>) in the vicinity of FLL. Broward County has three monitoring sites that collect small particle data. Information on site location and data for 2005 are presented in Appendix B. Data from prior years is also presented, taken from EPA's AQS pollution database. Also in Appendix B is a report on the largest emitters of toxic chemicals in Broward County, taken from the Scorecard database (see <http://www.scorecard.org>). Many sources of particulate emissions are included in the list.

#### **2.4. Review of Community Deposition Complaints**

Prior to initiating any deposition collection, our team solicited comments from the community about deposition off of the airport. A brief questionnaire was



distributed to several individuals who had mentioned this as a problem in public meetings that discussed airport environmental issues. Six completed questionnaires were returned (see Appendix E).

The Table 2-1 summarizes the responses received on the questionnaires.

## **2.5. Sample Collection Plans and Protocol**

In planning the sample collection, the first step was to develop a sampling protocol. Based on our research we looked for the small spherical particles characteristic of aircraft particles. We also decided to conduct a chemical analysis of the collected materials looking for the unburned hydrocarbons that commonly condense onto the particles' surface. It is difficult, if not impossible, to discern sulfates from aircraft from sulfates from diesel equipment so we decided not to analyze for them. Also the research did not identify any specific marker elements or compounds that are definitive signs of aircraft emissions. Therefore we chose to limit our initial analyses to the visual inspection of the particles and the chemical analysis for hydrocarbons as an indication of aircraft emissions. A copy of our initial protocol is presented in Appendix C.

## **2.6. Data Collection**

Based on research into prior airport studies and our community questionnaire, we collected deposition samples and looked for aircraft soot particles using an electron microscope. We also decided to collect samples both on and off the airport property.

Our focus in selecting sampling sites was to collect deposits from areas predominately exposed to aircraft (and airport) operations, community sites under the flight paths, and areas removed from the airport, to get a "background" sample for typical Ft. Lauderdale urban deposits. Our objective was to compare collected particles and if possible isolate a combination of factors (e.g., particle size and shape and presence of jet fuel) that show the influence of the airport or the lack of influence.

Exhibit 2-4 shows an aerial view of the airport, pinpointing the three sample collection sites on the airport as well as one in an adjacent neighborhood. Exhibit 2-5 shows all sampling sites for the project. These are summarized in Table 2-2.

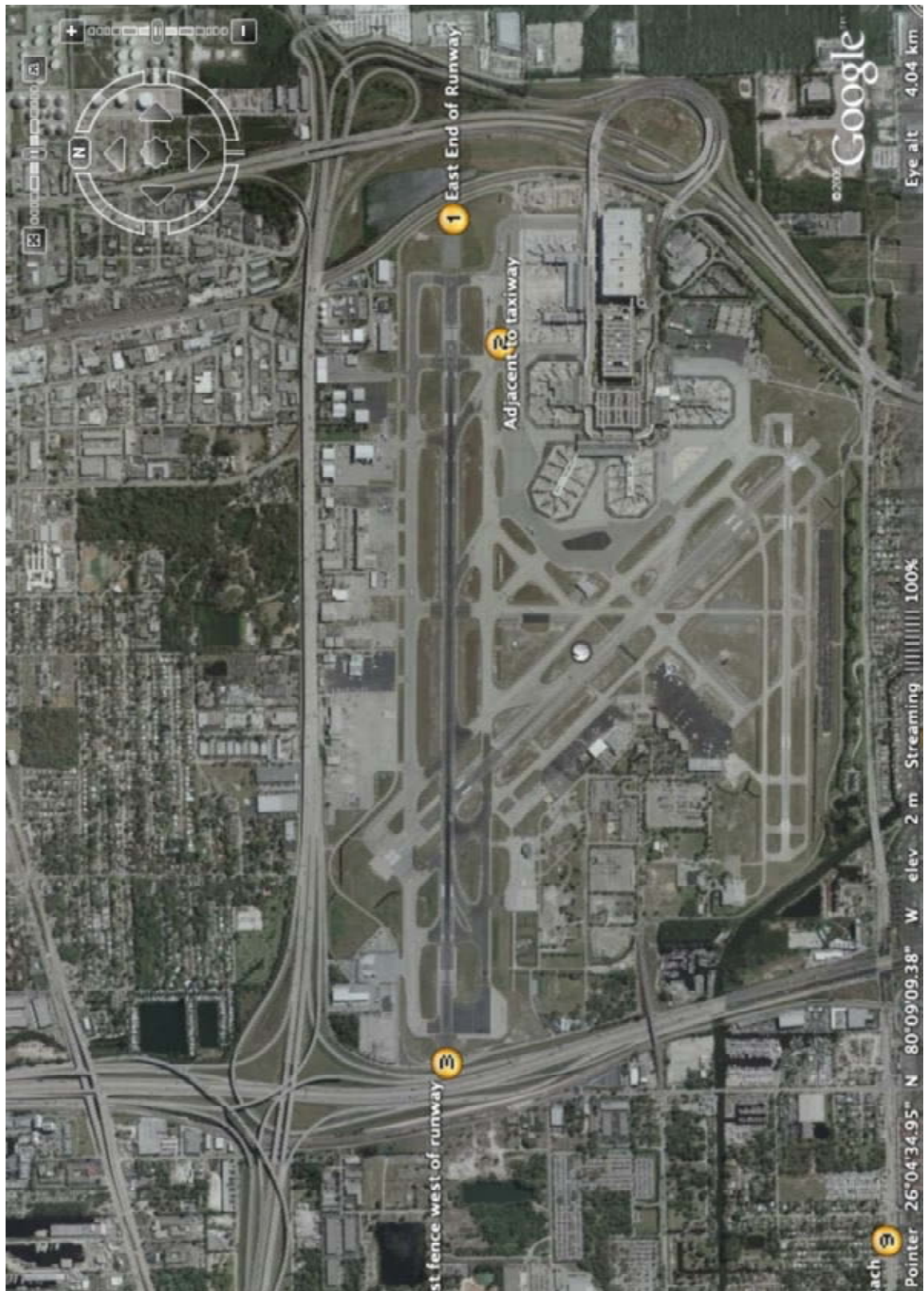


Exhibit 2-4: On-Airport Sampling Sites

**Table 2-1: Responses to Deposition Questionnaire**

<b>Question</b>	<b>Respondent 1</b>	<b>Respondent 2</b>	<b>Respondent 3</b>	<b>Respondent 4</b>	<b>Respondent 5</b>	<b>Respondent 6</b>
<b>What did the deposition look like?</b>	Ground up coal dust	Black soot. Fine grains of black particles	Black deposit with sticky oil feel	Very dark soot	Black soot	Dark grey fine pepper
<b>Did the deposition have a texture or feel?</b>	Like oily coal dust	Soft in nature and smear when rubbed	Similar to household dust but has an oily feel to it	Extraordinarily course and gritty	Light texture	Slightly gritty: finer than sand, grittier than flour
<b>Is it most prevalent during a certain season, day or time</b>	When planes come morning evening and holidays	More noticeable during summer months	Have not tried to determine	When the wind is blowing a certain way	No, it is constant	Have not noticed
<b>Are there situations that you believe cause the deposition to accelerate or diminish?</b>	Wind factor	When we don't have rain for long periods	Have not tried to determine	Patio furniture under an umbrella stays dirty	Suspect planes are dumping fuel	Nave not noticed
<b>Where did you observe the deposition (e.g., roof, car, lawn furniture, etc.)?</b>	All of the above	Car, poolside, deck, lawn furniture, glass top table	Anything left outside, furniture, boat, car, etc.	Definitely on the roof	All of the above	Window sills and all over horizontal surfaces such as desks, appliances, and floor
<b>How long does it typically take for the deposition to become noticeable after cleaning or a cleansing rain?</b>	Approximately one week to one month	Three days	Within 24 to 48 hours of cleaning	Only a day or two	Within a month or two	Within weeks

**Table 2-1: Responses to Deposition Questionnaire (continued)**

<b>Question</b>	<b>Respondent 1</b>	<b>Respondent 2</b>	<b>Respondent 3</b>	<b>Respondent 4</b>	<b>Respondent 5</b>	<b>Respondent 6</b>
<b>Are you aware of any damage to property or health issues that you feel may be related to this deposition?</b>	Major allergies, general health, sleeping habits	Furniture discoloration, water pollution	Can't be a positive influence on health	Noise expressed as main concern	Concerned about air pollution effects on children – respiration and sleep disorders	Damages computer and other electronics equipment
<b>Do you feel that the problem is getting better, staying the same, or growing worse?</b>	About the same	Getting a little worse with increase of flight activity	Is not getting better and may be increasing over time	Comes and goes depending on the wind	Getting worse due to a 10-fold increase in air traffic. Noise has also increased.	Believe its getting worse



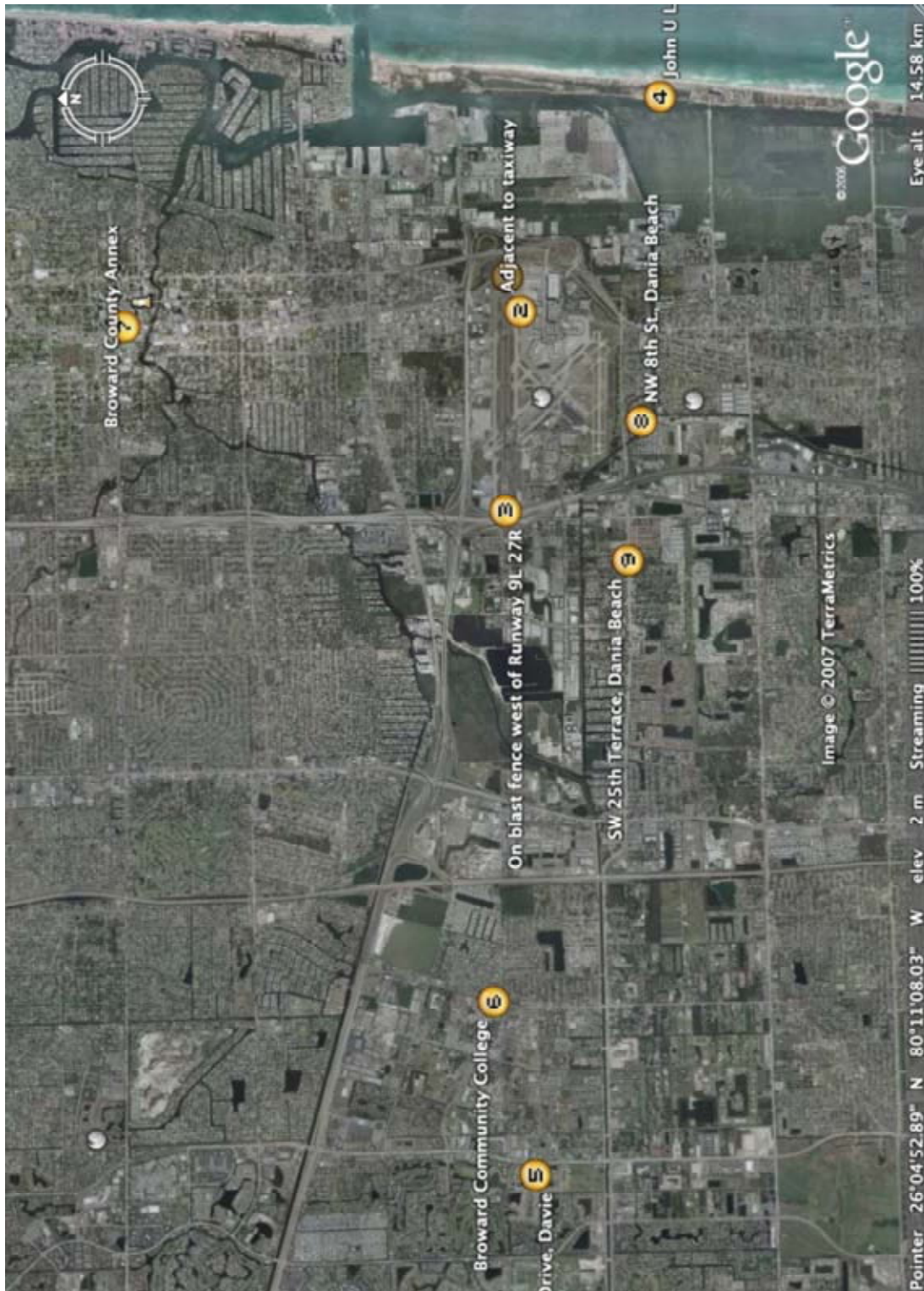


Exhibit 2-5: All Project Sampling Sites

To collect deposited materials, 4" x 4" white, ceramic tiles were typically mounted on a roof or other flat surface and attached to a permanent fixture to ensure they could not be removed (see Exhibit 2-6 which shows the two tiles on the roof of the Broward County Annex building). On the tile, a special disk-shaped target for use with electron microscopes was mounted and a portion of the surface was covered with a sticky, conductive carbon tape. This ensured that any material deposited would remain in spite of wind or rain. It also gave two separate surfaces for the microscope operator to image. The sample collection plate and attachments at sample site #3 were mounted vertically on a blast fence at the end of the main runway to collect impinging material from aircraft power-up prior to takeoff.



Exhibit 2-6: Deposition Collection Tiles Installed on Roof of Broward County Annex (Site #7)

For a first set of samples, the sample plates were exposed to the atmosphere for 3-4 days (Sites 1, 2, 3, 4, 5, 6, and 7). A second set was left in place for a month to evaluate a longer collection period (Sites 6, 7, 8, and 9). Material collected during the first sampling period was sent for analysis by scanning electron microscope and chemical analysis. The second set of samples was only sent out for chemical analysis.

The samples for microscopic analysis were sent to the Scanning Electron Microscope (SEM) Laboratory at the Center for Microelectronics Research and the University of South Florida in Tampa, FL. Samples for chemical analysis were sent to PC&B Environmental Laboratories, Inc. in Oviedo, FL.

Table 2-2: Deposition Sample Collection Sites		
Site	Location	Description
1	On airport	East end of runway 9L/27R. Sample collection plate located on ground adjacent to runway lighting support.
2	On airport	Adjacent to taxiway north of Terminal 1. Sample collection plate located on ground adjacent to taxiway sign.
3	On airport	West end of runway 9L/27R. Sample collection plate located on blast fence.
4	Off airport	John U. Lloyd Beach State Park. Sample collection plate located on marina roof.
5	Off airport	Lake Estates Drive, Davie. Sample collection plates located on balcony and pool deck.
6	Off airport	Broward Community College. Sample collection plates located on library roof.
7	Off airport	Broward County Annex. Sample collection plates located on building roof.
8	Off airport	NW 8 <sup>th</sup> Street, Dania Beach (Melaleuca Gardens). Sample collection plate located on roof of home.
9	Off airport	SW 25 <sup>th</sup> Terrace, Dania Beach. Sample collection plate located on roof of home.
10	On airport	Jet fuel tanks in airport tank farm
11	On airport	Jet engine exhaust manifolds – two Boeing 717s

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An example microscopic image is shown in Figure 2-6, which was collected at site 3. Note that the primary particle is approximately 25 micrometers across (about half the thickness of a human hair and one hundred times larger than the particles we were seeking. Other SEM images can be found in Appendix D.

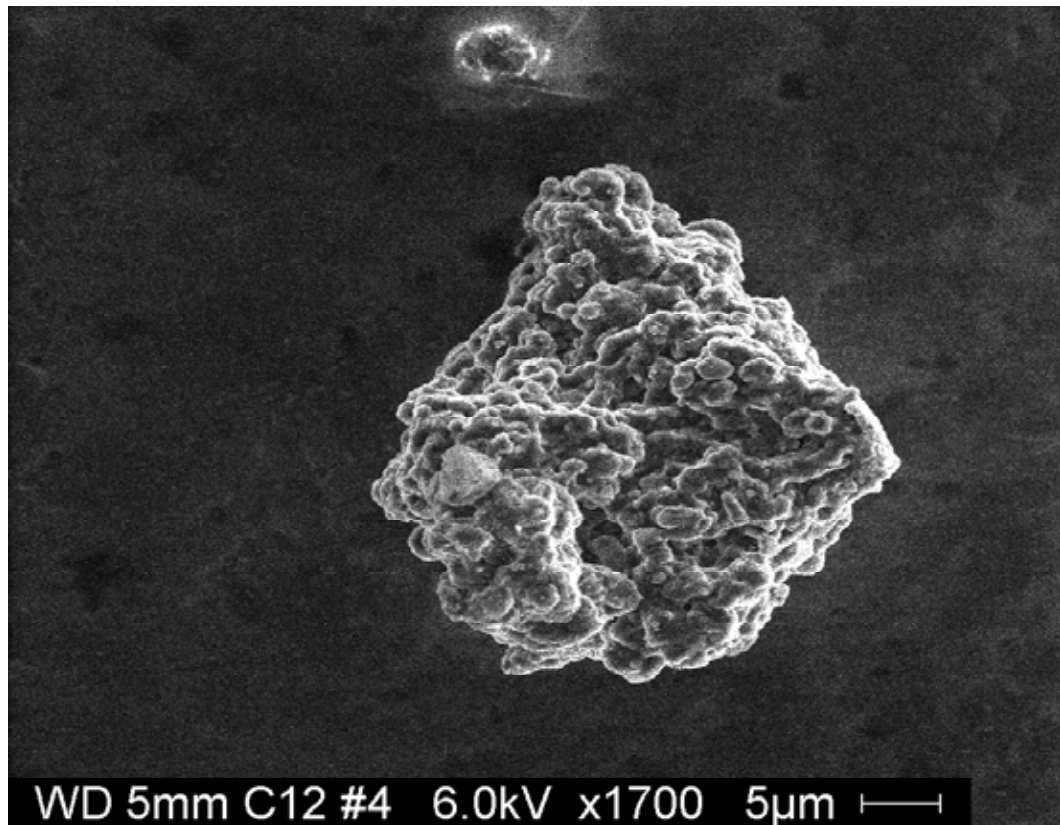
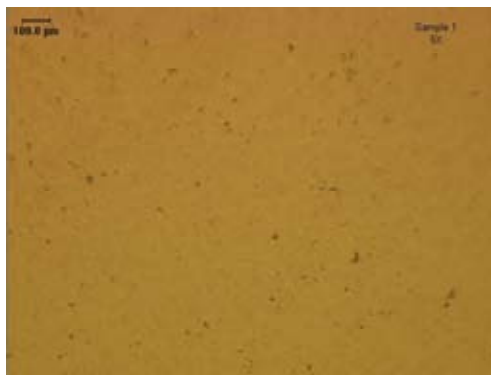
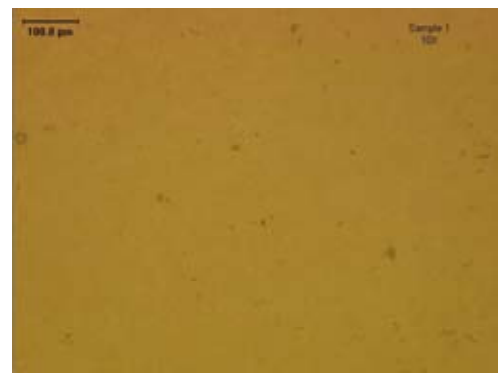


Figure 2-6: SEM image of particle at 1700 magnification

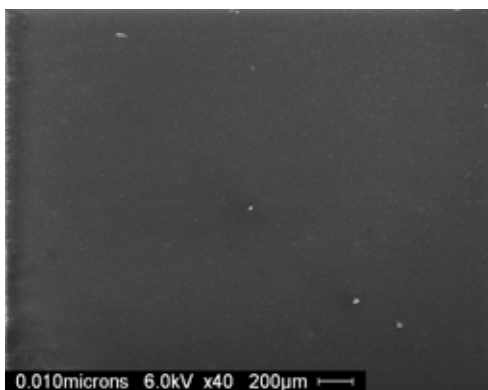
Figure 2-7 shows a sequence of images, starting with a low magnification image of the material collected on a tile mounted at site 3, in order of increasing magnification. The final image in this sequence is the same particle shown in Figure 2-6.



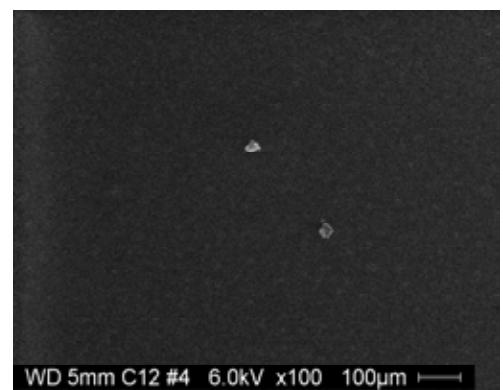
5x magnification



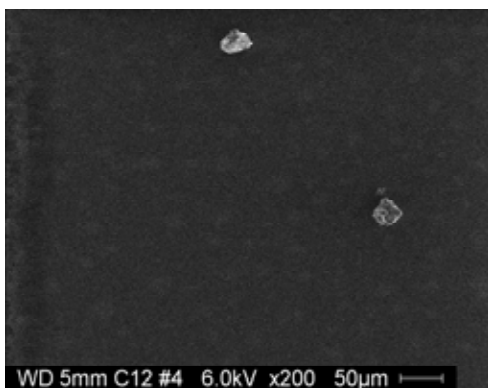
10x magnification



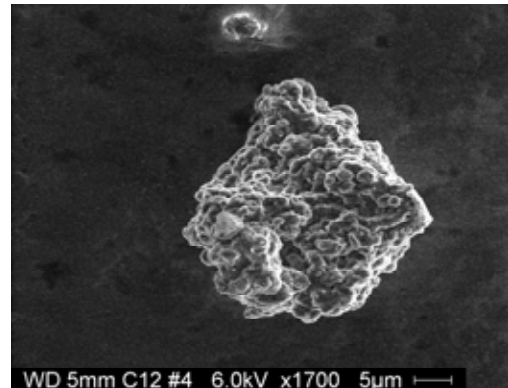
40x magnification



100x magnification



200x magnification



1700x magnification

Figure 2-7: Zooming Down onto a Particle

## 2.7. Sample Analysis

The particle shown in Figure 2-6 was also subjected to elemental analysis using a technique called energy dispersion spectroscopy. The results of this analysis are shown in Figure 2-8.

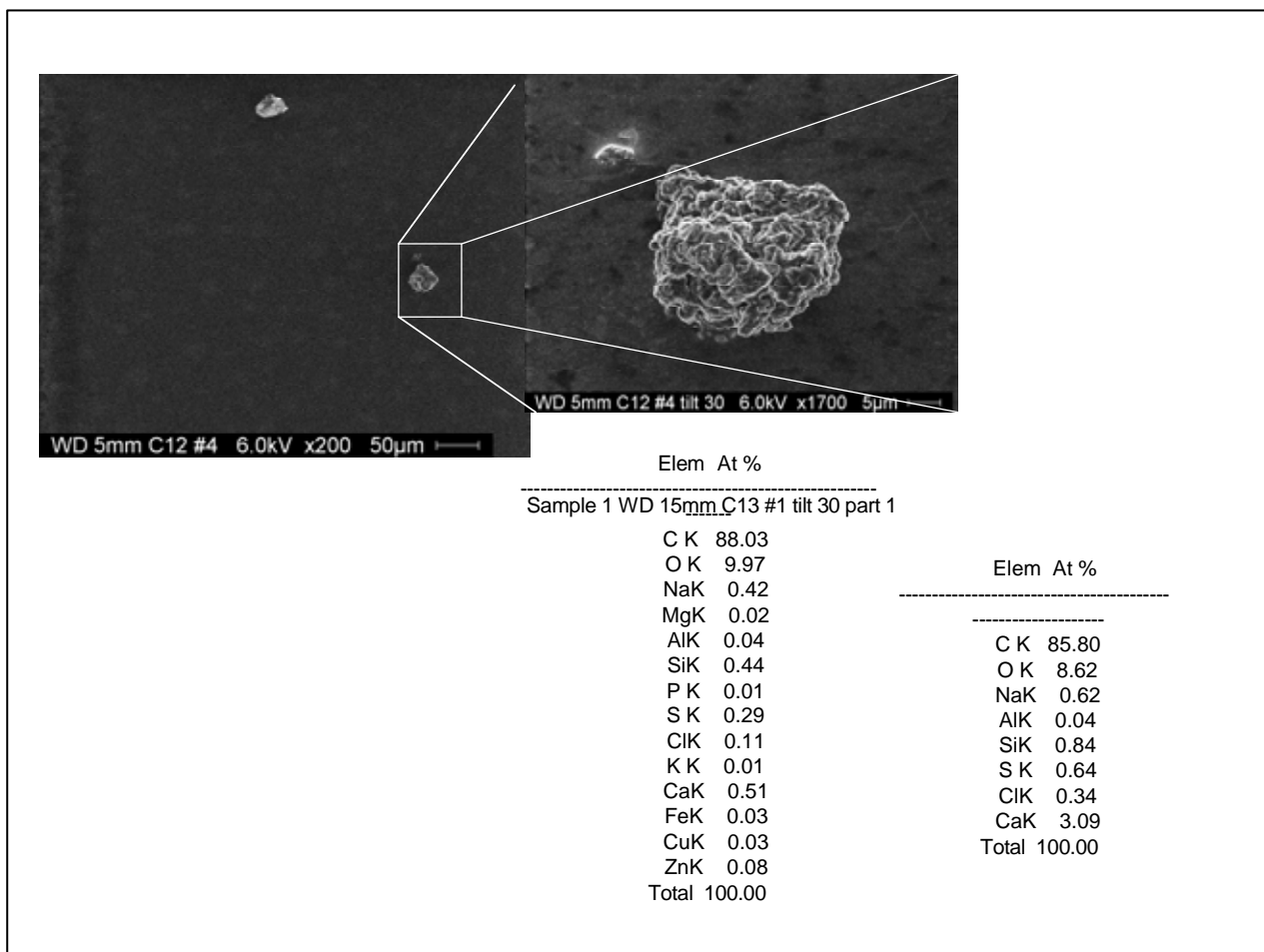


Figure 2-8: Elemental Analysis of Particle

In addition to taking SEM photomicrographs of the particles, swab samples were taken from the sample collection plates and sent to a laboratory for chemical analysis. Each sample was analyzed for petroleum hydrocarbons, which are ranges of hydrocarbons typical of fuels (e.g., jet fuel, gasoline, diesel, and kerosene) and total petroleum hydrocarbons (TPH) (e.g., any other relatively light hydrocarbon not representative of fuels such as

lubricating oils or pesticides). Table 2-2 summarizes the results of those analyses.

Table 2-2: Results of Chemical Analysis			
Site	Sample No.	Description	Result
	Hotel	Control	No hydrocarbons detected
11	3	Airport blast fence	No hydrocarbons detected
12	1	East end of runway	No hydrocarbons detected
13	2	Adjacent to taxi way	No hydrocarbons detected
14	7	County Annex roof – 4 days/plate 1	No hydrocarbons detected
14A	7	County Annex roof – 4 days/plate 2	No hydrocarbons detected
14S	7	Swab of roof surface	No hydrocarbons detected
15	5	Residential balcony	No hydrocarbons detected
16	4	John U. Lloyd Park roof	No hydrocarbons detected
16A	4	Residential roof	No hydrocarbons detected
16C	4	Area adjacent to pool	No hydrocarbons detected
16D	4	Swab of glass table top	No hydrocarbons detected
17	6	BCC library roof – 4 day sample	No hydrocarbons detected
21	7	Annex roof – 4 week sample	No hydrocarbons detected
22	9	Residential roof – 4 week sample	24 mg/tile Chloride 1930 micrograms/tile Si 750 micrograms/tile Na
23	8	Residential roof – 4 week sample	63 mg/tile Chloride 1290 micrograms/tile Si 3880 micrograms/tile Na
26	11	Engine wipe – N969AT	No hydrocarbons detected
27	11	Engine wipe – N969AT	No hydrocarbons detected
28	11	Engine wipe – N932 AT	No hydrocarbons detected
29	11	Engine wipe – N932AT	No hydrocarbons detected
30	6	BCC library roof – 4 week sample	No hydrocarbons detected
JF1	10	Jet fuel from fuel tanks	~100% jet fuel
JF2	10	Jet fuel from fuel tanks	~100% jet fuel

## **2.8. Analysis of Data**

The SEM analyses of the particles collected on and around the airport typically showed irregularly shaped particles in the 5-50 micrometer size range. The chemical analysis of the particles did not detect any hydrocarbons, either fuel related or otherwise.

Because the first samples did not show particles that looked as though they came from aircraft engines (less than 1 micrometer and spherical), the sampling protocol was modified. For the SEM analysis, the sample collection surface was changed from a carbon tape to a copper tape, which has a smoother surface than either the carbon tape or the aluminum target disk. Several samples were left exposed to the atmosphere for four weeks rather than the originally planned four days to collect more particles. None of these changes had a material effect on the findings.

Since carbon particles were not readily apparent, particles from other potential sources were considered. FP&L has a coal-fired power plant adjacent to the airport, often with a visible plume from its stacks. This could be a possible source of deposition particles from ash, which would include silica. Also, since the airport is adjacent to the ocean, sea salt, which would include sodium chloride, is another possibility. Two samples (22 and 23) were analyzed for silica, sodium, and chloride to see if inorganic particles were present, which proved to be the case.

## **2.9. Conclusions and Protocol Considerations**

In our analysis of the data, we were unable to identify any particles that looked representative of known aircraft engine-generated particles or that had their expected chemical characteristics. The particles were much larger (typically 5-50 micrometers) and irregularly shaped as opposed to less than 1 micrometer and round. They also did not include any petroleum hydrocarbons or similar compounds.

The analyses for inorganic chemicals (e.g., silica, sodium, and chlorides) were somewhat consistent with the results of the energy dispersion spectroscopy presented in Exhibit 2-8, which indicates the possibility of the particles being utility plant ash and sea salt.

In view of the fact that we were unable to identify PM from aircraft or other aviation sources in our analyses, we do not propose further use of the protocol we developed for evaluating such emissions. None of the sampling protocols reviewed for this project, including the one that was used, have demonstrated an ability to identify PM from aviation sources. This either means there is no discernable link between aviation PM sources and the deposition in surrounding communities or that some other analytical approach will be required to demonstrate that link. For example, real-time monitors that actively collect and filter particles from the air could measure a wider range of parameters such as particle size, particle size distribution, particle mass, and chemical composition would allow a much more precise characterization albeit at a much higher cost.

Various research projects have been conducted at airports that collected samples from the exhaust plume directly behind aircraft to study their emissions, however, these projects also are quite expensive and have yet to demonstrate that PM emissions from aircraft are significant contributors to the material deposited on surrounding communities.

#### **2.10. Recommendation to BCC**

The CAP team's analysis and research could not find a correlation between material deposited in the community and aircraft operations. The study did confirm, however, that PM is being deposited on homes and buildings throughout the area. To assure the community that this material does not pose a significant health hazard the CAP team recommends the County conduct an expanded study. The purpose would be to examine the role that area sources play in the deposition observed and to analyze collected materials to identify contributing sources and the magnitude of risks they may pose to the community, individually and collectively.

## Appendix A – Annotated Bibliography

***Fine Particulate Matter (PM<sub>2.5</sub>) Monitoring During the Ft. Lauderdale-Hollywood International Airport Air Runway Overlay Project***, Suarez, et al, Broward County Environmental Protection Department, Air Quality Division, Ambient Monitoring Section, August 31 – October 21, 2004. Concentrations of PM<sub>2.5</sub> experienced at sampling site under the temporary flight path were higher than at sampling site under the normal flight path (unused during overlay project), however, the differences were consistent during normal operations, which suggests that the differences are not dependent on the increased air traffic caused by the resurfacing of the primary runway at FLL; changes in concentrations at the two sites mimicked each other, which may be indicative of the material contained in the air mass over the broader area.

***Measuring and Modeling of Atmospheric Deposition on Santa Monica Bay and the Santa Monica Bay Watershed***, Stolzenbach, et al Institute of the Environment, University of California, Los Angeles, and Schiff, et al, Southern California Coastal Water Research Project, September 2001. Annual rate of atmospheric transport and deposition of trace metals to Santa Monica Bay is significant; most of the mass of metals deposited by dry deposition on Santa Monica Bay and its watershed originates as relatively large (>10 microns) aerosols from area sources (off-road vehicles and small businesses); for metals the most important sources of emissions to the atmosphere are non-permitted area sources.

***Air Monitoring Study of Felton and Lloyd Schools***, Barbosa, et al, South Coast Air Quality Management District, September 2001 – Studied VOC, carbonyls, carbon (organic and elemental), and metals; school is in the prevailing wind trajectory of Los Angeles International Airport (LAX); no impact of airport was discernible.

***Soot and Odor***, Goldman, KM Chng Environmental Inc., - Summary of soot studies at several airports concluded that studies to date have shown that deposits have been made up of fungus, minerals and soil, particles from wood burning, particles from automobile and diesel truck exhausts, or general urban contamination. While there may be a very small contribution from aircraft exhaust in the deposits in the neighborhoods, the deposits are almost entirely made up of non-aircraft-related components.



***Air Monitoring Study in the Area of Los Angeles International Airport,*** Eden, et al, South Coast Air Quality Management District, April 2000. Key compounds detected in the study are associated with mobile sources; all key compounds are lower at residential sites than at Aviation and Felton School sites, which are influenced by emissions from major highways; fallout samples depict greater abundance of larger-than-PM<sub>10</sub>-sized combusted oil soot particles than is observed at most other locations in the South Coast Basin.

***Inglewood Particulate Fallout Study Under and Near the Flight Path to Los Angeles International Airport,*** South Coast Air Quality Management District, September 2000. Combusted oil soot particles were not present in abundance in the majority of samples collected during the study, but no conclusions can be drawn from this finding due to the limited sampling period; the composition of the fallout is consistent with that typically found in other areas of the Basin; there is no discernible pattern of either carbon mass or total fallout mass under LAX's flight path which would indicate a predominant influence from aircraft fallout; the concentration and growth of gasoline and diesel powered vehicle traffic in and around the airport is a concern from an emissions impact perspective.

***Air Monitoring Study at Los Angeles International Airport,*** Barbosa, et al, South Coast Air Quality Management District, October 1999. AQMD conducted a study to address concerns about the pollutant levels to which LAX staff may be exposed; although PM<sub>10</sub> 24-hour measurement levels at LAX exceeded the South Coast Air Basin averages on most sampling days, these levels were still below federal ambient PM<sub>10</sub> standards for 24 hours.

***LAX Master Plan – Technical Report Deposition Monitoring,*** Camp Dresser & McKee, Inc, March 1998. Data collected at the six monitoring stations tend to eliminate the airport as the major deposition source for the areas directly adjacent to the airport; the deposition rate data implicates freeway traffic for high daytime concentrations; copper composition data indicates that a small fraction of the total deposition seen in the daytime is potentially from aircraft breaking.

***Analysis of Hydrocarbons and Trace Metals in Environmental Samples in support of Los Angeles International Airport 2015 Master Plan Expansion Project EIS/EIR,*** Venkatesan, Institute of Geophysics and Planetary Physics, University of California at Los Angeles and Boyle,

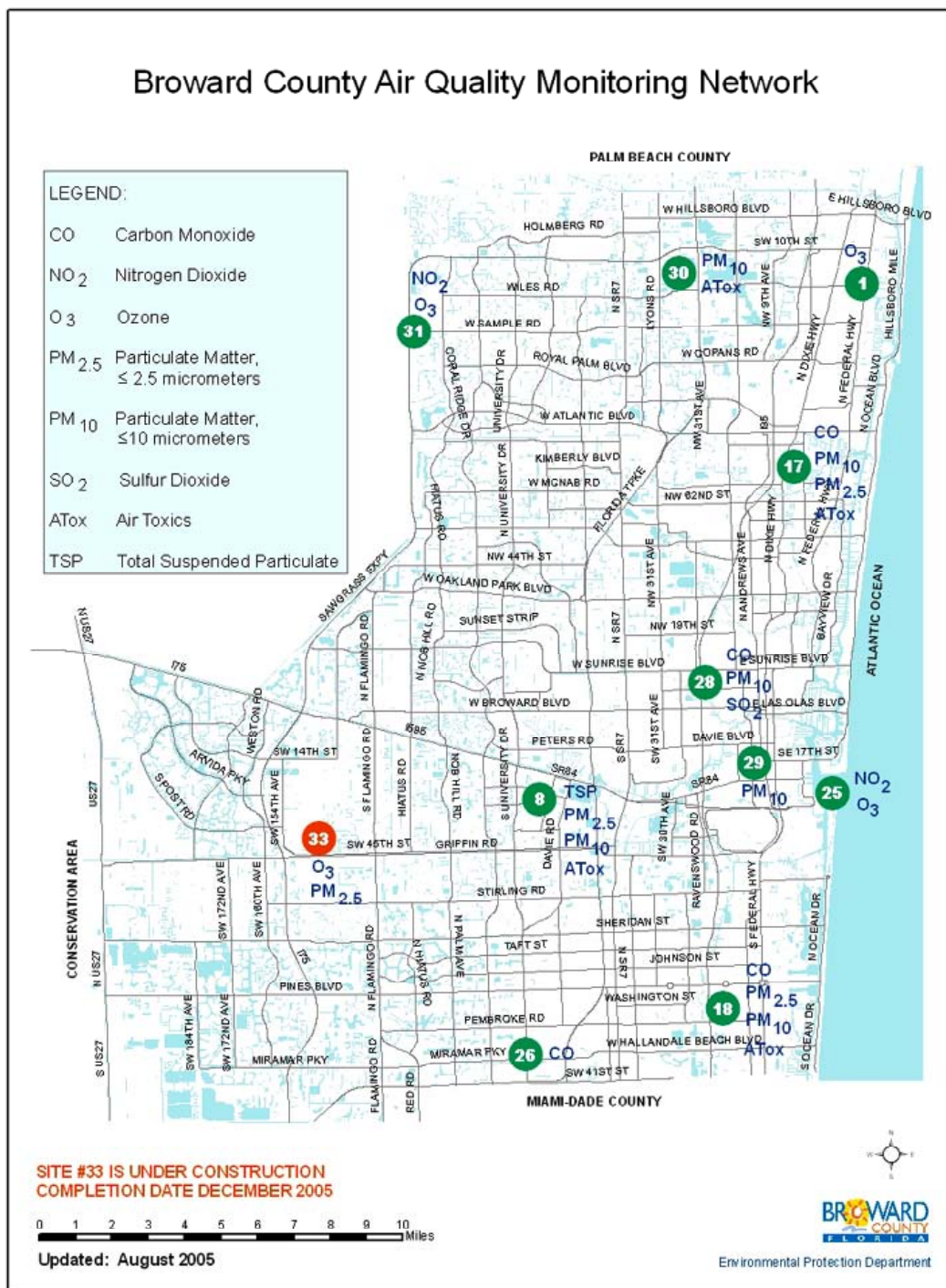


Department of Organismic Biology, Ecology, and Evolution, University of California at Los Angeles, July 1998. Study commissioned to characterize aircraft emissions in the vicinity of Los Angeles International Airport; jet aircraft exhaust apparently does not contribute significantly to the saturated hydrocarbons found in the atmospheric particles, soils, plant surface, and water samples evaluated from the area of potential effect; saturated hydrocarbons present in samples appear to be comparably influenced by regional atmospheric deposition; with the exception of vanadium, aerial deposition of trace metals and boron is occurring in the El Segundo Dunes at levels that are consistent with studies of other urban areas; concentrations of trace elements in ambient PM<sub>10</sub> were within expected values for urban locations.

**Community Impact of Aircraft Particle Emissions**, Hoffnagle, TRC Environmental Corporation, Fall 1996. Chemical mass balance analysis of particles collected with deposition plates on Logan Airport (BOS) and in communities surrounding the airport; airport sources examined included engine swipes and tire wear/brake wear; materials from examined sources represented up to 8.5% of fallout collected on airport site; materials from community sites represented less than 0.3% of fallout.

**Summary of Two Logan Soot Studies**, K.M. Chng Environmental, Inc. Fall 1996. There were no ongoing chronic soot impacts from airport-related activity either for departing or arriving aircraft or from other Logan activity; there were no indications of raw jet fuel in the soot samples analyzed; the contribution of inorganic particles from brake wear and tire wear drop off rapidly and are not observed in the nearby communities.

## Appendix B – Public Data on FLL Area Emissions and Other Pollutants Releases



# AirData

QuickTime™ and a  
TIFF (Uncompressed) decompressor  
are needed to see this picture.

## Monitor Values Report - Criteria Air Pollutants

**Geographic Area:** Broward Co, FL **Pollutant:** Particulate (size < 2.5 micrometers) **Year:** 2005 **EPA Air Quality Standards:** ☐ Particulate (diameter < 2.5 micrometers): 65 µg/m3 (24-hour average), 15.0 µg/m3 (annual mean) ☐

☐ µg/m3 = micrograms per cubic meter ☐

	PM2.5 (µg/m3)													
	24-Hour Values							Annual						
Row #	# Obs	1st Max	2nd Max	3rd Max	4th Max	98th Pct	# Exceed	Mean	# Exceed	Site #	Site Address	City	County	State
SORT														
1	300	21	21	20	19	17	0	8.3	0	8	3205 Sw 70th Avenue	Davie	Broward Co	FL
2	314	21	21	20	19	17	0	8.2	0	17	851 Sw 3 Avenue Pompano Beach	Pompano Beach	Broward Co	FL
3	109	17	17	16	16	16	0	8.2	0	18	2701 Plunkett Street Hollywood	Hollywood	Broward Co	FL

## Monitor Values Report - Criteria Air Pollutants – Prior Years

\* US EPA - AirData Monitor Values Report - Criteria Air Pollutants

\* Geographic Area: Broward Co, FL

\* Pollutant: Particulate (2.5 micrometers)

\* Exceptional Events Included

			# Obs (24- Hour PM2.5)	1st Max (24- Hour PM2.5)	2nd Max (24-Hour PM2.5)	3rd Max (24- Hour PM2.5)	4th Max (24- Hour PM2.5)	98th Pct (24- Hour PM2.5)	# Exceed (24-Hour PM2.5)	Annual Mean (PM2.5)	Annual # Exceed (PM2.5)
Site Address	3205 Sw 70th Avenue	2004	329	24	23	22	21	19	0	8.2	0
City	Davie	2003	355	19	19	18	18	16	0	7.8	0
County	Broward Co	2002	340	46	34	34	20	18	0	7.8	0
Monitor Type (PM2.5)	SLAMS	2001	347	47	29	29	21	20	0	8.4	0
Monitoring Objective	Highest Concentration	2000	356	52	36	36	34	23	0	9.5	0
		1999	334	108	59	48	31	25	0	9.2	0

			# Obs (24- Hour PM2.5)	1st Max (24- Hour PM2.5)	2nd Max (24-Hour PM2.5)	3rd Max (24- Hour PM2.5)	4th Max (24- Hour PM2.5)	98th Pct (24- Hour PM2.5)	# Exceed (24-Hour PM2.5)	Annual Mean (PM2.5)	Annual # Exceed (PM2.5)
Site Address	851 Sw 3 Avenue Pompano Beach	2004	326	23	22	22	22	21	0	8.4	0
City	Pompano Beach	2003	327	18	18	18	18	16	0	8.0	0
County	Broward Co	2002	326	67	23	22	18	18	0	7.9	0
Monitor Type (PM2.5)	SLAMS	2001	337	54	26	26	25	20	0	8.6	0
Monitoring Objective	Population Exposure	2000	342	50	35	33	32	24	0	9.5	0
		1999	251	47	26	26	24	19	0	8.4	0

			# Obs (24- Hour PM2.5)	1st Max (24- Hour PM2.5)	2nd Max (24-Hour PM2.5)	3rd Max (24- Hour PM2.5)	4th Max (24- Hour PM2.5)	98th Pct (24- Hour PM2.5)	# Exceed (24-Hour PM2.5)	Annual Mean (PM2.5)	Annual # Exceed (PM2.5)
Site Address	2701 Plunkett Street Hollywood	2004	93	24	20	19	17	20	0	8.8	0
City	Hollywood	2003	113	17	17	17	17	17	0	8.2	0
County	Broward Co	2002	117	62	20	19	18	19	0	8.0	0
Monitor Type (PM2.5)	SLAMS	2001	117	33	24	23	19	23	0	8.6	0
Monitoring Objective	Population Exposure	2000	121	35	28	26	21	26	0	9.3	0
		1999	85	21	21	20	17	21	0	8.1	0

**Data from Scorecard – The Pollution Information Site ([www.scorecard.org](http://www.scorecard.org))**

Your Community: BROWARD County

Who Is Polluting Your Community?

Reported Environmental Releases from TRI Sources\* in 2002

Rank	Facility	City	Pounds
1	FPL PORT EVERGLADES POWER PLANT	FORT LAUDERDALE	402,413
2	SUN GRAPHIC INC.	POMPANO BEACH	244,304
3	AMERICAN WHIRLPOOL PRODS. INC.	HOLLYWOOD	58,295
4	DUSKY MARINE INC.	DANIA	15,500
5	JUPITER MARINE INTL. INC.	FORT LAUDERDALE	14,660
6	PORT EVERGLADES NORTH TERMINAL	FORT LAUDERDALE	14,428
7	EXXONMOBIL OIL CORP. PORT EVERGLADES TERMINAL	FORT LAUDERDALE	14,252
8	COASTAL FUELS MARKETING INC. - PORT EVERGLADES TERMINAL	FORT LAUDERDALE	8,571
9	C&C MARBLE INC.	FORT LAUDERDALE	8,240
10	AMERADA HESS CORP. FORT LAUDERDALE TERMINAL	FORT LAUDERDALE	6,669
11	CHEVRON PRODS. CO. PORT EVERGLADES	FORT LAUDERDALE	5,503
12	SONIC USA INC.	HOLLYWOOD	4,713
13	CUSTOM MARBLE INC.	POMPANO BEACH	4,400
14	BP PRODS. N.A. INC. PORT EVERGLADES TERMINAL	FORT LAUDERDALE	2,912
15	IN-VOGUE INDS. INC. (DBA ELEGANT MARBLE)	DEERFIELD BEACH	2,137
16	TROPICAL ASPHALT PRODS. CORP.	PEMBROKE PARK	2,000
17	OWENS CORNING	FORT LAUDERDALE	750
18	CHEMCENTRAL INTL.	POMPANO BEACH	255
19	ABB INC.	CORAL SPRINGS	15

20	FPL FORT LAUDERDALE POWER PLANT	FORT LAUDERDALE	14
----	---------------------------------	-----------------	----

\*TRI stands for the U.S. Toxics Release Inventory. Under Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (EPCRA), certain manufacturing facilities are required to report the amounts of approximately 650 toxic chemicals that they release into the environment or produce as waste. The TRI inventory is, at present, the only source of information used by Scorecard on environmental releases of toxic chemicals and waste management of those chemicals. The data includes all reported releases to air, water and land. This total does not include any waste that is transferred offsite.

## Appendix C – Deposition Collection and Analysis Protocol

The following is the proposed protocol used to guide the collection and analysis of particles deposited onto airport property as well as the surrounding community.

### ***Protocol for Evaluating Particulate Matter Deposition from FLL Sources***

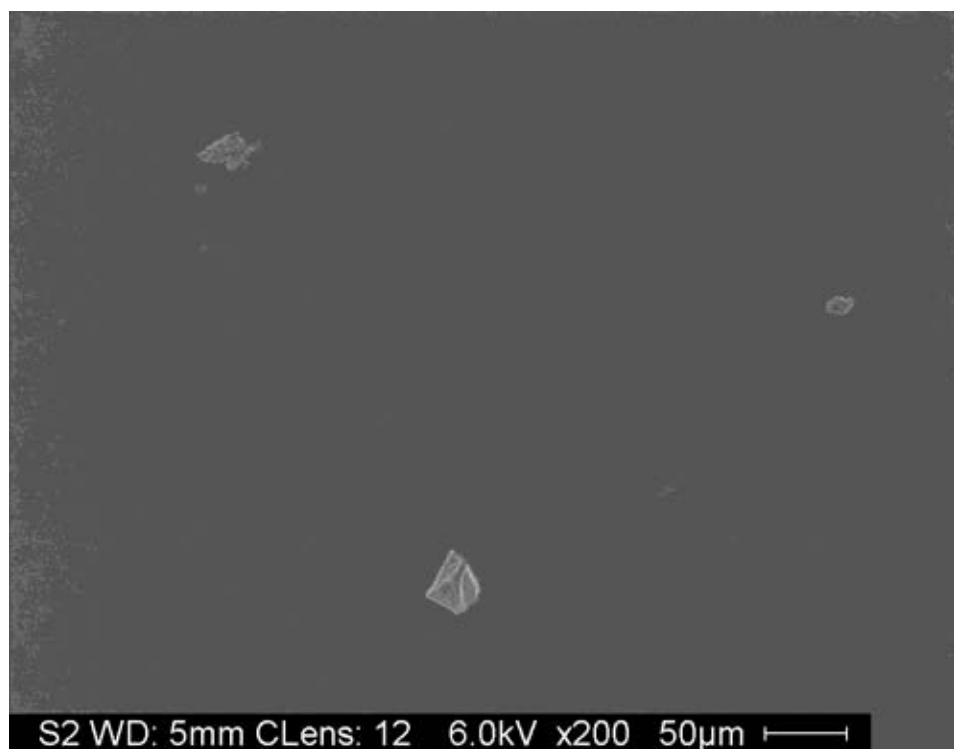
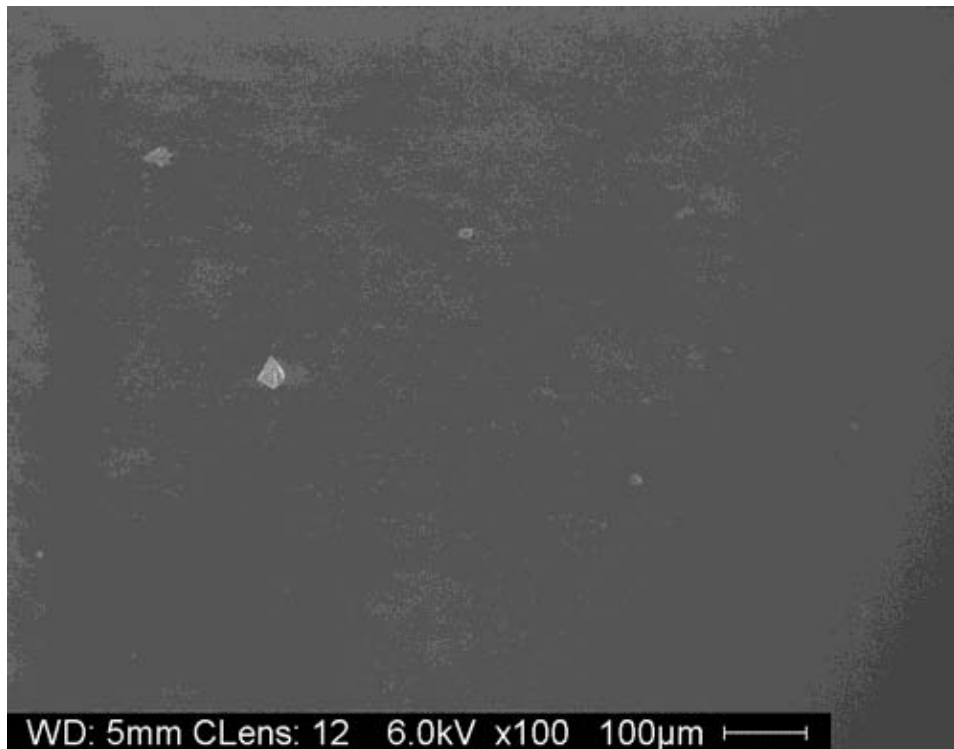
1. Identify sampling locations
  - a. On airport sampling:
    - i. Adjacent to engine run up area, turn from taxiway to active runway, or other area that shows evidence of particle emissions. Indicators might include blackened sound barriers or airfield instrument housings.
    - ii. On airport property east of the end of Runway 9L/27R.
    - iii. On airport-controlled property west of the end of Runway 9L/27R, possibly in the runway protection zone.
    - iv. Jet engine swab samples from three aircraft that are typical of those that operate at FLL
    - v. Jet fuel from the FLL fuel farm.
  - b. Off airport sampling:
    - i. In John U. Lloyd State Park in an area inaccessible to the public, for example on the roof of a ranger station. Alternatively, on the roof of a building at Port Everglades, in an area inaccessible to the public. Location should generally be off the east end of Runway 9L/27R
    - ii. In the Riverland community or a similar location in Davie in an area inaccessible to the public, for example, on the roof of a school or County-owned building. Davie has been the source of complaints of deposition in the past, which should be used as a guide to locating the sampling site.
    - iii. On the roof of the Broward County Government Center in an area inaccessible to the public. This will be a control site.
2. Collect samples
  - a. Flat plate particle collection sampling will be used in all locations except for the engine swab samples and fuel sample.

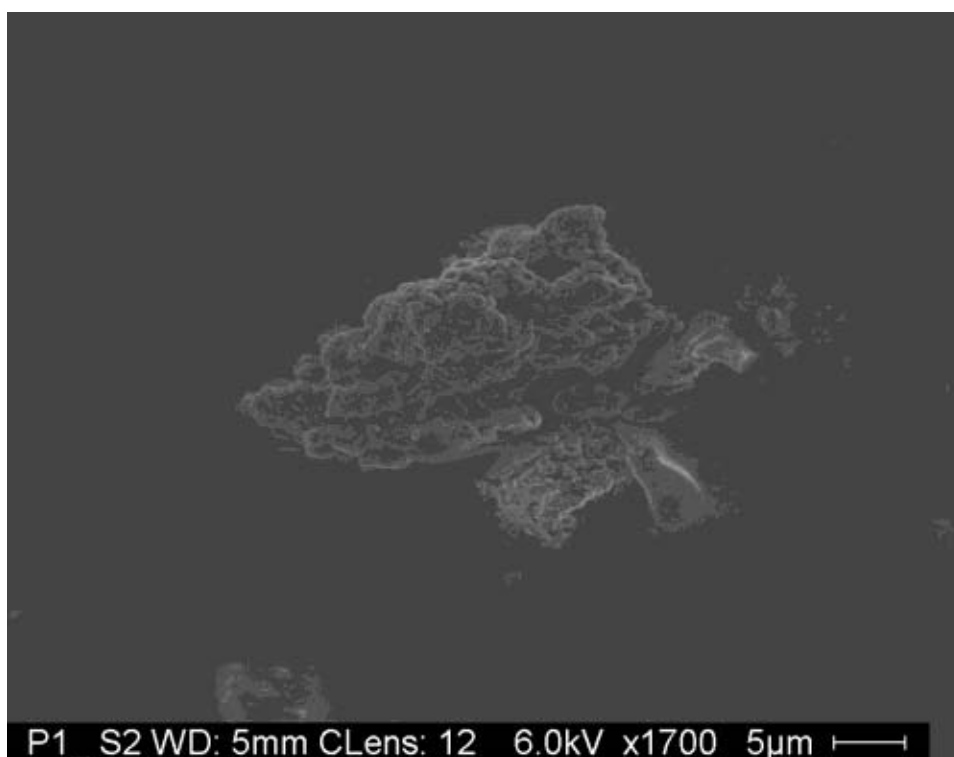
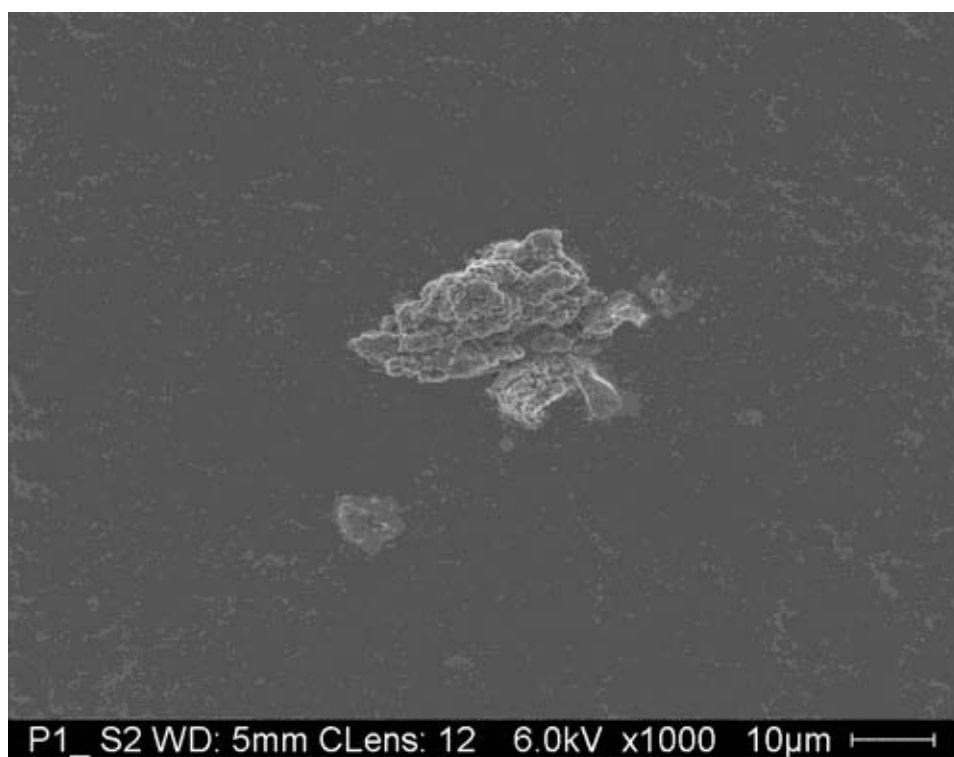
The swab sample will be a dry sample collected directly from the engine exhaust area and the fuel sample will be a liquid sample.

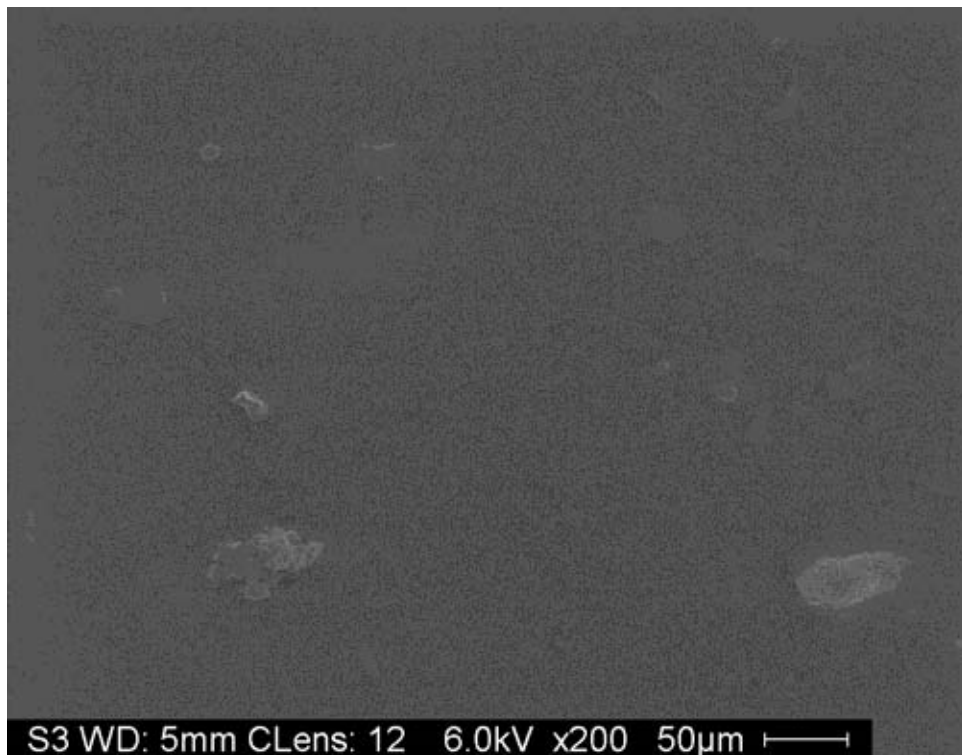
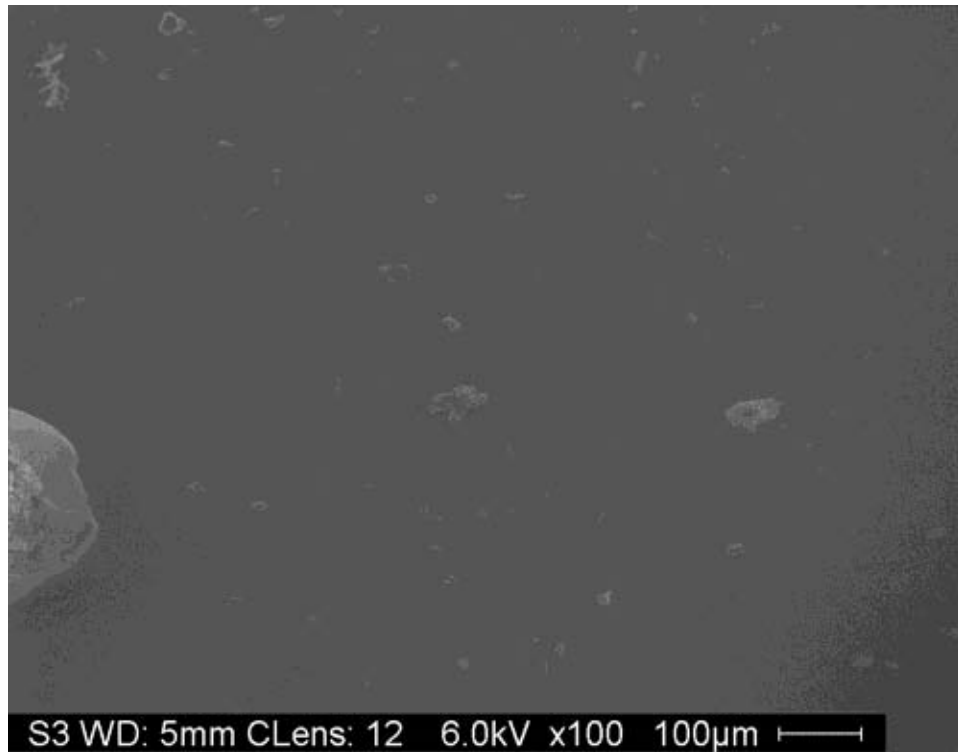
- b. Flat plate sample collection will last for 2 to 10 days depending on how long it takes to collect a sample large enough for analysis. Shorter period is preferred.
3. Analyze samples
- a. Particles collected during sampling will be analyzed to identify composition and structure.
    - i. Analyze hydrocarbon constituents by GC-MS.
    - ii. Analyze particles for presence of sulfates.
    - iii. Inspect/photograph particles using electron microscope.
    - iv. Jet fuel sample will be analyzed for its hydrocarbon constituents.
4. Evaluate analytical results
- a. Compare hydrocarbon constituents, looking for commonality or significant differences.
  - b. Compare presence and/or composition of sulfates.
  - c. Compare particle physical properties such as size and shape.
5. Report results
- a. Prepare report documenting sampling plan, sample collection, and sample analysis. Report should propose whether sampling indicates presence of aviation PM in the community. If results are inconclusive or indicate a potential concern, recommend potential follow-on course of sampling. Additional sampling may be required, particularly at sites where complaints have been lodged. Sample analysis will be guided by the results of the initial course of sampling.
  - b. Prepare briefing to summarize results of initial deposition testing.

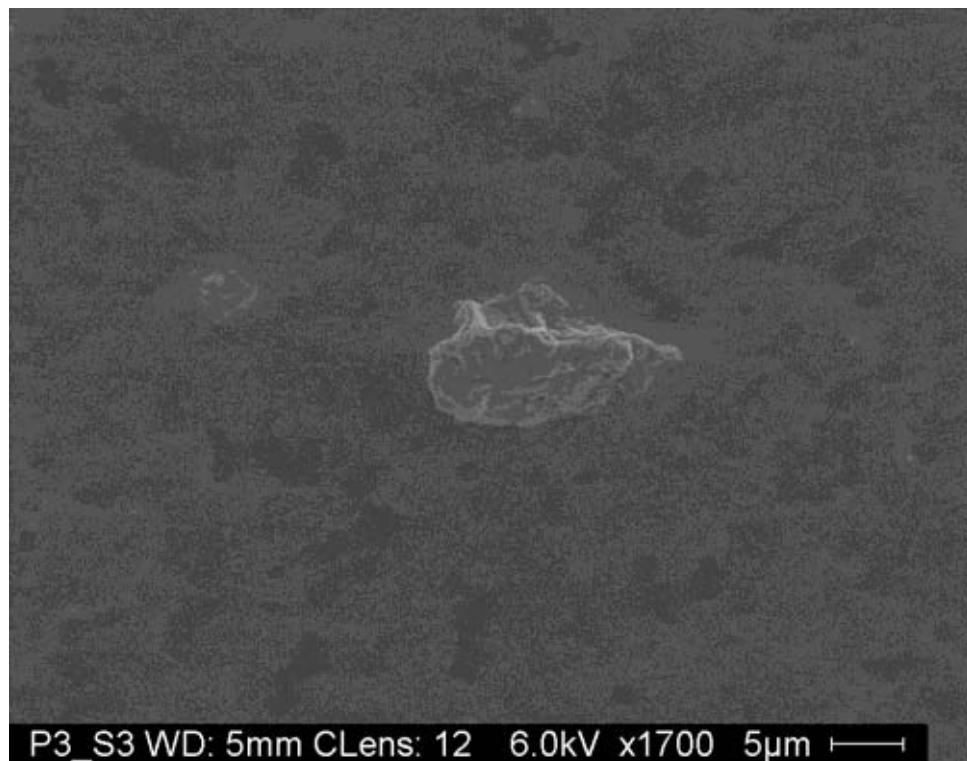


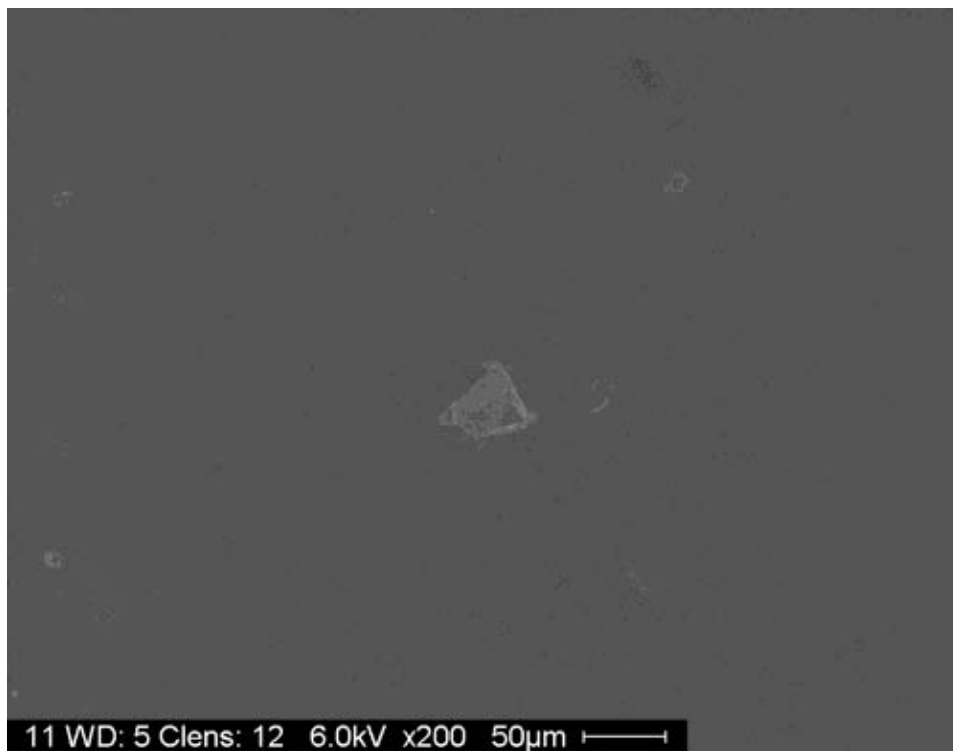
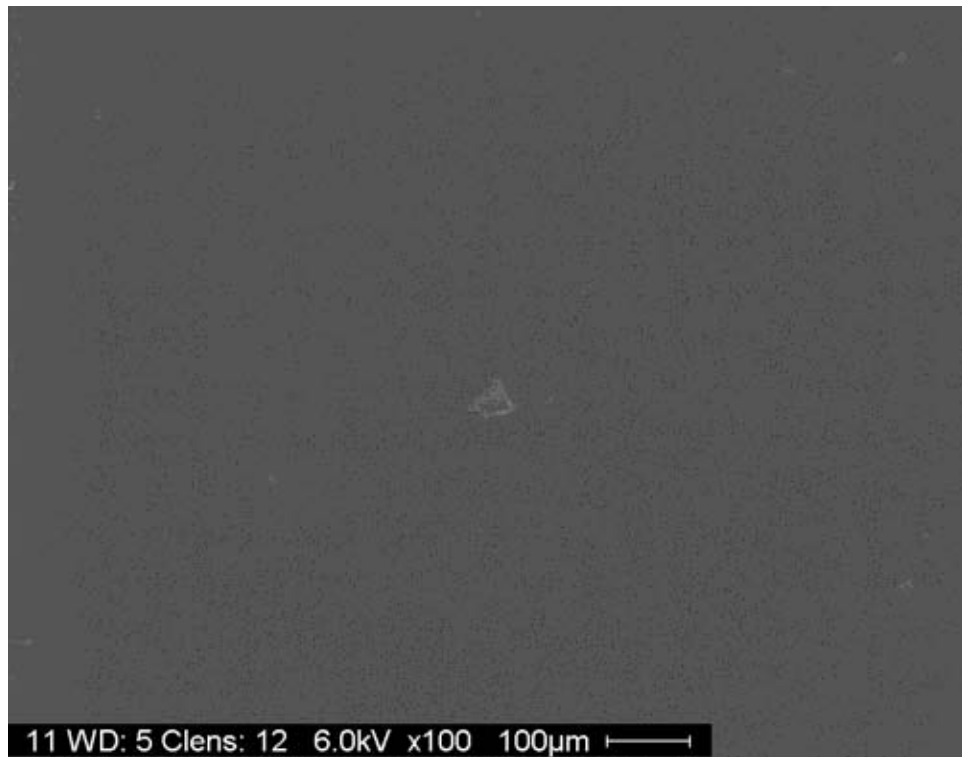
## Appendix D – Photomicrographs of PM from Deposition Sampling













## **Appendix E – Survey Forms Collected from Community**



Sandy Webb,  
FTH & H



12600 W. Colfax Avenue, Suite C-400, Lakewood, CO 80215  
303/462-1647. Fax 303/232-5161  
www.cleanairports.com

Steven Howards  
Executive Director

Bob! Thanks for your help!  
Steve  
THANKS  
Cable

11/01/05

The Clean Airport Partnership has been tasked by the Board of County Commissioners to develop a state-of-the-art protocol for determining both the current sources and potential human health effects of the air deposition reported by some residents who reside in the vicinity of Fort Lauderdale-Hollywood International Airport.

We understand that you are among those residents who have observed and expressed concerns about this situation. Could you please respond directly via e-mail to the following 11 questions by the close of business on Friday, November 4<sup>th</sup>? This will help us in designing the monitoring protocol.

Please briefly describe any deposition that you have observed that has affected your home or property:

1. What did the deposition look like? Ground up coal Dust
2. Did the deposition have a texture or feel? Yes, Like oily COAL Dust
3. Is it most prevalent during a certain season, day, or time? Yes, when planes come in morning, evening and holidays
4. Are there situations that you believe cause the deposition to accelerate or diminish? Yes, wind factor
5. Where did you observe the deposition (e.g., roof, car, lawn furniture, etc.)? All of the above
6. How long does it typically take for the deposition to become noticeable after cleaning or a cleansing rain? Appx. one week to one month
7. Are you aware of any damage to property or health issues that you feel may be related to this deposition? Yes, MAJOR Allergies, General health, ~~sleeping~~ sleeping habits
8. Do you feel that the problem is getting better, staying the same, or growing worse? Please explain your reasoning. About the same
9. How long have you lived at your residence and what is your address? 3 1/2 years - 3900 E. Lake Estates Dr. Davie FL 33328
10. Approximately how far do you live from the boundary of FLL; the Port; and the FP&L power plant? 6-7 miles
11. May we contact you if we have additional questions? Yes

\*Note:

Need to clean filters once per month.  
Need professional carpet cleaner 3-6 months  
Pressure clean house at least once year





12600 W. Colfax Avenue, Suite C-400, Lakewood, CO 80215  
303/462-1647. Fax 303/232-5161  
[www.cleanairports.com](http://www.cleanairports.com)

Steven Howards  
Executive Director

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We understand that you are among those residents who have observed and expressed concerns about this situation. Could you please respond directly via e-mail to the following 11 questions by the close of business on Friday, November 4<sup>th</sup>? This will help us in designing the monitoring protocol.

Please briefly describe any deposition that you have observed that has affected your home or property:

1. What did the deposition look like?  
☒ Black soot. Fine grains of black particles.
2. Did the deposition have a texture or feel?  
☒ Yes...It texture was soft in nature and would smear when rubbed.
3. Is it most prevalent during a certain season, day, or time?  
☒ The soot is consistently more noticeable during the summer months as I'm poolside more often. It also appears on the dock and house walls as it is light colored.
4. Are there situations that you believe cause the deposition to accelerate or diminish?  
☒ Yes...When we don't have rain for long periods there tends to be a larger build up of deposits.
5. Where did you observe the deposition (e.g., roof, car, lawn furniture, etc.)?  
☒ Car, poolside, deck, lawn furniture, extremely prevalent on my glass table top.
6. How long does it typically take for the deposition to become noticeable after cleaning or a cleansing rain?  
☒ Three days.
7. Are you aware of any damage to property or health issues that you feel may be related to this deposition?  
☒ Furniture discoloration, water pollution etc...I am overall blessed with good health however, I can't tell you what hazards are present over the long term while in/outdoors and inhaling the deposits.

8. Do you feel that the problem is getting better, staying the same, or growing worse?  
Please explain your reasoning.

**KE:** I feel it is getting a little worse with the increase of flight activity directly over my home. The collection of deposits that appear on my glass patio table top is a good indicator of the buildup. There is no way I can entertain or eat from the table without windex cleaning every three days. Before, you didn't need to clean it as often.

9. How long have you lived at your residence and what is your address?

**KE:** A little over five years.

10. Approximately how far do you live from the boundary of FLL; the Port; and the FP&L power plant?

**KE:** The regional jet liners runway approach is directly overhead 200 or so feet, the commercial airport run way (FLL) is to the right approximately 1 mile, the Port Everglades is approximately 3 miles as is FP&L.

11. May we contact you if we have additional questions?

**KE:** Yes! Keith A. Roberts (954.309.5555)

By December 2006, we expect to complete a draft monitoring and research protocol for determining the sources and affects of air deposition that may be occurring in your area. By responding to this survey, you will automatically be notified of a meeting we intend to hold in January 2006 for purposes of providing additional information on the protocol, soliciting input, and answering any questions that you might have. Many thanks for your thoughtful and timely response.

Sincerely,



12600 W. Colfax Avenue, Suite C-400, Lakewood, CO 80215  
303/462-1647. Fax 303/232-5161  
[www.cleanairports.com](http://www.cleanairports.com)

Steven Howards  
*Executive Director*

11/01/05

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We understand that you are among those residents who have observed and expressed concerns about this situation. Could you please respond directly via e-mail to the following 11 questions by the close of business on Friday, November 4<sup>th</sup>? This will help us in designing the monitoring protocol.

Please briefly describe any deposition that you have observed that has affected your home or property:


1. What did the deposition look like? The soot is a black deposit with an sticky oil like feel. Although some of the deposit can be rinsed away some remains until cleaned.
2. Did the deposition have a texture or feel? To the touch it is very similar to household dust but it has an oily feel to it.
3. Is it most prevalent during a certain season, day, or time? I have not tried to determine how much more accumulation occurs at different wind directions as the deposits are year round.
4. Are there situations that you believe cause the deposition to accelerate or diminish? See above.
5. Where did you observe the deposition (e.g., roof, car, lawn furniture, etc.)? the deposits occur on anything left outside, furniture, boat, car etc.
6. How long does it typically take for the deposition to become noticeable after cleaning or a cleansing rain? If you wipe your hand or clean towel on a flat surface the deposits are noticeable within 24 to 48 hours of cleaning.
7. Are you aware of any damage to property or health issues that you feel may be related to this deposition? It is a given that these deposits are airborne and it can't possibly be a positive influence on health.
8. Do you feel that the problem is getting better, staying the same, or growing worse? Please explain your reasoning. Because we clean the boat, cars and furniture outside

regularly, it is not really possible to measure the amount of deposit with any precision. The fact that the deposits are there and need to be cleaned regularly would indicate the problem has not gotten better by any significant measure and logic would have it that the source has only increased over time.

9. How long have you lived at your residence and what is your address? Since 12/86
10. Approximately how far do you live from the boundary of FLL; the Port; and the FP&L power plant? We are little less than 1000 feet south of the existing south runway and approx the same distance east of the west end of this runway. Don't know the measure from the FP&L plant or port. The fact that FP&L is installing soot filters in their plant now will have some impact on our neighbors to the north, however the prevailing winds tend to make the smoke from the FP&L facility move away from us.
11. May we contact you if we have additional questions? Yes.

By December 2006, we expect to complete a draft monitoring and research protocol for determining the sources and affects of air deposition that may be occurring in your area. By responding to this survey, you will automatically be notified of a meeting we intend to hold in January 2006 for purposes of providing additional information on the protocol, soliciting input, and answering any questions that you might have. Many thanks for your thoughtful and timely response.

Sincerely,

From: <CAirportP@aol.com>  
Subject: fyi  
Date: November 22, 2005 9:09:59 AM EST  
To: Sandy@environmentalassistant.com  
 1 Attachment, 78.5 KB [Save ▼](#)

I have personally complained on several occasions as to the noise and soot levels left as a result of our current airport practices. I would be willing to help develop adequate monitoring protocols. I also agree that the process should review sincere experiences, examination, identification and prioritizing both sides concerns and develop appropriate initiatives/protocols with time lines, to help resolve the concerns. I applaud your outreach effort and feel that it may be possible to perform this needed monitoring function transparently as a partnership provided there is willingness to act on what issues are revealed.

Keith A. Roberts



[MonitoringL.doc \(78.5 KB\)](#)

From: <CAirportP@aol.com>  
Subject: **Re: FLL air deposition study, per our conversation today**  
Date: November 11, 2005 6:38:47 PM EST  
To: ssadjusters@comcast.net  
Cc: Sandy@environmentalassistant.com

In a message dated 11/11/2005 1:27:37 PM Mountain Standard Time, ssadjusters@comcast.net writes:

Yes, I received your questionnaire, however, very busy since Wilma. I will answer your survey now.

1. My screened in porch with all white furniture and my car is white which is in the driveway. I hose down these areas every 2-3 days and they are literally covered with very dark soot.
2. Yes, it is extraordinarily coarse and gritty.
3. Yes, especially, when the wind is blowing a certain way, the planes seem to need that push from the tail end of the craft. If you live over their flight pattern for take off and landings; this noise and dirt/grit can drive you crazy.
4. Only if it is a very strong wind or rain and my car gets washed off, however, the patio furniture is under an umbrella and stays very dirty.
5. Definitely on the roof, as I have it pressured cleaned every 4 to 6 months due to my barrel tiles being light pink the dirt is very noticable.
6. Only a day or two and it's right back dirty and gritty.
7. We tend to stay inside due to all the heat and humidity during the year except for a few months like Dec, Jan, Feb & March where we can enjoy the outdoors before the unbearable heat is back. It's very annoying when you hear an air plane taking off every 2 minutes over your house continually all day long.
8. The problem comes and goes depending on the wind, however, since 911 all the airplanes have been re routed to take off and land parallel with 595.
9. I have live here since June of 2000. My address is 181 S.W. 94th Terrace, Plantation, Fla. 33324
10. I don't know exactly; perhaps 5 to 8 miles due West of Airport and the Port. I don't know where the FP & L Plant is?
11. Please, anytime. Thank you for your interest.

thanks very much. we will be back. steve



12600 W. Colfax Avenue, Suite C-400, Lakewood, CO 80215  
303/462-1647. Fax 303/232-5161  
[www.cleanairports.com](http://www.cleanairports.com)

Steven Howards  
Executive Director

11/01/05

The Clean Airport Partnership has been tasked by the Board of County Commissioners to develop a state-of-the-art protocol for determining both the current sources and potential human health effects of the air deposition reported by some residents who reside in the vicinity of Fort Lauderdale-Hollywood International Airport.

We understand that you are among those residents who have observed and expressed concerns about this situation. Could you please respond directly via e-mail to the following 11 questions by the close of business on Friday, November 4<sup>th</sup>? This will help us in designing the monitoring protocol.

Please briefly describe any deposition that you have observed that has affected your home or property:

1. What did the deposition look like? Looks like black soot
2. Did the deposition have a texture or feel? Light texture
3. Is it most prevalent during a certain season, day, or time? No it is constant. Visible on my pool deck, cars and roofs especially light colors.
4. Are there situations that you believe cause the deposition to accelerate or diminish? Planes fly low over our area and we are 10 miles West of airport. I suspect planes may be dumping fuel etc.
5. Where did you observe the deposition (e.g., roof, car, lawn furniture, etc.)? ALL OF THE ABOVE...
6. How long does it typically take for the deposition to become noticeable after cleaning or a cleansing rain? Within a month or two.
7. Are you aware of any damage to property or health issues that you feel may be related to this deposition? Our community has A LOT of young children and I am very concerned with long term effects of the constant air pollution. This a metropolitan area. My 2 children (ages 6 & 9) suffer from sleep disorders due to planes in the middle of the night. My youngest has some respiratory issues.
8. Do you feel that the problem is getting better, staying the same, or growing worse? Please explain your reasoning. The problem is getting a lot worse as the amount of air traffic over our residential neighbor (and our schools) has increased 10-fold since 1998! It

is not just our concern about the air quality (or lack thereof) it is also about the incredible NOISE POLLUTION that has increased significantly within the past 7 years.

9. How long have you lived at your residence and what is your address? I have lived at my home since 1993. My address is 2870 Hidden Hollow Lane Davie Fl. 33328
10. Approximately how far do you live from the boundary of FLL; the Port; and the FP&L power plant? I only know that we live 10 miles West of the Ft. Lauderdale/Hollywood Intl' airport
11. May we contact you if we have additional questions? Yes

By December 2006, we expect to complete a draft monitoring and research protocol for determining the sources and affects of air deposition that may be occurring in your area. By responding to this survey, you will automatically be notified of a meeting we intend to hold in January 2006 for purposes of providing additional information on the protocol, soliciting input, and answering any questions that you might have. Many thanks for your thoughtful and timely response.

Sincerely,



From: <CAirportP@aol.com>  
Subject: **Re: Air pollution deposition reported by residents near FLL - completed form**  
Date: November 14, 2005 10:34:12 AM EST  
To: pedro\_monteiro@yahoo.com  
Cc: Sandy@environmentalassistant.com

In a message dated 11/13/2005 9:23:56 AM Mountain Standard Time, pedro\_monteiro@yahoo.com writes:

Steve,

Please pardon the delay due to Hurricane Wilma. I hope that you can extend the deadline for me and the other people that you contacted. I recommend that you send out a reminder email, as some people only got their electricity turned on a few days ago, and your original email may be lost in the backlog.

I took the distance measurements by using Google Earth (<http://earth.google.com>). You may wish to download it; it's a useful tool.

Please find attached the Air Monitoring Letter with the answers completed.

The answers are also pasted below.

What did the deposition look like? **Dark grey fine pepper.**

Did the deposition have a texture or feel? **Slightly gritty: finer than sand, grittier than flour**

Is it most prevalent during a certain season, day, or time? **Have not noticed**

Are there situations that you believe cause the deposition to accelerate or diminish? **Have not noticed**

Where did you observe the deposition (e.g., roof, car, lawn furniture, etc.)? **Window sills, and all over horizontal surfaces such as desks and appliances, and floor**

How long does it typically take for the deposition to become noticeable after cleaning or a cleansing rain? **Window sill deposits become noticeable in weeks. Rain turns the deposits into a muddy cake.**

Are you aware of any damage to property or health issues that you feel may be related to this deposition? **This polluted buildup over my computer equipment and other belongings causes oxidation damage to electronic equipment, in addition to making the equipment and furniture unsightly. As a result, I have been forced to leave my windows closed and run the air conditioning, which I would otherwise not do.**

Do you feel that the problem is getting better, staying the same, or growing worse? Please explain your reasoning. **I think it is getting worse. Deposits appear to accumulate faster than five years ago, though I have not performed any quantitative tests.**

How long have you lived at your residence and what is your address? **More than five years at this address:**

**1500 SE 15th St #315**

**Fort Lauderdale, FL 33316-2712**

Approximately how far do you live from the boundary of FLL; the Port; and the FP&L power plant? **Straight line distance from my home to:**

**Port Everglades nearest ship (cruise ships): 0.5mi ESE**

**Port Everglades furthest ship (cargo ships): 2.7mi SSE**

**FLL North Runway 9L/27R (east end): 1.9mi SSW**

**FPL smoke stacks: 1.9mi S**

May we contact you if we have additional questions? **Please do. I would like to have a monitoring station here that can be taken to a lab and analyzed to identify the pollution sources and the potential harm they can cause.**

Pedro Monteiro

Phone: 954-525-3324

Sierra Club

Florida Chapter Executive Committee

Broward Group Conservation Chair

Florida Hometown Democracy Liaison

thnx much pedro! steve  
Steven Howards  
Executive Director  
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