PRELIMINARY STRUCTURAL ASSESSMENT

FOR AEROVOX BUILDING DEMOLITION

Introduction

The Aerovox building in New Bedford, Massachusetts is about 450,000 square feet. It consists of a western section that contains two floors and an eastern section that contains 3 floors. The exterior walls of the building are brick, the roof is wood, and the floors are timber planks. The first floor in the western section is about 6 feet below grade and the first floor of the eastern section is about 1-½ feet below grade. The first floor slab and the foundation walls of both sections are reinforced concrete.

A site visit was accomplished on 21 November 2005 to observe the overall structural characteristics and configuration of the building to aid in determining the methodology of demolishing this structure. However, this site visit was not a comprehensive structural assessment or condition survey. It included a brief visual inspection of the primary structural characteristics and a representative number of components, including the exterior walls, interior columns and framing members, and interior and exterior connections. The roof was not accessed. Overall, the building appears to be structurally sound.

Structural Observations

The exterior walls appear to be unreinforced brick masonry with thickened wall portions (pilasters) spaced approximately every 11' on center. The pilasters are about 24" deep and 36" wide (see Photo 1). There are areas between the pilasters that appear to be former window locations that are now covered. These spaces are approximately 8' wide by 14' high (see Photo 2). The exterior walls are about 12" thick, but the complete cross-section configuration of the wall is unknown (number of wythes, collar joint dimension, etc.). Isolated areas of the mortar were inspected and appear to be intact and in good condition throughout the structure. However, there was at least one area of diagonally cracked mortar joints located in the west stairwell along the north wall. Due to the overall limitations in accessing various areas, there may be other deficiencies that were not observed during this site visit.

The interior columns are mostly 12" diameter timbers, although there are some 8" x 8" timber columns at various locations. The columns appear to be in overall good condition. Steel I-beam sections of unknown size frame into the tops of the columns (see Photo 3) and the ends are set on angles attached to the brick pilasters of the exterior walls (see Photo 4). All observed column and pilaster connections appeared to be intact. Timber flooring (tongue and groove) spans

between the floor beams and rests on sleepers attached to the top flange of the steel floor beams. This configuration of framing indicates that floor loads are transferred to the steel floor beams and then to the interior columns and brick pilasters on the exterior walls.

The timber floor planks likely act as a diaphragm to provide lateral restraint for the exterior walls and framing system.

Demolition Methodologies

Demolition of a PCB contaminated building is an appropriate alternative when either the extent of the contamination renders cleaning technologies ineffective or the cost to clean and renovate the building exceeds its value. Assuming this is the case, the demolition of the Aerovox building can essentially be accomplished two ways:

1) Use typical mechanical means such as a wrecking ball and crane or a clamshell and bucket loader. This type of demolition method would allow for the commingling of contaminated and non-contaminated material and may require that all of the debris be treated as contaminated material, thereby increasing the costs for processing and disposal.
2) Selective demolition/building dismantlement where the building is taken down a portion at a time using controlled demolition methods and contaminated and non-contaminated material is segregated. This requires removing only portions of the building at a time. This would reduce dust and airborne contaminants and allow for the on-site segregation of contaminated and non-contaminated material.

A 160,000 square foot PCB contaminated building located in Kansas City, Missouri within EPA Region 7, was successfully demolished in early 2005 using building dismantlement methods. A second PCB contaminated building, also located in Kansas City, is scheduled for a similar method of demolition in 2006.

Each method of demolition requires the completion of various phases, some of which can be accomplished concurrently. Due to the presence of contaminated building materials, dust suppression and air monitoring will be required for any form of demolition throughout the process. The typical phases of demolition are described below:

Phase 1 – Removing, separating, and processing all equipment, furniture, and stockpiled inventory that remains within the Aerovox building complex.

Phase 2 – Demolition of the structure either by traditional wrecking ball and crane methods, building dismantlement, or a combination of the two.

Phase 3 – Debris Handling and Material Preparation. The most common aspect of material preparation is separation of the materials. Segregation of the debris is required for the effective processing of the debris, for either on-site or off-site disposal. Handling of the debris will depend on the overall methodology. The debris from the Aerovox building will primarily consist of brick masonry rubble, timber floor decking, some timber columns, structural steel framing (steel I-sections and columns), and reinforced concrete foundation walls and ground floor slab.

Phase 4 – Debris Processing. It is possible that non-contaminated debris could be used as fill for the site. Processing of non-contaminated debris from the Aerovox site would typically include shredding, grinding, pulverizing, and chipping. Shredding would be used for the wood materials (e.g., floor decking and timber columns), and grinding and pulverizing for the brick masonry and concrete. It is assumed that the PCB contaminated debris would have to be segregated and transported to a suitable disposal facility. Structural steel could be transported to a disposal or recycling facility for off-site processing.

Below is a brief description of each of the demolition methods.

1. Mechanical Demolition

One of the most commonly used methods for building demolition is using a wrecking ball and crane to demolish the masonry structure. Upper levels of the structure are demolished using the wrecking ball. Lower floor levels can be accessed and demolished using large bucket loaders and other similar types of equipment. This form of demolition creates a great deal of dust, vibration and noise.

Typically, mechanical demolition yields a commingled pile of debris that can be quickly loaded and hauled away. However, this is not the case with the Aerovox building. If this type of demolition is used, then portions of the building's load bearing walls and framing that are contaminated with PCB's will require some form of mitigation (e.g., cleaning) prior to demolition. Otherwise, segregation of the contaminated (> 50 parts per million, ppm) and non-contaminated (< 50 ppm) material will be difficult if all the debris is commingled.

Given the need to keep contaminated and non-contaminated material separate, it is unlikely that this method of demolition is suitable for the Aerovox site.

2. Building Dismantlement

This form of demolition requires the building to be dismantled starting from the roof and working down. The sequencing of the dismantlement can only be determined after the engineering survey/structural analysis is completed. Since the building is contaminated with PCB's and potentially other contaminants (e.g.,

asbestos), the demolition workers will likely have to be outfitted in some form of PPE. The demolition equipment to be used will have to be able to work in localized areas in a controlled manner and the sequence of demolition operations will have to be accomplished in a way to keep the structure stable during dismantlement. The accumulated debris will need to be transferred to lower floor levels and segregated for processing and/or loading onto trucks for off-site disposal.

Demolition of the Aerovox building using this methodology will likely require temporary bracing of the exterior masonry walls prior to removal of the roof/floor above them. The bracing is required to provide lateral support for the temporarily cantilevered masonry walls after the floor or roof is removed from the top of that section of wall. Since the site visit of 21 November 2005 was not a comprehensive structural assessment or condition survey, the need for or location of temporary bracing or shoring has not yet been determined. For example, the limited observations made found cracked masonry in a stairwell that could change the type of temporary bracing for that particular location.

Demolition of exterior walls and floors must begin at the top of the structure and proceed downward. Some of the demolition criteria include:

- Masonry walls must not be permitted to fall on the floors of the building in masses that would exceed the safe carrying capacities of the floors.
- No wall section, one story in height or higher, shall be permitted to stand alone without lateral bracing, unless such a wall was originally designed and constructed to stand without such lateral support, and is safe enough to be self-supporting (this should be determined as a result of the engineering survey/structural analysis).
- All walls must be left in a stable condition at the end of each work shift.
- Structural or load-supporting members on any floor must not be cut or removed until all stories above such a floor have been removed.

The building dismantlement demolition methodology was successfully used at a PCB contaminated building site located in EPA Region 7 (Kansas City, Missouri). This seven-story, 159,600 square foot PCB contaminated building was demolished in early 2005 on a floor-by-floor basis, beginning at the roof and working downward. Building debris was conveyed to the ground floor through interior shafts and dust suppression and air monitoring was conducted during all phases of dismantlement and loading.

Sections of the Kansas City building's concrete and masonry that contained elevated levels of PCB's were marked, removed, and segregated, prior to dismantlement of non-contaminated sections of each floor. PCB contaminated debris was then loaded onto covered trucks and transported to an off-site disposal facility. Non-contaminated debris was also transported to an off-site disposal facility in covered trucks to keep dust down.

This same demolition methodology is also being considered at a second site in EPA Region 7 located in Kansas City, Missouri. This second building is a five-story concrete and brick warehouse structure contaminated with PCB's and scheduled for demolition in 2006. According to EPA Region 7 information, the proposed demolition approach is very similar "to the one very successfully used earlier this year..." at the seven-story building described above.

The means and methods used to dismantle the seven-story building in Kansas are provided below and can be used as a guide for the method of demolition of the Aerovox building.

1) Conduct structural analysis. This includes a structural analysis to determine the allowable loading at each floor level for the various types of equipment needed for dismantlement.
2) Develop and implement a Storm Water Mitigation Plan in the event of rain while dismantling the building. Runoff from a rain event could potentially contact PCB contaminated walls and floors during dismantlement. This runoff must be controlled and tested prior to discharges occurring at the site.
3) Develop a Dust Control and Water Containment Plan. Water misting will be the primary means of dust suppression. Water misting will occur prior to the initiation of breaking operations and continue through the breaking and stockpiling cycle until the debris is loaded onto the trucks for transfer. Water containment areas will be constructed around certain PCB contaminated areas and regular air monitoring will be performed. All water contacting contaminated portions of the building, including storm water runoff, should be collected, sampled, and treated, if necessary.
4) Demolition will take place from the roof down. All floor levels will have to be cleared of existing furniture, machinery, and inventory stockpiles for the possible placement of shoring and bracing. Temporary shoring of the exterior masonry walls of the Aerovox building will be required prior to dismantling operations on each floor. In addition, it may be necessary to provide temporary shoring of the timber floor decking for use by the demolition equipment. The temporary shoring and bracing will be moved to lower levels and demolition progresses. Laborers could use jackhammers, compressors, and other tools to remove the brick masonry and debris will be lowered to the ground floor through floor openings or chutes. Skid-steer bobcats could likely be used to temporarily stockpile and transport rubble for disposal. Substructure foundation walls and slabs could be removed using a conventional excavator and bucket and reduced in size with hydraulic breakers.
5) Waste segregation is required to eliminate commingling of the contaminated (>50 ppm) and non-contaminated (<50 ppm) debris. This is required because of the need for different disposal methods and facilities for the debris. The overall building dismantlement plan is dependent on a comprehensive survey of the various levels of contamination throughout the building and the identification of the specific areas, particularly those areas with

concentrations greater than 50 ppm. This will have a significant impact on the overall building dismantlement, as it requires a separation of the contaminated and non-contaminated waste streams. For example, separate vertical drop chutes and separate detachable buckets on loaders to eliminate cross-contamination of the debris piles may be required.

The Engineering Evaluation and Cost Analysis (EE/CA) conducted in 1998 by Blasland, Bouck & Lee, Inc. for the Aerovox site indicates that the timber flooring and concrete floor slabs can be removed first, and then the remainder of the building can be demolished using traditional mechanical demolition techniques such as a wrecking ball and excavators. This is a suitable demolition method provided that the brick masonry walls are not also contaminated above 50 ppm. Portions of the exterior brick walls and interior framing may contain elevated levels of PCB's which, if not effectively cleaned prior to demolition, will have to be segregated from the other debris for disposal. A preliminary demolition sequence for the Aerovox building is provided below:

Demolition Sequence	Comments
Phase 1	
1. Removal of all equipment, furniture, and other items not specifically attached to the building.	Required prior to any demolition occurring.
2. Separate and process these items at an off-site location.	
Phase 2	
1. Demolish the existing structure using building dismantlement methods.	Identify and mark areas greater than 50 ppm PCB contamination. Requires temporary bracing of masonry walls, possible shoring of the floors, and careful handling and transportation of debris during demolition.
2. Requires dust suppression such as water mist. Also requires the collection and treatment of any runoff.	Water misting should be performed as necessary to control the release of contaminated dust. All water contacting contaminated portions of the building including storm water runoff should be collected, sampled, and treated, if necessary.
Phase 3	
1. Debris from the building must be separated (based on the levels of PCB contamination).	All debris should be stored or transported in covered containers to minimize dust. Dust suppression is also required.
Phase 4	
1. Debris processing is required to make the non-contaminated debris manageable for use as on-site fill material or for transporting PCB contaminated debris to an off-site facility.	Off-Site Disposal: Removal of PCB contaminated (>50 ppm) debris will require covered transportation to an off-site facility for final processing. On-Site Disposal: On-site processing (pulverizing or grinding) of non-contaminated debris for use as fill will also require dust suppression.

Conclusions and Recommendations

The particular method of demolition is dependent on the extent of contamination within the building. As proposed by the EE/CA (1998) for the Aerovox building, the removal of the timber flooring and concrete slab can be accomplished first and then the remainder of the building demolished using a wrecking ball and crane. This method appears to be feasible provided an engineering structural analysis is accomplished and the exterior brick walls and interior steel framing have levels of PCB's less than 50 ppm. If not, then a more comprehensive method of building dismantlement may be required, such as what occurred at the PCB contaminated building in Kansas City.

Based on the successful completion of the demolition project of a PCB contaminated structure in EPA Region 7, the building dismantlement method of demolition is structurally feasible for the Aerovox building in New Bedford, Massachusetts, provided a structural analysis is accomplished identifying the need for temporary bracing and shoring.

Certain preliminary tasks must be accomplished prior to demolition. Any demolition must take into account numerous factors, including, but not limited, to the following issues:

i. Prior to any demolition (per EM 385-1-1, USACE Safety and Health Requirements Manual, section 23.A.01), an engineering survey of the structure must be accomplished to fully determine the structure layout, condition of framing, floors, walls, the possibility of unplanned collapse of any portion of the structure, and the existence of other potential or real demolition hazards. This engineering survey should be submitted by the Contractor to USACE for review and approval prior to demolition.

ii. A demolition plan based on the engineering survey must be accomplished describing the safe dismantling and removal of all building components and debris (including existing equipment and inventory presently stored within the building). This plan should include the sequence and methodology to be used, a description of any temporary bracing and shoring, and the specifics of a dust suppression plan. The plan should be submitted by the Contractor to USACE for review and approval prior to demolition.

References

1. Pers. comm. with Bob Field, Project Coordinator (field.robert@epa.gov) and Pauletta France-Isetts, Remedial Project Manager (france-isetts.pauletta@epa.gov).
2. Region 7 Fact Sheets – February 2005, November 2005, and September 2003
3. "Concepts for Reuse and Recycling of Construction and Demolition Waste", USACERL Technical Report 97/58, June 1999
4. "Demolition with Brokk" Handbook
5. "Selection of Methods for the Reduction, Reuse, and Recycling of Demolition Waste", Public Works Technical Bulletin 420-49-32, 16 July 2001
6. Wyandotte Design – Final, Burns & McDonnell Engineering Company, April 2004
7. Wyandotte Design – Amendment 1, Burns & McDonnell Engineering Company, October 2004
8. Engineering Evaluation and Cost Analysis for PCB Treatment, Inc., Burns & McDonnell Engineering Company, May 2000
9. PTI Wyandotte Building Completion of Removal Action Report, Hard Hat Services, Inc., August 2005
10. Engineering Evaluation and Cost Analysis for Aerovox, Inc., Blasland, Bouck & Lee, Inc., August 1998

Photo 1 – Exterior wall/pilaster at basement level.

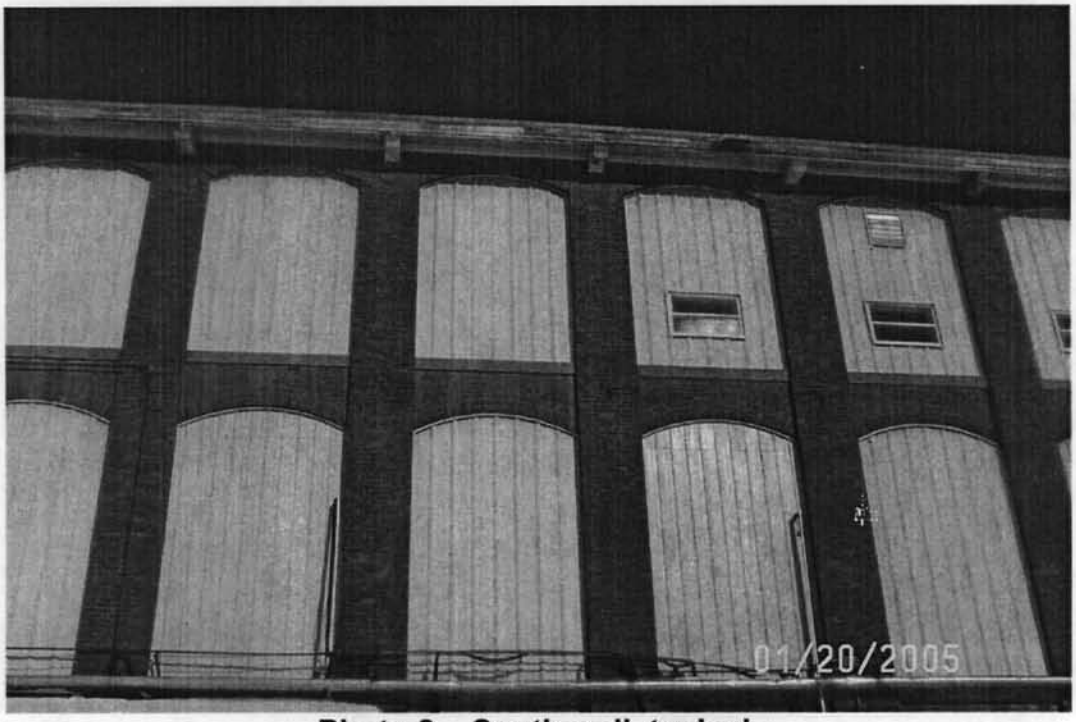

Photo 2 – South wall, typical.

Photo 3 – Typical interior connection at column. Note floor boards resting on sleepers above beam.

Photo 4 – Typical beam/pilaster connection. The beam rests on an angle attached to the wall.

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To Dave Dickerson/R1/USEPA/US@EPA
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Subject Aerovox Structural Assessment

Dave - Attached is the Aerovox Structural Assessment that John Kedzierski completed. I think there are scenarios presented in the assessment that probably don't apply to Aerovox because likely all of the building debris is classified as TSCA waste. I figured it didn't make sense to spend more effort and money on revising the assessment since it really tells us what we need to know in its current state which is there's a way to dismantle the building in a controlled manner. After reviewing the assesment, you believe we should revise it further, no problem. Let me know what you think.

Gary

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