



TECHNICAL MEMORANDUM

TO: Donald Robinson
FROM: Jeffrey Hamel
DATE: May 15, 2009
SUBJECT: Summary Data Report – Window Glazing and Existing Indoor Sample Data
Lederle Graduate Research Center, Amherst, Massachusetts

INTRODUCTION

In March 2009 a limited hazardous building materials investigative survey and assessment was conducted by Environmental Health & Engineering, Inc. (EH&E) for Fitzmeyer & Tocci, Inc., to identify asbestos-containing materials, lead in paint, polychlorinated biphenyls (PCBs), and other hazardous building materials in anticipation of renovations planned at the Lederle Graduate Research Center (LGRC) low rise building. A report documenting the survey was submitted to the University on March 25, 2009.

During the assessment, a sample of the interior window glazing from the third floor conference room of the Science Library was collected and analyzed for PCBs. This sample and a duplicate of this sample detected total PCBs at concentrations of 12,000 parts per million (ppm) and 11,000 ppm, respectively.

Given that these concentrations exceed regulatory thresholds per Federal regulations (40 CFR 761) for PCBs in a non-totally enclosed manner, the University retained the services of Woodard & Curran to work with the University to develop an approach and plan to address these conditions.

This memorandum presents the results from an initial assessment of the window glazing performed in April/May 2009 and summarizes existing indoor sample data collected within the LGRC building.

INITIAL ASSESSMENT

This initial assessment included an inspection and inventory of the windows in the low rise and Tower A of the LGRC followed by the collection of representative samples for PCB analyses.

Inspection and Inventory

As indicated in the previous section, analytical results from one interior glazing sample collected from the third floor Library conference room reported a total PCB concentration of 12,000 ppm. On April 6, 2009 a site walk conducted by UMass and Woodard & Curran personnel identified visually similar glazing materials on the majority of low rise building windows, the walkway windows between the low rise and Tower A, and laboratory windows in Tower A.

Based on these initial observations, a more thorough initial inspection of the low rise, walkway, and Tower A windows was conducted on April 16 and 17, 2009. The results of this inspection were used to develop a sampling plan to collect representative samples of window glazing to confirm the presence of PCBs in this material throughout the respective buildings.



The assessment included visual inspection of accessible windows including observed window and framing construction, types of sealant present (glazings, caulking, gaskets, etc.), and a measurement of window dimensions. Specific locations observed during the inspection were:

- Low Rise Library: Windows on all three floors inspected including study areas on all three floors, conference rooms (third floor Room 365A), and second floor staff office spaces;
- Low Rise North Wing: Accessible windows on both east and west sides from all three floors, specifically third floor east side office spaces (Room A343), second floor west side classroom (Room A203), second floor east side common space (Room A268), and first floor east side office spaces (Room 141);
- Other Low Rise windows including those observed on hallway doors, stairwells, and entrance locations;
- Walkway connecting the low rise building to Tower A; and
- High Rise Tower A: One accessible east side study area/office space (Room 503), and windows within the elevator common areas on the first, fifth, and fourteenth floors.

Results of the inspection confirmed the observations made during the April 6th site walk. Glazing material similar in appearance to that observed in the library conference room 365A was observed on the majority of window joints throughout the low rise, the walkway, and Tower A. The glazing material was black in color and had very little plasticity. Below surficial portions, the material was observed to be softer and in one location (glazing sample location LGRC-GZ-008 High Rise Location) an increase in the overall plasticity was observed. In general, the glazing along the lower horizontal window joints and lower portions of the vertical window joints was observed to be in a deteriorated condition. The physical condition of the glazing typically improved moving up the vertical joints and in locations with limited direct sunlight exposure.

Based on window construction drawings and field observations, the glazing material appears to be present on both the interior and exterior sides of the window glass and in between the bottom (or top) of the window glass and the metal frame.

In addition to the interior inspection, an inventory of windows was taken from the outside of the low rise and Tower A buildings to develop an estimate of total linear footage of windows on each building. Total linear footage of windows was calculated based on the dimensions of the inspected windows and the exterior window inventory. Approximately 17,140 linear feet of windows is estimated at the LGRC Low Rise and High Rise Tower A buildings. A summary of total linear footages per building is provided in Table 1.

A standard window construction was observed in the majority of windows in both the low rise building and Tower A of the high rise. Within this standard construction, a variety of window sizes and shapes were noted. A summary of the number of windows by overall frame dimensions is included in Table 1. Windows were typically constructed of approximately 1 inch thick metal framing set back approximately 1 inch from the face of interior walls. At the base of the majority of windows a tile or stone shelf was observed ranging in width from 6 to 12 inches. For windows at which the ledges were present, the majority also had vents associated with the building's HVAC system either directly next to or adjacent to the window units. Windows on the walkway connecting the low rise to high rise building were constructed in a similar manner; however, window ledges were not observed. In addition, caulking material was observed throughout portions of the walkway as an apparent temporary patch due to past leakages.



During the inspection some windows with slightly different construction were observed on the first floor of the library and in the walkway. These windows were visibly different in two ways; the type of metal stripping in place perpendicular to the window face and the type of material present in the joints. Interior joints surrounding each of these windows contained a black caulking material, which was highly plastic and generally found to be in good condition. Inspection of the joints was not able to determine whether black glazing material was present beneath the caulking.

A gasket material was also observed on select windows during the interior window inspections. The gasket material was a black, rubberized material. The width of the gasket varied between $\frac{1}{8}$ inch and $\frac{1}{4}$ inch wide. The gasket material was observed on doors and windows of the main building entrances and windows adjacent to the low rise main stairwell. Gasket material was also observed on the main library entrance windows.

Sample Collection and Analyses

Based on the estimated linear footage, a sampling plan was developed that included the collection of ten glazing samples and two caulking samples from window locations throughout the low rise, walkway, and Tower A. Sample locations were selected to assess representative samples of window glazing from each of the major types of windows observed and to achieve spatial distribution throughout the buildings. In the low rise building, seven samples were collected representing one sample for approximately every 1,400 l.f. of glazing or caulking materials (based on an estimated 9,925 l.f.). From Tower A and the walkway, five samples were collected representing one sample for approximately every 1,440 l.f. of glazing or caulking materials (based on an estimated 7,215 l.f.).

On April 20 and 21, 2009 samples of the glazing materials and caulking were collected by Woodard & Curran personnel accompanied by UMass staff. Prior to sample collection, the area surrounding the selected location was cleaned using a non-phosphate detergent and water rinse and allowed to dry. Polyethylene sheeting was placed at the base of the sample location to prevent the spread of material. Water was then used to dampen the material to minimize any dust generation during the sampling process. Samples were collected by hand using a $\frac{1}{4}$ -inch wood chisel to remove the material from the window joint. Samples were placed in a laboratory provided container and stored on ice prior to transfer under standard chain of custody protocols to the analytical laboratory for PCB analysis. After sample collection, each sample location was cleaned using the procedures described above and a replacement bead of translucent vinyl window caulking was placed over the sample location.

Analytical results indicate that the concentrations of PCBs in the observed black window glazing materials ranged from 4,040 milligrams per kilogram (mg/kg) to 14,000 mg/kg. The concentrations of total PCBs in the two black caulking material samples were 82.2 and 129 mg/kg. A summary of each sample location and the analytical results is presented in Table 2.

All results confirmed the initial data (e.g., this glazing material contains PCBs at concentrations greater than 50 ppm).

IDENTIFICATION OF POTENTIAL EXPOSURES

Based on the presence of PCBs at concentrations > 50 ppm in the interior window glazing material, an initial identification of potential exposure pathways and receptors was performed. As part of this task, existing data collected as part of previous PCB remediation work conducted at the buildings (exterior locations) was summarized and is presented below. The purpose of this task was to assess the current data that is available from the interior of the building to aid in determining the need for supplemental data for future monitoring.



Preliminary Exposure Assessment

Based on our current understanding of the LGRC buildings and their use, potential receptors to interior window glazing include adult workers within the buildings (UMass staff) and college-age students, including graduate students. No children would be present in the inside of the buildings.

Potential transport pathways for PCBs from the glazing include deterioration or weathering and generation of dust or particulate matter that may become airborne or deposit on an interior building surface. As noted previously, vents associated with the building's HVAC system are present on the window sills adjacent to the majority of the windows and some of the glazing in some areas is present in a deteriorating condition.

Potential exposure pathways include:

- Inhalation of indoor air that may contain PCBs (limited to the fraction that may be present as respirable particulate matter);
- Dermal contact; and
- Incidental ingestion following dermal contact (e.g., hand to mouth contact) with PCBs present as particulate matter on surfaces.

Summary of Existing Data

In support of the previously conducted exterior PCB remediation activities, a substantial amount of interior samples have been collected from several media. The information summarized in the following sections was taken from the following reports:

- Preliminary Report of Building-Related PCB Assessment, LGRC Complex, EH&E, October 12, 2006
- Additional Indoor Sample Results, LGRC Complex, EH&E, February 21, 2007
- Additional Air and Wipe Sample Results from the Low Rise Building at LGRC, EH&E, July 9, 2007

Indoor Air

On August 21, 2006, indoor air samples were collected from the following locations:

- Four samples from Tower A
- Two samples from the northern wing of the low-rise
- Two samples from the low-rise library
- Control samples – three samples from the Conte building, two samples from Tower B and two samples from Tower C (PCBs > 50 ppm were not present in exterior caulking from these buildings)

All samples were collected following NIOSH Method 5503 protocols. A summary of results is provided below. For relative comparison purposes, NIOSH has established a Recommended Exposure Limit (REL), which is a science-based time-weighted average (TWA) concentration that NIOSH recommends not be exceeded for up to a 10-hour workday during a 40-hour workweek, of 1.0 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) for PCBs.



Building	Location	Total PCBs (ug/m ³)	Air volume (in liters)
Tower A	Hallway outside Room 1214	0.24	1,396
	Room 801	0.23	1,364
	Room 602	0.18	1,315
	Room 1606	0.20	652
Low-Rise North Wing	2 nd floor Room A211B	0.69	1,379
	3 rd floor, Room A322	0.44/0.47	812/585
Low-Rise Library	1 st floor	1.1	1,379
	2 nd floor, office	1.2	952
Control Samples	Conte, Room A610, B422, A111	<0.08, <0.09, and <0.09	719/704/657
	Tower B: Room 1530, 317A,	<0.08, <0.28	792/216
	Tower C: Room 1535, 430	0.05, 0.05	1,431/1,344

As indicated above, low concentrations of PCBs were detected in samples from Tower A and the low-rise building; however, only two of the samples exceeded the NIOSH REL (only slightly in excess of the 1.0 ug/m³ standard). Both samples were collected from the low-rise library. It was reported by others that in July 2006 contractors had removed PCB containing caulking from the exterior south side of the library and this action may have affected the indoor air results.

Given the data, backer rods were placed within the removed caulking voids, ventilation rates were increased in the library, and the library area was pressurized during the subsequent exterior work. Following these activities, additional indoor air sampling was conducted within the library on September 6, 2006. The results are summarized below.

Building	Location	Total PCBs (ug/m ³)	Air volume (in liters)
Low-Rise Library	1 st floor, SE end	0.58	1,042
	1 st floor, SW end	0.62	1,074
	1 st floor, SW end	0.64	1,074
	2 nd floor, office, SE end	0.57	1,109
	2 nd floor, reference desk area	0.22	1,148
	2 nd floor, SW end	0.48	1,075
	3 rd floor, outside Room A365	0.52	1,016
	3 rd floor, SW corner	0.46	1,146



As indicated above, concentrations of PCBs were detected in all samples; however, all results were less than the August 21, 2006 results and below the REL of 1.0 ug/m³.

As reported in the above-mentioned reports, based on surface wipe sample results (described in the following section), UMass contracted with Clean Harbors Environmental Services to conduct a cleaning of the library in September 2006.

On September 22, 2006, another set of indoor air samples were collected in the library to evaluate the effects of the cleaning activities. These samples were collected and analyzed following EPA Method TO-10 protocols and total PCB homologs were reported (to support the development of risk-based occupancy criteria). On January 4, 2007, indoor air samples were collected from these same locations to continue to evaluate PCB concentrations over time. However, these samples were analyzed following NIOSH Method 5503 protocols. A summary of the sample results is provided below.

Building	Location	September 22, 2006		January 4, 2007	
		Total PCBs (ug/m ³)	Air volume (in liters)	Total PCBs (ug/m ³)	Air volume (in liters)
Low-Rise Library	1 st floor, West end near shelf 72	0.36	4,322	0.40	1,302
	2 nd floor, office cubicle	0.23	4,297	0.31	1,220
	3 rd floor, NE shelves 04-05 and duplicate	0.14/0.20	4,271/4,275	0.28	1,301
Outside	Main entrance	0.03	4,340	Not analyzed	

As indicated above, PCBs continued to be detected in the samples. All results correlated well and continue to be less than 1.0 ug/m³.

On June 5, 2007, additional indoor air samples were collected to assess conditions within the computer room on the first floor of the low rise northern wing. This sampling was completed based on building occupant requests. Air samples were collected within the room, from an adjacent hallway, and from an exterior ambient air location and analyzed for PCBs following EPA Method TO-10A protocols.

Building	Location	Total PCBs (ug/m ³)	Air volume (in liters)
Low-Rise North Wing	1 st floor, Room A155/157	0.39/0.44	4,326/4,290
	1 st floor, hallway outside Room A-141	0.32	4,404
Outside	main entrance	0.05	4,368

Consistent with the previous indoor air samples, low concentrations of PCBs were detected with all concentrations below 1.0 ug/m³.

As part of the February 21, 2007 Remediation Plan prepared by EH&E for the LGRC exterior caulking and other materials, which was subsequently approved by EPA on June 22, 2007, a risk-based re-occupancy criteria was calculated for Tower A and the low rise buildings. This report provided a recommended re-occupancy criterion for indoor air of 0.29 ug/m³ total PCBs.



In comparing the existing indoor air data to this criterion:

- Tower A, B, and C, and Conte buildings – all samples were below 0.29 ug/m³
- Low rise north wing – all 5 samples were above 0.29 ug/m³ (ranging from 0.32 – 0.69 ug/m³)
- Low rise library – 14 of 18 samples were above 0.29 ug/m³ (ranging from 0.31 – 1.2 ug/m³)

With regard to indoor air, EPA's June 22, 2007 approval included the following requirements:

- Post abatement indoor air sampling for PCBs shall be conducted to determine the impact of the abatement activities (Remedial and Disposal Condition 13f)
 - Indoor air sampling shall be conducted in accordance with EPA Method TO-10A. Sufficient sample volumes shall be collected to provide a minimum laboratory reporting limit of < 1.0 ug/m³. Higher sample volumes (lower laboratory limits) may be necessary for PCB congener analyses to support the risk-based air cleanup standard and to evaluate the contribution of dioxin-like PCB congeners.
 - PCB analysis shall be conducted for PCB homologues and/or PCB congeners by EPA method 680 or EPA Method 1668, and/or for PCB Aroclors by EPA Method 8082, as appropriate.
- PCB cleanup standards under this project = Post-abatement indoor air sampling in Tower A and the low-rise, to verify that PCB indoor air concentrations have been reduced to less than 0.29 ug/m³ (page 2 of the Approval).

On July 22 and 23, 2008, post-abatement indoor air samples were collected by EH&E and are summarized below.

Building	Location	Total PCBs (ug/m ³)	Air volume (in liters)
Tower A	Room 1606	0.2	1,475
	Room 1214	0.13	1,488
	Room 801	0.101	1,469
	Room 202	0.269	1,463
	Room 602	0.176	1,463
Low-Rise North Wing	1 st floor, Room A125	0.224	1,434
	2 nd floor Room A211	0.158	1,434
	3 rd floor, Room A322	0.158	1,437
Low-Rise Library	1 st floor	0.239	1,446
	1 st floor	0.256	1,446
	2 nd floor	0.237	1,416
	3 rd floor, conf room, east	0.257	1,449
	3 rd floor, conf room west	0.221	1,422

As indicated above, low concentrations of PCBs were detected in samples from Tower A and the low-rise building; however, all samples were below the derived risk based occupancy criteria of 0.29 ug/m³.



Interior Surfaces

Several rounds of surface wipe samples have been collected from interior surfaces within the low rise building and Tower A to assess for the presence of PCBs.

On August 22, 2006, surface wipe samples were collected from various interior surfaces within Tower A, the low rise northern wing, and the low rise library and analyzed for PCBs. A summary of the sample results by building are provided below.

Building	Location	Total PCBs (ug/100 cm ²)	Wipe area (ft ²)
Tower A	1 st floor, entrance, window ledge lobby	0.6	0.8
	2 nd floor, Room 204, desk	0.2	1.0
	3 rd floor, window ledge, elevator lobby	3.7	1.0
	4 th floor, room 404, counter top	<0.1	1.0
	5 th floor, Room 503 Window ledge	1.1	0.8
	6 th floor Room 608, desk shelf	0.5	1.0
	7 th floor, Room 707, kitchen counter	<0.1	1.0
	8 th floor, desk	0.3	1.0
	9 th floor, window ledge in elevator	0.3	1.0
	10 th floor Room 1006, desk	0.2	1.0
	11 th floor, room 1105 window ledge	0.4	0.7
	12 th floor, window ledge, elevator lobby	0.9	1.0
	14 th floor, Room 1404, window ledge	1.5	0.3
	15 th floor window ledge elevator lobby	0.5	1.0
	16 th floor, Room 1609, desk next to window	0.2	1.0

As indicated above 8 of the 15 samples were collected from window ledges. In general, samples from the window ledges detected higher concentrations of PCBs than samples from other surfaces (desks, tables, etc.). For relative comparison purposes the results were compared to EPA's cleanup level for non-porous surfaces in high occupancy areas, which is 10 micrograms per 100 square centimeters (10 ug/100cm²). All results were below this cleanup level.

A summary of the August 22, 2006 interior surface sampling from the low-rise building is presented below.



Building	Location	Total PCBs (ug/100 cm ²)	Wipe area (ft ²)
Low-Rise- North wing	1 st floor, e-mail kiosk table	0.4	1.0
	1 st floor Room A125C, window ledge	0.6	0.7
	1 st floor Room A139, window ledge	1.3	0.7
	2 nd floor, Room A265 Table in office	0.5	1.0
	2 nd floor, Room 234, work station	0.3	1.0
	2 nd floor, Room A209, window ledge	<0.2	0.5
	3 rd floor, Room A323, desk	0.3	1.0
	3 rd floor, window ledge outside A311	5.2	0.5
	3 rd floor, Room A307, desk	0.2	1.0
Low Rise Library	1 st floor, stairway workstation	1.0	1.0
	1 st floor, south wall window ledge	34.4	1.0
	2 nd floor, window frame	2.5	0.5
	2 nd floor, cabinet, NE corner	0.2	1.0
	3 rd floor, table SW corner	0.3	1.0
	3 rd floor, window ledge SE corner	3.1	1.0

As indicated above 7 of the 15 samples were collected from window ledges. In general, samples from the window ledges detected higher concentrations of PCBs than samples from other surfaces (desks, tables, etc.). All results were below the EPA's high occupancy cleanup level with the exception of 1 sample collected from the first floor library window ledge. This sample was collected from the low window ledge in the main reading room and detected 34.4 ug/100cm² total PCBs.

On September 6, 2006 additional surface wipe samples of interior surfaces from the library were collected based on the initial sampling phase. A summary of this data is presented below.

Building	Location	Total PCBs (ug/100 cm ²)	Wipe area (ft ²)
Low-Rise- Library	1 st floor, south wall window ledge	7.9	1.0
	1 st floor, south wall, SE corner, window ledge	22.6	1.0
	2 nd floor, south wall window ledge, office area	3.1	1.0
	2 nd floor, SW corner, window ledge	2.7	1.0



Building	Location	Total PCBs (ug/100 cm ²)	Wipe area (ft ²)
Low-Rise- Library	3 rd floor, south wall window ledge	1.0	0.9
	3 rd floor, north wall window ledge	2.0	1.0
	3 rd floor, east wall window ledge	17.2	1.0
Low Rise Library	1 st floor, bookshelf	0.1	1.7
	1 st floor, table, SE Corner	0.5	1.0
	1 st floor, bottom stair	0.5	1.0
	2 nd floor, south wall, SE corner, desk	0.1	1.0
	2 nd floor, north wall, computer workstation	0.3	1.0
	2 nd floor, floor tile at doorway	0.1	1.0
	Stairway between 1 st and 2 nd floor	0.7	1.0
	2 nd floor, east wall bookshelf	<0.06	1.7
	2 nd floor west side air return grill	0.3	1.8
	2 nd floor, east side air supply	<0.07	1.5

As indicated above, seven samples were collected from window ledges. In general, samples from the window ledges detected higher concentrations of PCBs than samples from other surfaces (desks, tables, etc.). All results were below the EPA's high occupancy cleanup level with the exception of two samples collected on a first floor southern wall window ledge and on a third floor eastern wall window ledge.

As reported in the above-mentioned reports, based on the surface wipe sample results, UMass contracted with Clean Harbors Environmental Services to conduct a cleaning of the library in September 2006.

On September 22, 2006, 10 surface wipe samples were collected in the library to evaluate the effects of the cleaning activities. A summary of this data is presented below.

Building	Location	Total PCBs (ug/100 cm ²)	Wipe area (ft ²)
Low-Rise- Library	1 st floor, south wall, SE end window ledge	0.64	1.0
	1 st floor, south wall, center, window ledge	0.78	1.0
	1 st floor, south wall, SW end window ledge	0.23	0.75
	2 nd floor, south wall, SE end window ledge	0.20	1.0
	2 nd floor, south wall, SW end window ledge	0.98	1.0
	2 nd floor, south wall, window ledge	0.19	0.75



Building	Location	Total PCBs (ug/100 cm ²)	Wipe area (ft ²)
Low-Rise- Library	3 rd floor south wall, SW end window ledge	0.13	0.91
	3 rd floor, north wall, window ledge	0.10	1.0
	3 rd floor south wall window ledge	0.28	0.91
	1 st floor shelving row 53	<0.07	0.78

As indicated above, all samples from window ledges exhibited a decrease in PCB concentrations following cleaning. All results were also below the EPA's high occupancy cleanup level.

On June 5, 2007, additional surface wipe samples from interior surfaces were collected for PCB analyses to assess conditions within the computer room on the first floor of the low rise northern wing. This sampling was completed based on building occupant requests. A summary of this data is presented below.

Building	Location	Total PCBs (ug/100 cm ²)	Wipe area (ft ²)
Low-Rise- North wing computer room	1 st floor, Room A-155, desktop	<0.1	1.0
	1 st floor, Room A-155, window ledge behind desk	16.4	1.0
	1 st floor, Room A-157 desktop	<0.2	0.5
	1 st floor, Room A-157 window ledge	7.8	0.6
	Basement, air conditioner unit, downstream of filters	3.6	0.3
	Basement, air conditioner unit, access port upstream of filters	86	0.03
Outside	Outdoor air intake for AC unit	<0.9	0.1

Consistent with other interior surface results, the samples from the window ledges exhibited higher concentrations than other surfaces within the room. One of the results was detected in excess of EPA's high occupancy cleanup level. PCBs were also detected on the air conditioner unit in the basement (identified as a low occupancy area).

It appears that surface cleaning in the library was effective in reducing the PCB concentrations on the window ledges to levels below the EPA's high occupancy cleanup criteria; however, data from the northern wing (computer room) suggests that PCBs may also be present on window ledges in this area of the low rise.

With regard to interior surfaces, EPA's June 22, 2007 approval included the following requirements:

- Post abatement indoor surface sampling for PCBs shall be conducted to determine the impact of the abatement activities (Remedial and Disposal Condition 13f)
 - Wipe sampling of indoor surfaces shall be performed on a surface area basis by the standard wipe test as specified in 40 CFR 761.123 (i.e., ug/100cm²). Chemical extraction for PCBs shall be conducted using Methods 3500B/3540C of SW-846 and chemical



analyses for PCBs shall be conducted using method 8082 of SW-846 unless another method(s) is validated according to Subpart Q.

Post-abatement wipe samples from interior surfaces were collected by EH&E between August 2007 and April 2008 from 19 locations. None of these samples detected PCBs above the high occupancy cleanup level. The results are summarized below:

- Ten samples were collected from Tower A with eight of the samples collected from surfaces associated with the windows. Seven of the samples were non-detect ($<1.0 \text{ ug}/100\text{cm}^2$) and the other samples were all well below $10 \text{ ug}/100\text{cm}^2$ (0.2, 0.4, and $0.5 \text{ ug}/100\text{cm}^2$).
- Seven samples were collected from the low rise northern wing with three samples associated with the windows. Five of the samples were non-detect ($<1.0 \text{ ug}/100\text{cm}^2$) and the other samples were all well below $10 \text{ ug}/100\text{cm}^2$ (0.1 and $0.2 \text{ ug}/100\text{cm}^2$).
- Two samples were collected from the low rise library (first floor table and window sill) and detected PCBs at 0.7 and $0.3 \text{ ug}/100\text{cm}^2$, respectively.

Additional Sampling Conducted in May 2009

A set of samples from the glazing and adjacent materials at the LGRC complex was collected on May 5, 2009 to support the development of options to address this condition. The scope was developed based upon an evaluation of potential exposure pathways and with the intent of gathering data that will assist in developing potential abatement/mitigation plans. The location for the sampling was the previous sample location LGRC-GZ-003 collected from the first floor library (second window from east wall). The location was selected because this area is easily accessible, a bulk glazing sample has already been collected from this unit (7,520 ppm PCBs), and an exterior glazing sample can easily be collected from the outside first floor.

Specifically, six samples were collected and included:

1. Surface wipe samples of the interior glazing and adjacent window framing to assess the potential for PCB exposure through direct contact with the glazing.
 - a. Pre-Cleaning Wipe: One wipe sample was collected to assess current “as-is” potential exposures.
 - i. A total PCB concentration of $38 \text{ ug}/100\text{cm}^2$ was detected in the sample
 - b. Post-Cleaning Wipe: One wipe sample was collected after cleaning of the window frame and glazing with a commercially available general cleaner to assess the effectiveness of standard cleaning methods in reducing potential exposure.
 - i. A total PCB concentration of $15 \text{ ug}/100\text{cm}^2$ was detected in the sample
 - c. Discussion: Both wipe samples exceed EPA’s cleanup level for high occupancy areas ($10 \text{ ug}/100\text{cm}^2$). Concentrations decreased after surface cleaning, which suggests that the PCBs may be related to particulates on the surface that can be removed by general cleaning.
2. Surface wipe samples of the adjacent window ledge to assess the presence of PCBs away from the glazing and to compare this result to the total and surface wipe sample results of the glazing from the same window unit.
 - a. Pre-Cleaning Wipe: One wipe sample was collected to assess current “as-is” potential exposures.
 - i. A total PCB concentration of $0.6 \text{ ug}/100\text{cm}^2$ was detected in the sample
 - b. Post-Cleaning Wipe: One wipe sample was collected after cleaning of the ledge with a commercially available general cleaner to assess the effectiveness of standard cleaning methods in reducing potential exposure.
 - i. A total PCB concentration of $0.2 \text{ ug}/100\text{cm}^2$ was detected in the sample



- c. Discussion: Both samples were much lower in PCB concentration compared to the wipe samples of the glazing/frame and were detected at concentrations below the EPA's cleanup level for high occupancy areas. The data also showed a decrease in concentration following general surface cleaning.
3. Bulk Sample of Dust: A bulk sample of dust found in the narrow recessed area adjacent to the window frame located adjacent to the window was collected to assess the presence of PCBs in accumulated dust that may require removal.
 - a. A total PCB concentration of 671 ppm was detected in this sample, which indicates that accumulated dust/particulate from the glazing is present in this recessed portion of the window system in excess of EPA cleanup levels.
4. Bulk Sample of Exterior Glazing: Engineering drawings of the window construction details indicate that the glazing appears to have been installed in the base of the frame and around both the interior and exterior portions of the window. The exterior glazing appears visually different from the interior, although this may be a result of weathering. This sample result aids in the understanding and development of potential actions to address the PCB impacted glazing (both interior and exterior locations).
 - a. A total PCB concentration of 82.7 ppm was detected in the sample. This sample is two orders of magnitude lower than the interior glazing sample; however, the concentration is still in excess of the 50 ppm regulatory threshold.

SUMMARY

The results of the data collected to date indicate the following:

- Interior window glazing on the majority of the windows at the low-rise and Tower A contain PCBs in excess of 50 ppm. In accordance with 40 CFR Part 761, use of PCBs at concentrations greater than 50 ppm in window glazing (non-totally enclosed manner) is a use that is not authorized;
- Potential transport and exposure pathways for the PCB containing glazing to potential receptors include direct contact and/or generation of dust or particulate matter that may become airborne or rest on interior surfaces;
- Existing indoor data collected from 2006 through 2009 indicate:
 - Low concentrations of PCBs were detected in indoor air samples throughout the low-rise building. The majority of the samples collected during the abatement activities were detected at concentrations slightly in excess of risk-based criteria derived as part of the exterior PCB Remediation activities. All of the post-abatement samples (July 2008) collected from Tower A and the low-rise building were below this criterion.
 - Results from interior surface wipe samples from the window ledges exhibited higher concentrations of PCBs than other interior surfaces (tables, desks, etc.); although the majority of the sample results were below EPA's high occupancy criteria. It appears surface cleaning of these surfaces was effective in reducing PCB concentrations. All 19 post abatement wipe samples were below EPA's high occupancy criteria.

Currently, plans are under development to continue the indoor monitoring program and assess potential alternatives to address the PCB containing window glazing.

Table 1

**Linear Footage Estimates of Interior Glazing and Caulking Materials
LGRC Low Rise and High Rise Tower A
UMass Amherst**

<p align="center">LGRC Low Rise – North Wing</p>	<p>North Wing First Floor - Windows East Face = 846 l.f. 36@109"x16" West Face = 1,202 l.f. 16@ 81"x75" 8@ 81"x 60.5" 11@109"x16" Total = 2,048 l.f. 71 windows</p>	<p>North Wing Second Floor- Windows East Face = 1,232 l.f. 36@109"x16" 24@77"x21" 3@111"x66" West Face = 936 l.f. 33 @ 87"x55" 11@ 87"x12" 11@ 109"x12" Total = 2,168 l.f. 118 windows</p>	<p>North Wing Third Floor- Windows East Face = 1,621 l.f. 39@87"x55" 26@87"x12" 13@109"x12" West Face = 936 l.f. 33 @ 87"x55" 11@ 87"x12" 11@ 109"x12" Total = 2,557 l.f. 133 windows</p>	<p>North Wing Interior Locations- Windows North End Stairwell = 70 l.f. 5@70"x14" First Floor Adj. to East Ent. = 275 l.f. 14@104"x14" Library to N. Wing Doorway = 87 l.f. 2@67"x23" 3@67"x16" 1@92"x16" Total = 432 l.f. 25 windows</p>	<p>North Wing Total- Windows Total = 7,205 l.f. 347 windows (not including interior locations or doorways)</p>
<p align="center">LGRC Low Rise - Library</p>	<p>Library First Floor- Windows 9@81"x12" 4@81"x75" 7@109"x16" 4@21"x75" Total = 462 l.f. 24 windows</p>	<p>Library Second Floor- Windows 16@81"x75" 16@20"x75" 22@109"x16" Total = 1,152 l.f. 54 windows</p>	<p>Library Third Floor- Windows 24@87"x52" 16@87"x12" 8@109"x16" Total = 1,035 l.f. 48 windows</p>	<p>East Face Stairwell- Windows 5@70"x14" Total = 70 l.f. 5 windows</p>	<p>Library Total- Windows Total = 2,719 l.f. 131 windows</p>
<p align="center">LGRC High Rise – Tower A</p>	<p>East Face- Windows First Floor = 402 l.f. 6@76"x74" 6@76"x27" 7@104"x24" Laboratories = 1,625 l.f. 98@81"x18.5" Total = 2,027 l.f. 117 windows</p>	<p>West Face- Windows First Floor = 509 l.f. 6@74"x76" 6@27"x76" 12@104"x24" Laboratories = 1,625 l.f. 98@81"x18.5" Total = 2,134 l.f. 122 windows</p>	<p>Elevator Areas- Windows South Windows = 1,297 l.f. 32@88"x26" 2@26"x55" North Windows = 635 l.f. 28@84"x26" 42@84"x28" Total = 1,932 l.f. 104 windows</p>	<p>Walk Way- Windows North Face East End = 368 l.f. 9@87"x55" 6@87"x12" 1@109"x12" 1@87"x52" 1@90"x12" West End = 356 l.f. 10@87"x52" 9@87"x12" South Face = 396 l.f. 11@87"x52" 10@87"x12" Total = 1,120 l.f. 58 Windows</p>	<p>High Rise and Walk Way Total- Windows Total = 7,213 l.f. 401 windows</p>

**Total Linear Feet: 17,137
Total Number of Windows: 879**

Notes:

1. All quantities have been rounded to the nearest 1 foot.
2. Estimates only include windows observed or of similar construction to those observed to contain black glazing material or black caulking material.
3. Total linear footage of glazing does not directly correlate to total window dimensions shown due to multiple window panes in specific windows.

Table 2

**Summary of Interior Window Glazing Sample Locations
LGRC low Rise and High Rise Tower A
UMass Amherst**

Building	Sample Location	Sample ID	Analytical Results (mg/kg)	Sealant Observed	Notes
Low-Rise Library	First floor eastern most window. Lower horizontal joint, 0-50" from bottom left corner.	LGRC-GZ-002	82.2	Black caulking material, dissimilar to glazing observed elsewhere. High level of plasticity, approximate 1/4" bead.	Material observed on windows with different construction. Metal framing along edges of panes different than that of the majority of windows.
	First floor second window from east. Lower left side vertical joint, 0-16" from bottom.	LGRC-GZ-003	7,520	Black glazing material, hard, varying condition. Approximately 1/4" bead.	Green paint observed on window frames.
	Second floor library study area. Eastern most window, lower horizontal joint (0-16") and lower right vertical joint (0-5") as measured from lower right corner	LGRC-GZ-012	12,900	Black glazing material, hard, varying condition. Approximately 1/4" bead.	Green paint observed on window frames.
	Third Floor Conference Room 365A. Lower horizontal joint, Center Window, 2.0 ft from bottom left corner.	LGRC-GZ-001	14,000	Black glazing material, hard, varying condition. Approximately 1/4" bead.	Collected from same window as original glazing sample to confirm sample results.
Low-Rise North Wing	First floor Room 141A, middle window pane, right vertical joint, 0-18" from bottom right corner.	LGRC-GZ-005	11,700	Black glazing material, hard, varying condition. Approximately 1/4" bead.	No paint on frames.
	Second floor Room A251 office space, Lower horizontal and lower left vertical joint, 0-12" in both directions from lower left corner.	LGRC-GZ-006	9,080	Black glazing material, hard, varying condition. Approximately 1/4" bead.	Black window frame finish wearing off, bronze appearance underneath. No heating vent under window.
	Third Floor Classroom A301, southern most window. Lower horizontal joint and lower left vertical joint 0-12" along both joints.	LGRC-GZ-004	4,040	Black glazing material, hard, varying condition. Approximately 1/4" bead.	No paint on frames. This was a recessed window which according to UMass was not included in exterior remediation project due to inaccessibility of joints.
Walkway	Third window grouping on north side from east end of walkway, large window pane, lower left horizontal joint, 0-24" from bottom left corner and lower left vertical joint 0-10" from lower left corner.	LGRC-GZ-007	129	Black caulking material, dissimilar to glazing observed elsewhere. High level of plasticity, approximate 1/4" bead.	Material observed on windows with different construction. Metal framing along edges of panes different than that of the majority of windows.
High Rise Tower A	Fifth floor window units south of elevators (over walkway). Second window from south, entire lower horizontal joint.	LGRC-GZ-008	12,400	Black glazing material, hard, varying condition. Approximately 1/4" bead.	Material has increased plasticity underneath.
	Third floor window units north of elevators. Right window, 0-12" along horizontal and vertical joint from lower left corner.	LGRC-GZ-011	6,480	Black glazing material, hard, varying condition. Approximately 1/4" bead.	Glazing appears to be more brittle than other samples of similar material. Heating vent below windows.
	West side laboratory window, Room 1212. Crankcase type window. 0-12" along lower horizontal joint and 0-18" along right vertical joint as measured from bottom right corner.	LGRC-GZ-009	7,070	Black glazing material, hard, varying condition. Approximately 1/4" bead.	Lab space recently renovated. Windows not included in renovation.
	East side conference Room 703. Entire lower horizontal joint and lower 6" of both vertical joints.	LGRC-GZ-010	11,400	Black glazing material, hard, varying condition. Approximately 1/4" bead.	