KEWEENAW NATIONAL HISTORICAL PARK
QUINCY SMELTER SITE STRUCTURAL ASSESSMENT

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Statement of Purpose

The purpose of the Quincy Smelter site inspection was to provide structural engineering support services for Weston Associates in their asbestos abetment assessment for the National Park Service. The support services were conducted in the field on December 7 and 8, 2004. The attached report is a summary of the findings for each individual building along with structures that may impact those buildings in which asbestos abatement operations are to be performed. Structures in which asbestos abatement operations are not to be performed are not included in this report.

Site Description

The Quincy Smelter is located on the north bank of the Portage Ship Canal in Franklin Township, Houghton County, Michigan, near Hancock and Houghton, Michigan. The site consists of approximately 27 structures ranging in condition to excellent to poor from near-collapse.

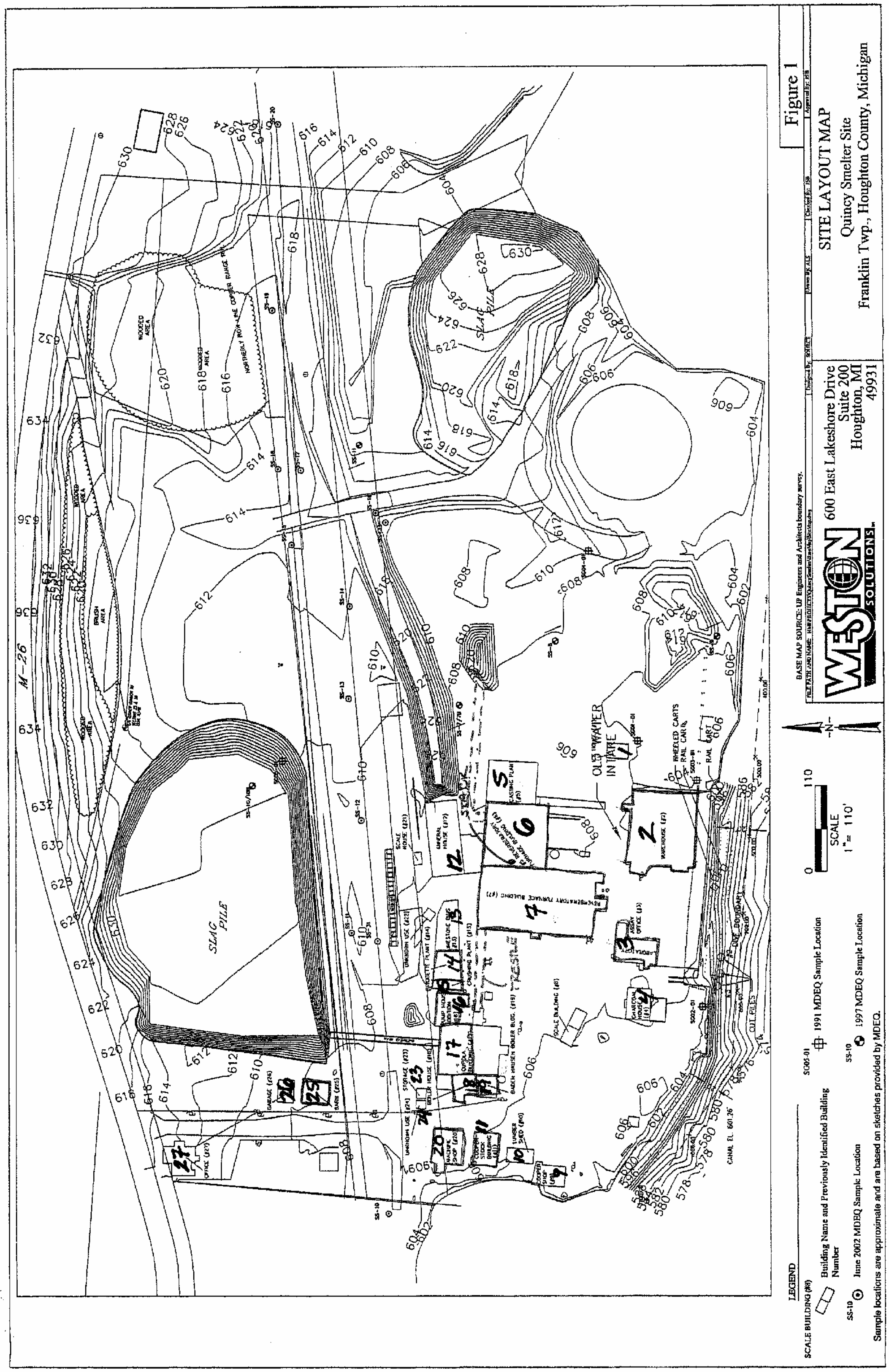
Notes on Structural Assessment

This report contains structural conditions of the Quincy Smelter site current as of December 8, 2004. Due to environmental and other effects the site may be significantly altered when asbestos removal operations are actually performed and it is recommended that a structural engineer perform an inspection at that time to verify that no significant changes to the structures have occurred. In addition, following the individual building structural remediation efforts, it is recommended that a structural engineer familiar with the site be on hand to witness the asbestos abatement operations to address any structural concerns during those efforts.

The descriptions and information contained within this report are limited in scope to those structures that could actually be verified as satisfactory. Structures that were deemed unsafe to enter were limited in their assessment to what could be verified from the outside of the building. The condition of structural members is limited to what could be seen by the naked eye from the finished floor elevation and no above ground survey was performed. Hidden defects may be present in structural members.

The structural assessment is limited to structures only and does not include notes regarding fall prevention, chemical, electrical, or tripping hazards, or other site safety aspects. Note that stairs, where they do exist, often do not have handrails and are not compliant with applicable building codes. It is not recommended that any existing ladders, catwalks, or stairs be used for personnel access. Where necessary, they should be replaced or shored as recommended in each building report.

Both the Reverberatory Stack and the Cupola Building pose a significant hazard to nearby buildings and personnel. It is recommended that both the Reverberatory Stack and the Cupola Building be remediated as recommended prior to asbestos abatement operations occuring in the affected areas as noted within this report.



Site Map, from Weston Solutions

Structural Condition Table

Structural Condition	Description
Good	Hazards are limited to loose corrugated metal siding or roof panels, loose window glass, and tripping hazards due to fallen material within the structure. The structural skeleton is in serviceable condition and poses a low risk of collapse.
Moderate	Hazards include those described above, plus the structure exhibits minor corrosion of structural elements due to weathering effects due to portions of failed cladding. Portions of the structural skeleton exhibit the potential for progression to structural failure and pose a medium risk to collapse.
Poor	Hazards include those described above, plus the structure displays a high probability of collapse of structural roof members, walls, or the structural skeleton. Structures described as poor are missing a significant portion of exterior cladding, rendering the structure highly vulnerable to continued deterioration due to environmental effects.

Building Name & Photos
Dockside Warehouse


(Left) Figure 1: Dockside Warehouse, west side, showing stair access
(Right) Figure 2: Dockside Warehouse, east wall, showing collapsed shed portion

Building Description
The Dockside Warehouse is a two story post and beam construction wood warehouse. The upper floor is a combination of concrete and wood decking.

Building Assessment
The overall building is in moderate condition with localized roof and wall failure of the east shed addition. The second story extension on the east side of the main building is unsupported from below due to the shed collapse. This building's condition is threatened by its location relative to the Reverberatory Furnace Bypass Stack.

Building Remediation Efforts Required for Asbestos Abatement
Perform Reverberatory Furnace Bypass Stack remediation prior to commencement of asbestos abatement in this structure.

Remove loose corrugated metal roofing and patch any open roof openings, remove loose window glass, and provide temporary shoring to any stairs used during abatement operations. Remove east side shed addition for access to asbestos under collapsed roof.

The east side shed addition and the cantilevered extension should have temporary support of the east line wall (seen in figure 2, above) during removal of the collapsed roof. The east line wall may either remain supported during abatement operations or may be demolished prior to asbestos removal. If the cantilevered extension and the shed wall are braced temporarily, the temporary support may be removed after asbestos abatement and the wall allowed to fall naturally or the wall may be demolished.

If the building is to be preserved for future access, construction of a wood frame wall along the east side of the structure is recommended prevent weather damage of the structure.

Building Name & Photos
Laboratory

(Left) Figure 3: Laboratory, east side
(Right) Figure 4: Laboratory, south wall showing below grade portion and south wall

Building Description
The Laboratory is a two story post and beam construction wood framed structure with one story below grade supported on concrete walls and footings.

Building Assessment
The overall building is in moderate condition with localized wall failure of the south portion of the low wall as seen in figure 4, above. This building's condition is threatened by its location relative to the Reverberatory Furnace Bypass Stack.

Building Remediation Efforts Required for Asbestos Abatement
Perform Reverberatory Furnace Bypass Stack remediation prior to commencement of asbestos abatement in this structure.

Remove loose corrugated metal roofing and patch any open roof openings, and remove loose window glass. Provide temporary support of the south side wall that is buckling inward during any abatement operations in the room immediately adjacent to the wall. Remove loose brick from the west side chimney to prevent loose bricks from falling during abatement operations adjacent to the chimney.

If the building is to be preserved for future access either a replacement load bearing wall should be constructed for the south wall that is buckling inward or the wall should be shimmed to prevent further movement of the wall inward.

<u>Building Name & Photos</u>
Casting Plant

(Left) Figure 5: Casting Plant, south side, showing failed windows and intact south roof
(Right) Figure 6: Casting Plant, north wall, showing deteriorated roof and window framing

<u>Building Description</u>
The Casting Plant is a large steel framed structure with a corrugated steel roof.

<u>Building Assessment</u>
This structure was not entered due to hazardous conditions present at the time of inspection. Based on an exterior examination of the structure the overall building is in poor condition with many missing roof and window panels. The structural skeleton appears to have experienced localized corrosion of structural members that do not appear to immediately threaten the stability of the structure. This building's condition is threatened by its location relative to the Reverberatory Furnace Bypass Stack.

<u>Building Remediation Efforts Required for Asbestos Abatement</u>
Perform Reverberatory Furnace Bypass Stack remediation prior to commencement of asbestos abatement in this structure.

Remove loose corrugated metal siding and roofing and loose window glass. Remove loose timbers from trestle on north side of structure if abatement personnel will require access within 10 feet of trestle. Do not perform abatement operations in winds of excess of 15 miles per hour.

Building Name & Photos
No. 5 Reverberatory Furnace Building

Figure 7: No. 5 Reverberatory Furnace Building (located in the center of the photo), south side, showing failed windows and intact south roof

Building Description
The No. 5 Reverberatory Furnace Building is a large steel framed structure with a corrugated steel roof.

Building Assessment
This structure was not entered due to hazardous conditions present at the time of inspection. Based on an exterior examination of the structure the overall building is in poor condition with many missing roof and window panels. The structural skeleton appears to have experienced localized corrosion of structural members that do not immediately threaten the structure. This building's condition is threatened by its location relative to the Reverberatory Furnace Bypass Stack.

Building Remediation Efforts Required for Asbestos Abatement
Perform Reverberatory Furnace Bypass Stack remediation prior to commencement of asbestos abatement in this structure.

Remove loose corrugated metal siding and roofing and loose window glass. Remove loose timbers from trestle on north side of structure if abatement personnel will require access within 10 feet of trestle. Do not perform abatement operations in winds of excess of 15 miles per hour.

<u>Building Name & Photos</u>
Reverberatory Furnace Building


(Left) Figure 8: Reverberatory Furnace Building (located to the left of the photo), south side, showing failed windows and intact south roof
(Right) Figure 9: Reverberatory Furnace Building, inteior looking south

<u>Building Description</u>
The Reverberatory Furnace Building is a large steel framed structure with a corrugated steel roof.

<u>Building Assessment</u>
The overall building is in poor condition with many missing roof and window panels on the structure. The structural skeleton appears to have experienced localized corrosion of structural members that do not immediately threaten the structure. The interior stack is precariously resting against roof members and threatens the building structure. This building's condition is threatened by its location relative to the Reverberatory Furnace Bypass Stack.

<u>Building Remediation Efforts Required for Asbestos Abatement</u>
Perform Reverberatory Furnace Bypass Stack remediation prior to commencement of asbestos abatement in this structure.

Remove loose corrugated metal siding and roofing and loose window glass. Remove loose timbers from trestle on north side of structure if abatement personnel will require access within 10 feet of trestle. Do not perform abatement operations in winds of excess of 15 miles per hour.

Provide temporary shoring of the interior stack or remove the interior stack prior to commencement of asbestos abatement in this structure. If catwalks are to be used or are located within 10 feet of asbestos abatement operations the catwalks should undergo a structural assessment, be shored or removed.

Building Name & Photos
Cooper Stock Building

(Left) Figure 10: Cooper Stock Building, east wall
(Right) Figure 11: Cooper Stock Building, interior stairwell

Building Description
The Cooper Stock Building is a two-story wood framed structure with a corrugated steel roof.

Building Assessment
The overall building is in good condition with an intact roof and very little loose material present.

Building Remediation Efforts Required for Asbestos Abatement
Remove loose corrugated metal siding and roofing and loose window glass if present at the time of abatement operations.

Building Name & Photos
Briquette Plant

(Left) Figure 12: Briquette Plant (right side of photo) looking at east and north walls
(Right) Figure 13: Briquette Plant, south wall, showing trestle on south side of wall

Building Description
The Briquette Plant is a two story masonry/sandstone bearing wall structure with a corrugated metal roof.

Building Assessment
The overall building is in poor condition with many missing roof and window panels on the north side of the structure. The structural skeleton appears unstable with localized failure of roof and upper floor structural members. Numerous mechanical components are still in the building that are either hung from the unstable roof, upper floor, or the walls of the structure. This building's condition is threatened by its location relative to the Reverberatory Furnace Bypass Stack.

Building Remediation Efforts Required for Asbestos Abatement
Perform Reverberatory Furnace Bypass Stack remediation prior to commencement of asbestos abatement in this structure.

Remove loose corrugated metal roofing, first floor timber beams and planks, mechanical components that will have asbestos abatement personnel under those components, and loose window glass. Provide temporary shoring of north masonry/stone wall. Remove loose timbers from trestle on south side of structure if abatement personnel will require access within 10 feet of trestle. Do not perform abatement operations in winds of excess of 15 miles per hour.

Building Name & Photos
Crushing Plant

(Left) Figure 14: Crushing Plant (left side of photo, behind electrical structure), south wall, showing trestle on south side of wall

Building Description
The Crushing Plant is a two story masonry/sandstone bearing wall structure with a corrugated metal roof.

Building Assessment
The interior of the structure could not be accessed due to safety concerns with the sole access ladder through the Briquette Plant. Assessment is based upon the study of the adjacent Briquette Plant.

The overall building is in poor condition with many missing roof and window panels on the north side of the structure. The structural skeleton appears to be in poor condition with localized failure of roof and upper floor structural members. This building's condition is threatened by its location relative to the Reverberatory Furnace Bypass Stack.

Building Remediation Efforts Required for Asbestos Abatement
Perform Reverberatory Furnace Bypass Stack remediation prior to commencement of asbestos abatement in this structure. Perform Briquette Plant remediation prior to asbestos abatement operations in this structure. The ladder access from the Briquette Plant should be avoided and replaced with a new (temporary) ladder.

Remove loose corrugated metal roofing, first floor timber beams and planks, mechanical components that will have asbestos abatement personnel under those components, and loose window glass. Provide temporary shoring of north masonry/stone wall. Remove loose timbers from trestle on south side of structure if abatement personnel will require access within 10 feet of trestle. Do not perform abatement operations in winds of excess of 15 miles per hour.

Building Name & Photos
Pump House

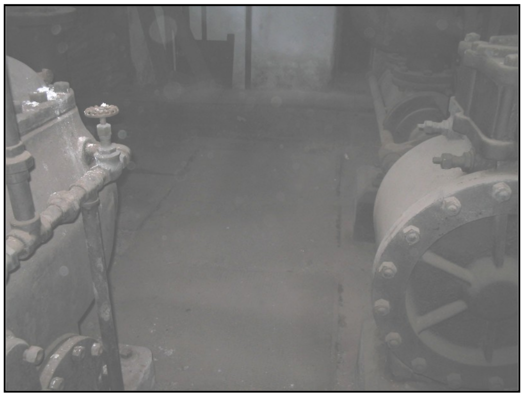


Figure 15: Pump House, interior, plate in floor

Building Description
The Pump House is a single story masonry/sandstone bearing wall structure with a corrugated metal roof.

Building Assessment
The overall building is in good condition with an almost complete roof structure. This structure is threatened by the adjacent Copula Building.

Building Remediation Efforts Required for Asbestos Abatement
Perform Reverberatory Furnace Bypass Stack remediation prior to commencement of asbestos abatement in this structure. Perform Briquette Plant remediation prior to asbestos abatement operations in this structure.

Remove loose corrugated metal roofing and loose window glass if present at the time of asbestos remediation efforts. Provide temporary shoring of pipes that will undergo asbestos abatement operations. Remove loose timbers from trestle on south side of structure if abatement personnel will require access within 10 feet of trestle.

<u>Building Name & Photos</u>
Cupola Building

(Left) Figure 16: Cupola Building, South wall
(Right) Figure 17: Cupola Building, interior roof of north side of structure

<u>Building Description</u>
The Cupola Building is a multi-story masonry/sandstone bearing wall structure with a corrugated metal roof on the south portion of the structure and a steel truss supported concrete roof on the north portion of the structure.

<u>Building Assessment</u>
The overall building is in poor condition with localized roof and wall failure of the south roof and wall. No interior assessment of the south portion of the building was performed due to hazardous conditions as the structural skeleton appears to have experienced localized failure of structural members that threaten the structure and those in the vicinity. North portion of structure is in good condition.

<u>Building Remediation Efforts Required for Asbestos Abatement</u>

Remove loose corrugated metal roofing and loose window glass if present in the area of asbestos abatement operations. Provide temporary shoring of east, west, and south walls that are unsupported due to roof failure and remove loose blocks from top of wall. If any loads are to be placed on the existing timber floor opening covers it is recommended that the covers be replaced with a structural plate capable of carrying the applied load. Do not perform abatement operations in winds of excess of 15 miles per hour.

Building Name & Photos
Boiler House


(Left) Figure 18: Boiler House, west wall
(Right) Figure 19: Interior of Boiler House, looking east - sandstone wall is shared with the cupola building

Building Description
The Boiler House is a single story combination steel frame with corrugated metal siding and masonry/sandstone bearing wall structure with a corrugated metal roof.

Building Assessment
The overall building is in poor condition with localized roof and wall failure of the north and west roof and wall and loose window glass. The structural skeleton appears to have experienced localized corrosion of structural members that do not immediately threaten the structure. Window in the common wall with the Cupola Building has a failing arch. Numerous mechanical components and catwalks remain in this structure that exhibit corrosion due to exposure to the environment. This structure is threatened by the adjacent Copula Building.

Building Remediation Efforts Required for Asbestos Abatement
Remove loose corrugated metal roofing, mechanical components that will have asbestos abatement personnel under those components, and loose window glass. Provide temporary shoring of unsupported walls due to roof failure and remove loose blocks from top of wall. Provide temporary shoring of window opening in east wall that is common with the Cupola Building. Do not perform abatement operations in winds of excess of 15 miles per hour.

Building Name & Photos
Baden Hausen Boiler Building

(Left) Figure 20: Baden Hausen Boiler Building, west wall
(Right) Figure 21: Baden Hausen Boiler Building (left portion of photo), south wall - sandstone wall is the cupola building

Building Description
The Baden Hausem Bioler Building is a single story reinforced concrete bearing wall structure with a corrugated metal roof.

Building Assessment
The overall building is in good condition with loose corrugated metal roof panels and loose window glass. Both the building and the reinforced concrete stack appear to be in good shape with localized spalling of concrete revealing exposed reinforcing steel. This structure is threatened by the adjacent Copula Building.

Building Remediation Efforts Required for Asbestos Abatement
Remove loose corrugated metal roofing, mechanical components that will have asbestos abatement personnel under those components, and loose window glass. Remove wood walkway planks that are above the finished floor elevation. Do not perform abatement operations until building remediation efforts for the Boiler House are complete.

Building Name & Photos
Machine Shop

(Left) Figure 22: Machine Shop, east wall
(Right) Figure 23: Machine Shop, north wall

Building Description
The Machine Shop is a single story sandstone structure with an upper loft consisting of structural steel and wood frame flooring members.

Building Assessment
The overall building is in good condition with loose corrugated metal roof panels and broken window glass. The north side chimney appears to be tilting to the east and may be in danger of collapse.

Building Remediation Efforts Required for Asbestos Abatement
Remove loose corrugated metal roofing, loose window glass, and loose brick from the top of the chimney.

Building Name & Photos
Barn

Figure 24: Barn, west wall

Building Description
The Barn is a two story wood frame structure with corrugated metal roof panels. The structure is attached to the adjacent Garage structure with three cables (to the left in Figure 24, above), apparently to prevent collapse of the Garage.

Building Assessment
The overall building is in good condition with loose corrugated metal roof panels and broken window glass. It is endangered by the potential for collapse of the adjacent Garage structure due to the attachment of the Garage to the Barn.

Building Remediation Efforts Required for Asbestos Abatement
Remove loose corrugated metal roof panels and broken glass. It is recommended that continuous monitoring of the cable attachments of this structure to the adjacent garage is maintained during asbestos abatement operations. If it appears that the Garage is in imminent danger of collapse the cables should be removed to prevent either the failure of the garage from damaging the barn or cable breakage injuring nearby personnel. Removal of the cable attachments to the Garage may lead to failure of the Garage, in which case temporary shoring of the Garage is recommend to prevent the failure of that structure.

Structure Name & Photos
Trestle


Figure 25: Trestle on northeast side of Casting Plant
Figure 26: Trestle on south side of Briquette Building

Structure Description
The trestle is a structural steel track structure in numerous locations throughout the site.

Structure Assessment
The trestle is in moderate condition, with structural steel members removed or damaged in various locations. As the trestle will not experience the full design load during the reaming lifetime of the structure it is anticipated that the few damaged or missing structural members pose a low risk to life or the trestle.

Structure Remediation Efforts Required for Asbestos Abatement
No asbestos is required to be removed from the trestle, however the structure is included in this report as asbestos abatement personnel will be working in the vicinity of the structure. It is recommended that loose ties or other loose portions of the structure be removed in the area of personnel access prior to working adjacent to the trestle.

Structure Name & Photos
Stack

Figure 27: Stack, looking north
Figure 28: Stack, Close-up looking north, indicating slackness in cables and overall tilt of stack

Structure Description
The stack is a strctural steel with firebrick stack near the Reverberatory Blast Furnace

Structure Assessment
The stack is in extremely poor condition and in danger of imminent collapse. The three remaining guy wires are slack and it appears that loose bricks continue to fall from the structure. The stack is visibly leaning to the north and the foundation of the stack may be in poor condition, although this could not be verified due to the dangerous conditions in the immediate vicinity of the foundation. The base of the stack was observed as resting on four lattice (built-up) columns which may be in various states of corrosion based upon the general condition of other structural steel members in the vicinity.

Structure Remediation Efforts Required for Asbestos Abatement
No asbestos is required to be removed from the stack; however abatement efforts in adjacent structures are impacted due to the poor condition of the structure. None of the remediation efforts proposed in the 2002 report by the International Chimney Corporation have been enacted, including roping off the adjacent area the posting of warning sings.

It is strongly recommended that the remediation efforts in the 2002 report by the International Chimney Corporation be followed prior to any work occurring in the adjacent structures that lie within the failure radius of the stack. It is recommended that if the stack remains in place that the four lattice foundation columns be strengthened by welding additional plates on the columns.

Conclusions

This report contains descriptions of structural conditions at the Quincy Smelter site observed on of December 7 and 8, 2004. Due to environmental and other effects the site may be significantly altered when asbestos abatement operations are actually performed and it is recommended that a structural engineer perform an inspection immediately prior to asbestos abatement to verify that no further significant changes to the structures have occurred.

In addition to following the individual building structural remediation efforts, prior to performing asbestos abatement operations it is recommended that a structural engineer familiar with the site be on hand to witness the asbestos abatement operations to address any structural concerns during those efforts.

It is imperative that structural remediation of the stack be completed prior to asbestos abatement operations begin in the area of the stack due to the hazards presented by its potential for failure. The author of this report agrees with the conclusions of the attached International Chimney Corporation report of 2002 regarding the structural stability of the stack.