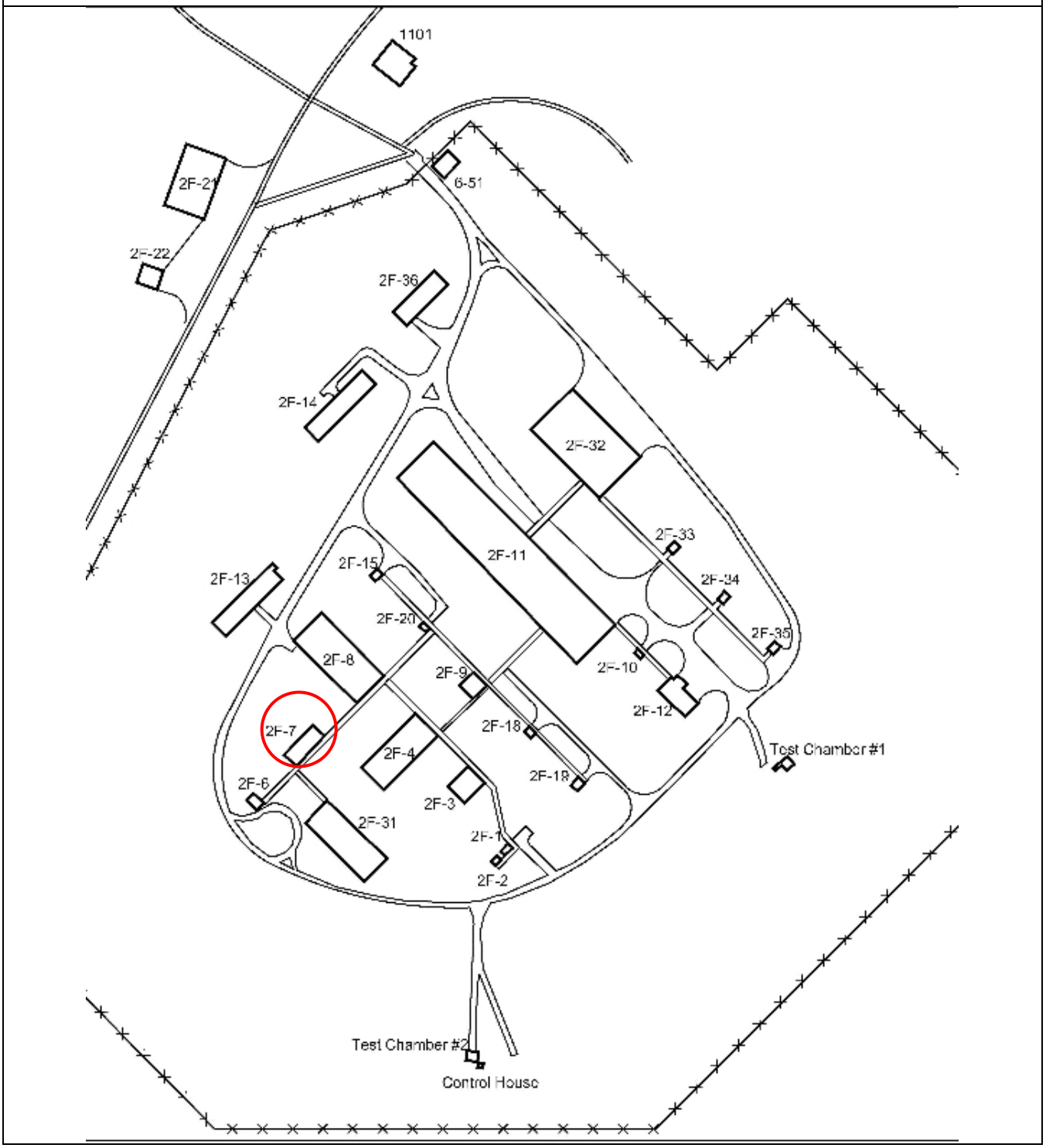
Property Owner:	Department of the Army BRAC Technical Support Office Rock Island Arsenal, Rock Island, IL	Site	Load Line 6
		Building Number	2F-7
Facility Address:	Ravenna Army Ammunition Plant 8451 St. Route 5 Ravenna, OH 44266	Function	Powder Pelleting
		Date of Inspection:	07/08/05

Building Location



Building Exterior

Picture of building

Historical Archive Search Results and Preliminary Visual Inspection

One story concrete and brick structure on concrete slab with transite roof.

Area of Building Footprint (sq. ft.): 1277

Wall Inspection Information

Wall Material	Concrete	Cinder Block	Brick	Metal	Wood Frame	Steel Frame
Interior Walls	☒	☐	☐	☐	☐	☐
Exterior Walls	☐	☐	☒	☐	☐	☐

Are Surfaces Painted : ☒Yes ☐ No If Yes, Was Peeling of Paint Observed: ☒Yes ☐ No

Observations/Comments: None

Visible Explosives Present: ☐Yes ☒ No If Yes identify location below.

Location: NA

Thickness of wall construction material > 1/8" ☒Yes ☐No If Yes answer below:

Are Cracks, Crevices, Openings bigger than a hairline: ☒Yes ☐No

Entrapment of Explosive Residues in Cracks, Crevices, or Openings observed: ☐Yes ☒No

Other suspect surfaces present that are not accessible for Visual Inspection: ☐Yes ☒No

For hollow wall construction (i.e. tile), is internal examination needed at wall penetrations or suspect areas? ☐Yes ☒No ☐NA

If yes, identify location and report findings below:

Observations/Notes: None

Roof Inspection Information

Pictures of roof inside and outside of building

Roof Type	☒ Transite Panels	☐ Shingled	☐ Tar	☐ Concrete	☒ Removed
Roof Frame	☐ Wood	☒ Steel			
Roof Condition :	☐ Intact	☐ Holes or Openings Observed	☐ Collapsed and Unsafe	☒ Removed	
Visible Explosives Present on interior roof framing or ceiling:	☐Yes	☒ No	If Yes, identify location below.		
Location: NA					
Suspect surfaces present that are not accessible for Visual Inspection:	☐Yes	☒No			
Other Observations/Notes:					

Floor Inspection Information

Floor Type	☒Concrete	☐Wood	☐Steel	☐Other
Floor Liner	☐Lead	☐Rubber	☐Composite	☒None

Visible Explosives Present: ☐Yes ☒No If yes identify location below.

Location: NA

Number of floor drains in building __0__ Visible Explosives in floor drain: ☐Yes ☐No ☒NA If yes, identify location below.

Location NA

Thickness of liner > 1/8" ☐Yes ☐No ☒NA If Yes to either answer below:

Are Slab Cracks, Crevices, Openings bigger than a hairline: ☒Yes ☐No

Are floor liner Cracks, Crevices, Openings bigger than a hairline: ☐Yes ☐No ☒NA

Entrapment of Explosive Residues in Cracks, Crevices, or Openings observed in floor slab. ☐Yes ☒No

Entrapment of Explosive Residues in Cracks, Crevices, or Openings observed in floor liner. ☐Yes ☐No ☒NA

Suspect surfaces present that are not accessible for Visual Inspection. ☐Yes ☒No

Other Observations/Notes: None

Process Equipment and Piping Inspection Information			
Process Piping Present ☐Yes ☒No	Process Equipment Present ☐Yes ☒No	Number of Sumps Present 0	Sump Water Present ☐Yes ☐No ☒ NA
Has Sump Water been Analyzed by Lab: ☐ Yes ☐No ☒ NA			
** Attach sump water sample results to Inspection form as applicable			
Visible Explosives Present on Process Equipment/Piping: ☐Yes ☐No ☒ NA			
Visible Explosives Present in Sumps: ☐Yes ☐No ☒NA			
Observations/Notes: None			

Non-process Equipment and Piping Inspection Information

Steam lines present ☒Yes ☐No Water Lines present ☒Yes ☐No ☒Other (identify below)

Description of other Fixtures: Ventilation System

Sump(s) present ☐Yes ☒No Sump Water present ☐Yes ☐No ☒ NA

Visible explosives present on non process piping/equipment ☐Yes ☒No ☐ NA

Visible Explosives Present in sump(s) ☐Yes ☐No ☒ NA

Observations/Notes: None

Non Explosive Hazards of Concern	
☒	Residual Peeling Paint Chips on the Walls, Equipment and Piping, and Structural Members
☐	Observation of animal droppings and miscellaneous debris on floor of buildings
☐	Asbestos Containing Material (Transite, Utility Pipe Insulation, lighting fixtures, etc.)
☐	Overhead Conveyors and Belt Systems, and Elevators
☐	Mercury Switches
☐	PCB Light Ballast
☐	Physical Safety Hazard from Removed or Damaged Building Structural Members
☐	Other (please explain)

Type of Demo Required Based on above Observations (please explain):

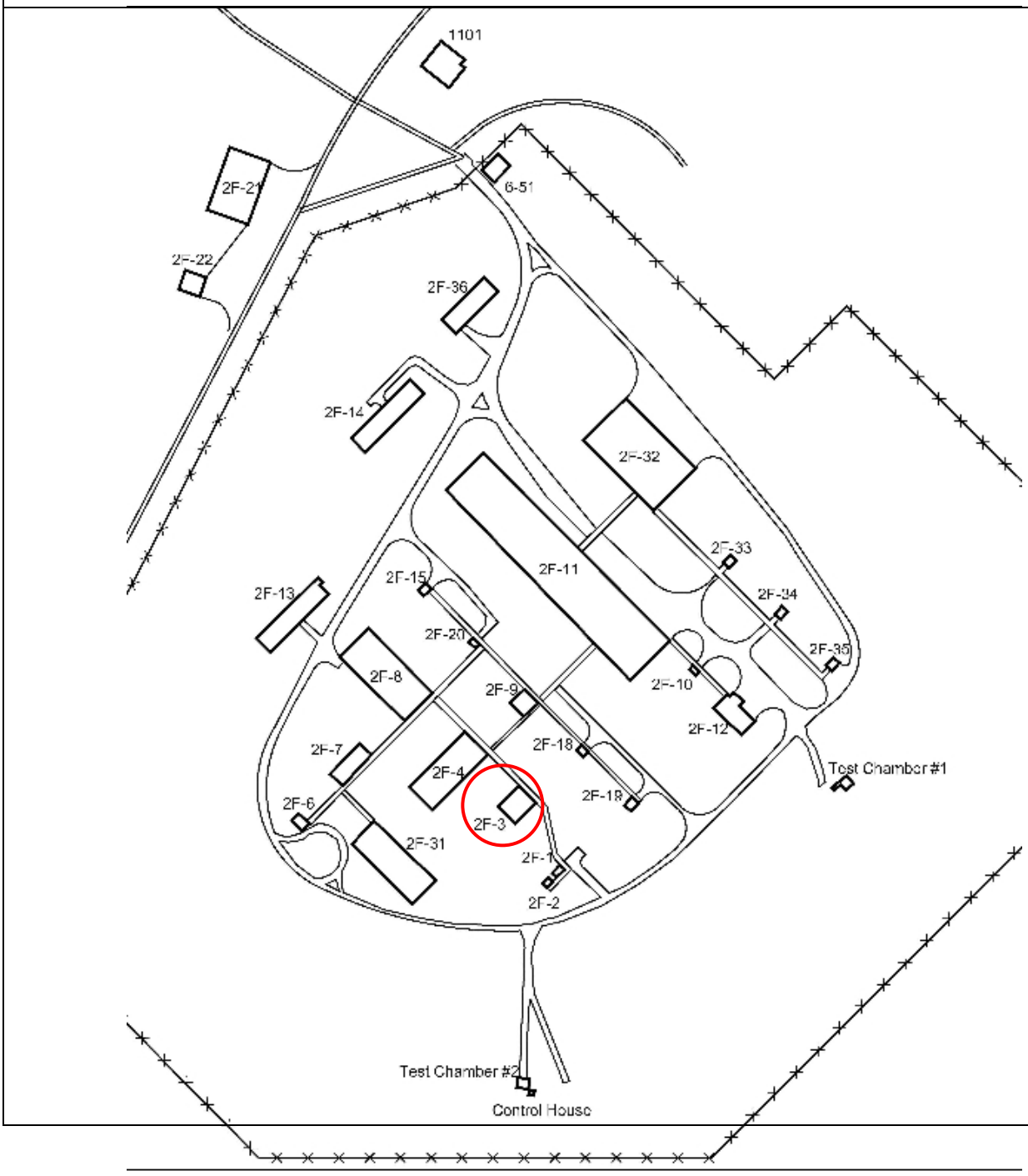
☐ **Thermal Decomposition**	☒ **Demo with Engineering Controls**	☐ **Conventional Demo**

Conclusions: No process equipment or bulk/visible explosives present. Recommend demolition using hardened earth moving machinery as added safety measure. Follow the established demolition procedures and follow-on inspection requirements prescribed in the approved RVAAP ESS.

Comments			
Data Engineer	Brian Stockwell	***UXO Safety Officer***	Fran McDevitt

Property Owner:	Department of the Army BRAC Technical Support Office Rock Island Arsenal, Rock Island, IL	Site	Load Line 6
		Building Number	2F-3
Facility Address:	Ravenna Army Ammunition Plant 8451 St. Route 5 Ravenna, OH 44266	Function	Fulminate Mix House
		Date of Inspection:	07/08/05

Building Location



Building Exterior

Historical Archive Search Results and Preliminary Visual Inspection

Small one story concrete and brick structure on concrete slab with transite roof.

Area of Building Footprint (sq. ft.): 1207

Wall Inspection Information

Wall Material	Concrete	Cinder Block	Brick	Metal	Wood Frame	Steel Frame
Interior Walls	☒	☐	☐	☐	☐	☐
Exterior Walls	☐	☐	☒	☐	☐	☐

Are Surfaces Painted : ☒Yes ☐ No If Yes, Was Peeling of Paint Observed: ☒Yes ☐ No

Observations/Comments:

Visible Explosives Present: ☐Yes ☒ No If Yes identify location below.

Location:

Thickness of wall construction material > 1/8" ☒Yes ☐No If Yes answer below:

Are Cracks, Crevices, Openings bigger than a hairline: ☒Yes ☐No

Entrapment of Explosive Residues in Cracks, Crevices, or Openings observed: ☐Yes ☒No

Other suspect surfaces present that are not accessible for Visual Inspection: ☐Yes ☒No

For hollow wall construction (i.e. tile), is internal examination needed at wall penetrations or suspect areas? ☐Yes ☒No ☐NA

If yes, identify location and report findings below:

Roof Inspection Information

Roof Type	☒ Transite Panels	☐ Shingled	☐ Tar	☐ Concrete	☒ Removed
Roof Frame	☐ Wood	☒ Steel			
Roof Condition :	☐ Intact	☐ Holes or Openings Observed	☐ Collapsed and Unsafe	☒ Removed	
Visible Explosives Present on interior roof framing or ceiling:	☐Yes	☒ No	If Yes, identify location below.		
Location: NA					
Suspect surfaces present that are not accessible for Visual Inspection:	☐Yes	☒No			

Floor Inspection Information

Floor Type	☒Concrete	☐Wood	☐Steel	☐Other
Floor Liner	☒Lead	☐Rubber	☐Composite	☐None

Visible Explosives Present: ☐Yes ☒No If yes identify location below.

Location: NA

Number of floor drains in building __0__ Visible Explosives in floor drain: ☐Yes ☐No ☒NA If yes, identify location below.

Location NA

Thickness of liner > 1/8" ☒Yes ☐No ☐NA If Yes to either answer below:

Are Slab Cracks, Crevices, Openings bigger than a hairline: ☒Yes ☐No

Are floor liner Cracks, Crevices, Openings bigger than a hairline: ☐Yes ☒No ☐NA

Entrapment of Explosive Residues in Cracks, Crevices, or Openings observed in floor slab. ☐Yes ☒No

Entrapment of Explosive Residues in Cracks, Crevices, or Openings observed in floor liner. ☐Yes ☐No ☒NA

Suspect surfaces present that are not accessible for Visual Inspection. ☐Yes ☒No

Other Observations/Notes: Lead Lined floor trough leads to outside sump which has been removed.

Process Equipment and Piping Inspection Information			
Process Piping Present ☐Yes ☒No	Process Equipment Present ☐Yes ☒No	Number of Sumps Present ___1 - removed___	Sump Water Present ☐Yes ☐No ☒ NA
Has Sump Water been Analyzed by Lab: ☐ Yes ☐No ☒ NA			
** Attach sump water sample results to Inspection form as applicable			
Visible Explosives Present on Process Equipment/Piping: ☐Yes ☐No ☒ NA			
Visible Explosives Present in Sumps: ☐Yes ☐No ☒NA			
Observations/Notes: Sump removed during previous demolition operations at the load Line.			

Non-process Equipment and Piping Inspection Information

Steam lines present ☒Yes ☐No Water Lines present ☒Yes ☐No ☒Other (identify below)

Description of other Fixtures: Ventilation System

Sump(s) present ☐Yes ☒No Sump Water present ☐Yes ☐No ☒ NA

Visible explosives present on non process piping/equipment ☐Yes ☒No ☐ NA

Visible Explosives Present in sump(s) ☐Yes ☐No ☒ NA

Observations/Notes: None

Non Explosive Hazards of Concern	
☒	Residual Peeling Paint Chips on the Walls, Equipment and Piping, and Structural Members
☐	Observation of animal droppings and miscellaneous debris on floor of buildings
☐	Asbestos Containing Material (Transite, Utility Pipe Insulation, lighting fixtures, etc.)
☐	Overhead Conveyors and Belt Systems, and Elevators
☐	Mercury Switches
☐	PCB Light Ballast
☐	Physical Safety Hazard from Removed or Damaged Building Structural Members
☐	Other (please explain)

Type of Demo Required Based on above Observations (please explain):

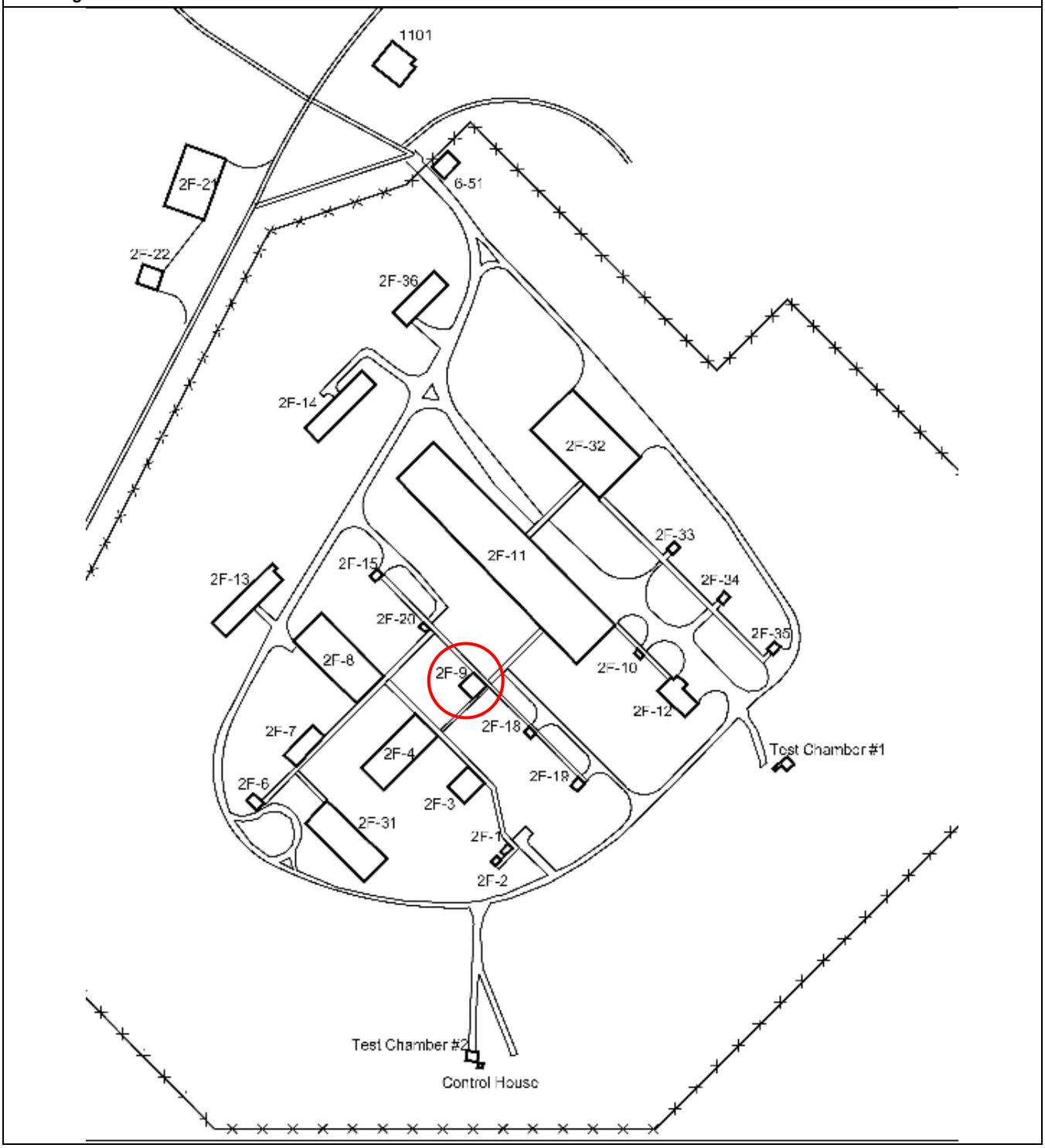
☐ **Thermal Decomposition**	☒ **Demo with Engineering Controls**	☐ **Conventional Demo**

Conclusions: No process equipment or bulk/visible explosives present. Recommend demolition using hardened earth moving machinery as added safety measure. Follow the established demolition procedures and follow-on inspection requirements prescribed in the approved RVAAP ESS.

Comments			
Data Engineer	Brian Stockwell	***UXO Safety Officer***	Fran McDevitt

Property Owner:	Department of the Army BRAC Technical Support Office Rock Island Arsenal, Rock Island, IL	Site	Load Line 6
		Building Number	2F-9
Facility Address:	Ravenna Army Ammunition Plant 8451 St. Route 5 Ravenna, OH 44266	Function	Primer Dry House
		Date of Inspection:	07/08/05

Building Location



Building Exterior

Historical Archive Search Results and Preliminary Visual Inspection

Small one story concrete and brick structure on concrete slab with transite roof.

Area of Building Footprint (sq. ft.): 640

Wall Inspection Information

Wall Material	Concrete	Cinder Block	Brick	Metal	Wood Frame	Steel Frame
Interior Walls	☒	☐	☐	☐	☐	☐
Exterior Walls	☐	☐	☒	☐	☐	☐

Are Surfaces Painted : ☒Yes ☐ No If Yes, Was Peeling of Paint Observed: ☒Yes ☐ No

Observations/Comments: None

Visible Explosives Present: ☐Yes ☒ No If Yes identify location below.

Location: NA

Thickness of wall construction material > 1/8" ☒Yes ☐No If Yes answer below:

Are Cracks, Crevices, Openings bigger than a hairline: ☒Yes ☐No

Entrapment of Explosive Residues in Cracks, Crevices, or Openings observed: ☐Yes ☒No

Other suspect surfaces present that are not accessible for Visual Inspection: ☐Yes ☒No

For hollow wall construction (i.e. tile), is internal examination needed at wall penetrations or suspect areas? ☐Yes ☒No ☐NA

If yes, identify location and report findings below:

Observations/Notes: None

Roof Inspection Information

Roof Type	☒ Transite Panels	☐ Shingled	☐ Tar	☐ Concrete	☒ Removed
Roof Frame	☐ Wood	☒ Steel			
Roof Condition :	☐ Intact	☐ Holes or Openings Observed	☐ Collapsed and Unsafe	☒ Removed	
Visible Explosives Present on interior roof framing or ceiling:	☐Yes	☒ No	If Yes, identify location below.		
Location: NA					
Suspect surfaces present that are not accessible for Visual Inspection:	☐Yes	☒No			
Other Observations/Notes: None					

Floor Inspection Information

Floor Type	☒Concrete	☐Wood	☐Steel	☐Other
Floor Liner	☐Lead	☐Rubber	☐Composite	☒None

Visible Explosives Present: ☐Yes ☒No If yes identify location below.

Location: NA

Number of floor drains in building _0_ Visible Explosives in floor drain: ☐Yes ☐No ☒NA If yes, identify location below.

Location: NA

Thickness of liner > 1/8" ☐Yes ☐No ☒NA If Yes to either answer below:

Are Slab Cracks, Crevices, Openings bigger than a hairline: ☒Yes ☐No

Are floor liner Cracks, Crevices, Openings bigger than a hairline: ☐Yes ☐No ☒NA

Entrapment of Explosive Residues in Cracks, Crevices, or Openings observed in floor slab. ☐Yes ☒No

Entrapment of Explosive Residues in Cracks, Crevices, or Openings observed in floor liner. ☐Yes ☐No ☒NA

Suspect surfaces present that are not accessible for Visual Inspection. ☐Yes ☒No

Other Observations/Notes: None

Process Equipment and Piping Inspection Information			
Process Piping Present ☐Yes ☒No	Process Equipment Present ☐Yes ☒No	Number of Sumps Present 0	Sump Water Present ☐Yes ☒No ☐ NA
Has Sump Water been Analyzed by Lab: ☐ Yes ☐No ☒ NA			
** Attach sump water sample results to Inspection form as applicable			
Visible Explosives Present on Process Equipment/Piping: ☐Yes ☐No ☒ NA			
Visible Explosives Present in Sumps: ☐Yes ☐No ☒NA			
Observations/Notes: None			

Non-process Equipment and Piping Inspection Information

Steam lines present ☒Yes ☐No Water Lines present ☒Yes ☐No ☒Other (identify below)

Description of other Fixtures: Ventilation System

Sump(s) present ☐Yes ☒No Sump Water present ☐Yes ☐No ☒ NA

Visible explosives present on non process piping/equipment ☐Yes ☒No ☐ NA

Visible Explosives Present in sump(s) ☐Yes ☐No ☒ NA

Observations/Notes: None

Non Explosive Hazards of Concern	
☒	Residual Peeling Paint Chips on the Walls, Equipment and Piping, and Structural Members
☐	Observation of animal droppings and miscellaneous debris on floor of buildings
☐	Asbestos Containing Material (Transite, Utility Pipe Insulation, lighting fixtures, etc.)
☐	Overhead Conveyors and Belt Systems, and Elevators
☐	Mercury Switches
☐	PCB Light Ballast
☐	Physical Safety Hazard from Removed or Damaged Building Structural Members
☐	Other (please explain)

Type of Demo Required Based on above Observations (please explain):

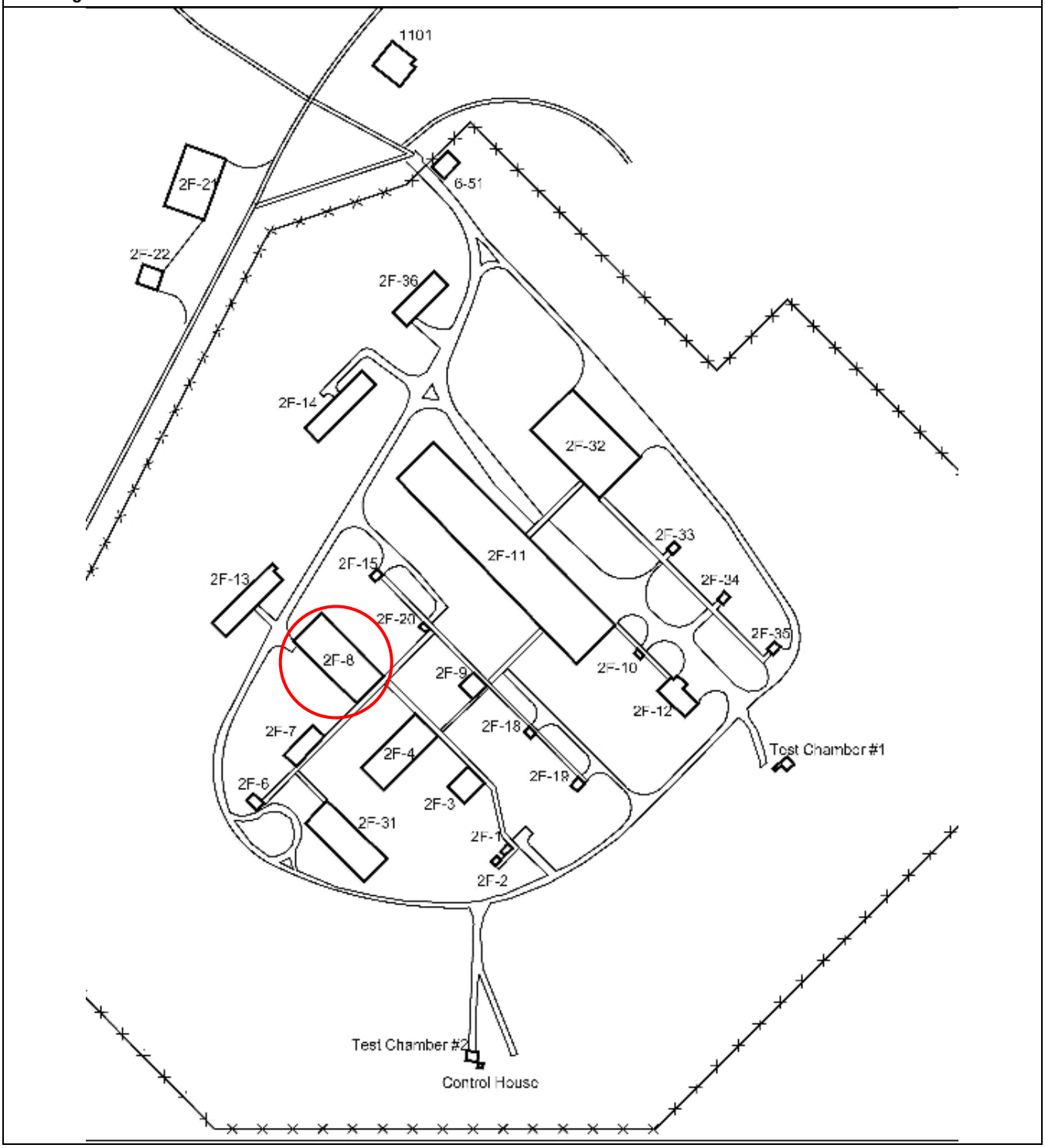
☐ **Thermal Decomposition** ☒ **Demo with Engineering Controls** ☐ **Conventional Demo**

Conclusions: No process equipment or bulk/visible explosives present. Recommend demolition using hardened earth moving machinery as added safety measure. Follow the established demolition procedures and follow-on inspection requirements prescribed in the approved RVAAP ESS.

Comments			
Data Engineer	Brian Stockwell	***UXO Safety Officer***	Fran McDevitt

Property Owner:	Department of the Army BRAC Technical Support Office Rock Island Arsenal, Rock Island, IL	Site	Load Line 6
		Building Number	2F-8
Facility Address:	Ravenna Army Ammunition Plant 8451 St. Route 5 Ravenna, OH 44266	Function	Delay Loading
		Date of Inspection:	07/08/05

Building Location



Building Exterior

Historical Archive Search Results and Preliminary Visual Inspection

Large one story brick and block structure on concrete slab with transite roof.

Area of Building Footprint (sq. ft.): 7104

Wall Inspection Information

Wall Material	Concrete	Block/Tile	Brick	Metal	Wood Frame	Steel Frame
Interior Walls	☐	☒	☒	☐	☐	☐
Exterior Walls	☐	☒	☒	☐	☐	☐

Are Surfaces Painted : ☒Yes ☐ No If Yes, Was Peeling of Paint Observed: ☒Yes ☐ No

Observations/Comments: None

Visible Explosives Present: ☐Yes ☒ No If Yes identify location below.

Location: NA

Thickness of wall construction material > 1/8" ☒Yes ☐No If Yes answer below:

Are Cracks, Crevices, Openings bigger than a hairline: ☒Yes ☐No

Entrapment of Explosive Residues in Cracks, Crevices, or Openings observed: ☐Yes ☒No

Other suspect surfaces present that are not accessible for Visual Inspection: ☐Yes ☒No

For hollow wall construction (i.e. tile), is internal examination needed at wall penetrations or suspect areas? ☐Yes ☒No ☐NA

If yes, identify location and report findings below:

Observations/Notes: None

Roof Inspection Information

Roof Type	☒ Transite Panels	☐ Shingled	☐ Tar	☐ Concrete	☒ Removed
Roof Frame	☐ Wood	☒ Steel			
Roof Condition :	☐ Intact	☐ Holes or Openings Observed	☐ Collapsed and Unsafe	☒ Removed	
Visible Explosives Present on interior roof framing or ceiling:	☐Yes	☒ No	If Yes, identify location below.		
Location: NA					
Suspect surfaces present that are not accessible for Visual Inspection:	☐Yes	☒No			
Other Observations/Notes: None					

Floor Inspection Information

Floor Type	☒Concrete	☐Wood	☐Steel	☐Other
Floor Liner	☐Lead	☐Rubber	☐Composite	☒None

Visible Explosives Present: ☐Yes ☒No If yes identify location below.

Location: NA

Number of floor drains in building _0_ Visible Explosives in floor drain: ☐Yes ☐No ☒NA If yes, identify location below.

Location: NA

Thickness of liner > 1/8" ☐Yes ☐No ☒NA If Yes to either answer below:

Are Slab Cracks, Crevices, Openings bigger than a hairline: ☒Yes ☐No

Are floor liner Cracks, Crevices, Openings bigger than a hairline: ☐Yes ☐No ☒NA

Entrapment of Explosive Residues in Cracks, Crevices, or Openings observed in floor slab. ☐Yes ☒No

Entrapment of Explosive Residues in Cracks, Crevices, or Openings observed in floor liner. ☐Yes ☐No ☒NA

Suspect surfaces present that are not accessible for Visual Inspection. ☐Yes ☒No

Other Observations/Notes: None

Process Equipment and Piping Inspection Information

Process Piping Present	Process Equipment Present	Number of Sumps Present	Sump Water Present
☐Yes ☒No	☐Yes ☒No	0	☐Yes ☐No ☒ NA

Has Sump Water been Analyzed by Lab: ☐ Yes ☐No ☒ NA

** Attach sump water sample results to Inspection form as applicable

Visible Explosives Present on Process Equipment/Piping: ☐Yes ☐No ☒ NA

Visible Explosives Present in Sumps: ☐Yes ☐No ☒NA

Observations/Notes: None

Non-process Equipment and Piping Inspection Information

Steam lines present ☐Yes ☒No Water Lines present ☒Yes ☐No ☒Other (identify below)

Description of other Fixtures: Ventilation System

Sump(s) present ☐Yes ☒No Sump Water present ☐Yes ☐No ☒ NA

Visible explosives present on non process piping/equipment ☐Yes ☒No ☐ NA

Visible Explosives Present in sump(s) ☐Yes ☐No ☒ NA

Observations/Notes: None

Non Explosive Hazards of Concern	
☒	Residual Peeling Paint Chips on the Walls, Equipment and Piping, and Structural Members
☐	Observation of animal droppings and miscellaneous debris on floor of buildings
☐	Asbestos Containing Material (Transite, Utility Pipe Insulation, lighting fixtures, etc.)
☐	Overhead Conveyors and Belt Systems, and Elevators
☐	Mercury Switches
☐	PCB Light Ballast
☐	Physical Safety Hazard from Removed or Damaged Building Structural Members
☐	Other (please explain)

Type of Demo Required Based on above Observations (please explain):

☐ **Thermal Decomposition** ☒ **Demo with Engineering Controls** ☐ **Conventional Demo**

Conclusions: No process equipment or bulk/visible explosives present. Recommend demolition using hardened earth moving machinery as added safety measure. Follow the established demolition procedures and follow-on inspection requirements prescribed in the approved RVAAP ESS.

Comments			
Data Engineer	Brian Stockwell	***UXO Safety Officer***	Fran McDevitt

ENGINEERING SURVEY REPORT #2

BUILDING 2F-11, 14, 32, 33,
34, 35, and 36
AT
LOAD LINE 6

AND

BUILDING DT-20, 21, and 22
AT
LOAD LINE 9

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

OCTOBER 9, 2002

Prepared for:

MKM ENGINEERS, INC.

4153 Bluebonnet Drive
Stafford, Texas 77477

Prepared by:

BAT Associates, Inc.
981 Keynote Circle
Suite 29
Cleveland, Ohio 44131

TABLE OF CONTENTS

1.0 INTRODUCTION

MKM Engineers, Inc. was contracted by the U.S. Army Operations Support Command to decontaminate, demolish, and dispose all buildings and asbestos materials at Load Lines 6 & 9 at the Ravenna Army Ammunition Plant in Ravenna, Ohio. BAT Associates, Inc. (BAT) was subcontracted by MKM Engineers, Inc. to perform structural engineering surveys on buildings and structures related to the asbestos removal and building demolition operations

After the decontamination operation, all buildings and concrete floors at the Load Lines 6 and 9 at the Ravenna Army Ammunition Plant are scheduled to be demolished and burned on site. An asbestos subcontractor is scheduled to be on site from October 10, 2002 to December 2002 to remove the asbestos material including corrugated asbestos roofing and siding, and composition rolled roof material which contains asbestos.

Three buildings at the load line 6 and seven building/structures at the load line 9 were inspected to survey the structural condition and integrity of each building/structure related to the asbestos removal operations on October 3, 2002. The engineering surveys were conducted by a Professional Engineer registered in Ohio from BAT Associates Inc.

All ten buildings inspected are more than sixty year old and have not been in service for many years. These buildings had not properly maintained for more than thirty years except for small portions of the 2F-11 assembling building at the south end of the building in the Load Line 6, which had been in use until 1993.

This report covers the results of the initial survey for the ten buildings in the Load Line 6 & 9 where asbestos panel removal operations are to be completed beginning the week of October 10, 2002. Section 2.0 Background, of this report gives a brief background of the Load Line 6 & 9 at Ravenna Army Ammunition Plant. Section 3.0, Purpose, describes the purpose of BAT's survey included in this report. Section 4.0 presents a Description of Buildings Surveyed for this report. Section 5.0 presents the Findings from the walk-through survey and Section 6.0 provides BAT's recommendations and Conclusions

2.0 BACKGROUND

Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio was built in 1940 to produce artillery, mortar shell bombs and components for ammunition through 1943 and was reactivated during the Korean and Vietnam Wars. The facility was deactivated completely in 1993.

It was found that the plant has many "areas of concern" for potential contamination by explosives, heavy metals, asbestos, and other chemicals left over from munition manufacture and disposal. The Army's Industrial Operations Command has plans for a 10-year cleanup of the site.

The Load Line 6 was a fuze & booster area and the Load Line 9 was a percussion element area when the plant was in operation.

3.0 PURPOSE

The purpose of the walk-through engineering survey is to evaluate the general structural conditions or hazards related to the safety, integrity, and stability of the buildings or structures. It was not intended to inspect every single member, element, or steel connection of the buildings/ structures. It was also not intended to locate, identify or measure every single deficiency of the structures or connections. There are many areas such as the roof that were not accessible for a closer survey.
It is therefore the responsibility of the asbestos contractor to verify and inspect each local structural deficiency such as rusted-out steel members or connections related to the safety of his work prior to the transite removal operations.

The purpose of the engineering survey of the building and structures in Load Line 6 & 9 prior to the asbestos removal operations is to:

A. Identify any structural safety hazards related to the removal of the corrugated asbestos siding, roof panels and composition rolled roofing material.
B. Identify the possibility of an unplanned collapse of the structures or portion of the structures due to the operations of the asbestos removal.
C. Assess the condition of the overall structural integrity, stability, and safety for the operations of the asbestos removal.
D. Locate and identify any sustained structural damages, distresses or deformations that would affect the strength and integrity of the structures.
E. Prepare and submit a written report summarizing the conclusion and recommendations regarding the asbestos removal operations.

4.0 DESCRIPTION OF BUILDING SURVEY

Detonator Loading Building DT-20, 21, & 22 at the Load Line 9 with composition rolled roof material and building 2F-11, 14, 32, 33, 34, 35, & 36 at the Load Line 6, which have corrugated asbestos roof and siding, were inspected on October 3 and are included in this report.

5.0 FINDINGS AND DISCUSSIONS

A. Building DT-20, 21 & 22 at the Load Line 9

Detonator Loading Buildings, DT-20, 21 and 22 at the Load Line 9 are one-story steel frame buildings with tile exterior and partition walls. The ground floor construction is a six inches slab-on grade.

Each building is about 200 feet long by 40 feet wide in plan dimensions and is about 16 feet high at the ridge. There is a 5 feet wide concrete sidewalk with canopy around the perimeter of the building. All three buildings were built in 1941 and have not been in use, and thus have not been properly maintained, for the last thirty years.

The roof construction of the buildings consists of composition rolled roofing and ridge over one and one half inches thick wood planks which are supported on steel purlins at approximately 4 feet spacing. The overall roof is in poor condition and has many locations of water leaking, rotten planks, and roof deterioration around the joints and roof vents at all three buildings. Missing roof planks and rotten planks at the canopy over the 5 feet wide sidewalks are observed at many locations of all three buildings.

The typical structural steel frame of the building is a Pratt type triangle roof truss spanning between two columns at approximately 40 feet apart. The steel truss frames are at 20 feet spacing supporting the purlins, steel channels, at approximately 4 feet spacing. All the structural steel inside the building is in fair condition with moderate rusting at the trusses and purlins. Steel brackets and their connections over the sidewalls are also in fair conditions.

There are no excessive purling defections, missing members, rusted-through steel members, or structural damages to the steel members observed.

The exterior walls and the partition walls are not bearing walls and can be removed during the demolition operations if it is necessary.

B. Building 2F-11 and 2F-32 at the Load Line 6

Fuze Assembling Buildings 2F-11and 2F-32 are identical in structural design but different in size. Building 2F-11 is 400 feet long by 81 feet wide and is about 31 feet high at the ridge. Building 2F-32 is 142 feet long by 81 feet wide by 31 feet high at the ridge. Both buildings are one-story, industrial type, long span steel truss structures with a high monitor bay at the middle portion of the span and exterior non-load bearing tile walls. There is a 5 feet wide sidewalk with canopy around the perimeter of the building.

Both buildings were built sixty years ago and have not been in use for more than two decades although a small portion of the 2F-11 building was occupied until 1993.

The exterior walls are non-bearing walls and can be removed during the demolition operations if it is necessary.

The typical steel frame of the building is a long span, industrial type steel truss spanning between end columns and have a high monitor bay in the middle of the span. The steel trusses have not been painted for years and have severe to moderate rusting.

The roof construction of the building, including the high and low roof, is corrugated asbestos roofing supported on steel joists at about 4 feet spacing. The roof joists, S.J.123 showed on design drawings are light steel joists and have moderate rusting. Two rows of horizontal bridging at the top chords of the joists were provided but no horizontal bridging at the bottom chords were provided. Two rows of horizontal bridges at the top chords and bottom chords of the joists are required for the joist with 20 feet span in accordance with the current standard specifications by the SJI (Steel Joist Institute). Roof support steel is designed to support dead loads plus live loads or snow loads, and wind pressure on the roof due to 80 miles per hour wind, as specified by the Ohio Basic Building Code. Our structural calculations indicates that, without the roof snow loads or high wind pressure on roof, these roof joists are still adequate for construction personnel to go on the roof to remove the asbestos roofing.

It should be noted that the asbestos panels at the end walls of the high bay are supported at the top and bottom of the walls only. There is no intermediate support.

It is also important to note that the corrugated asbestos roof panels fastened to the joists provide the lateral support for the joists through diaphragm action. When sections of the asbestos panels are removed, the joists might become unstable without bottom chord bridging. Therefore, it is recommended that the asbestos panel removal operations should start at the central portion of the steel joist and proceed evenly towards both ends of the joist in these two buildings.

There are no excessive roof defections, missing members, rusted-through steel members, or structural damages to the steel members observed.

C. Change House 2F-14 and 2F-36 at the Load Line 6

The two buildings are identical in size and structural design. The structures are one-story steel truss frames with tile exterior walls with brick at the top. Each building is 110 feet long by 30 feet wide and about 30 feet high at the ridge. The buildings are sixty years old and have not been in use and, thus maintained, for the last thirty years.

The roof of the building consists of corrugated asbestos roofing supported on steel channels, C12x17, at three feet six inches spacing at the top of truss. The typical steel frame of the buildings is a Pratt type triangle truss spanning between two end columns at 30 feet apart. The steel truss frames are at 20 feet spacing supporting the purlins.

All steel trusses have moderate to severe rusting in both buildings. Broken asbestos panels along the seam were observed in the Building 2F-36. There are no excessive purlin deflections, missing or rusted-through members, or major structural deficiency observed. The steel structures are still adequate for asbestos removal operations.

There are no excessive roof deflections, missing members, rusted-through steel members, or structural damages to the steel members observed.

D. Building 2F- 33, 34, & 35 at the Load Line 6

Building 2F-33, 34, and 35 are small brick buildings, 10 feet long by 8 feet wide by 12 feet high at the ridge with 4"x 8" wood rafter and 4"x 6" wood purlins and corrugated asbestos roofing.

The corrugated asbestos roofing has holes due to aging and the wooden purlins are decaying. The brick bearing walls are in poor condition.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Building structures and materials age and deteriorate with time and with the exposure to natural hazard impacts and environments. All ten buildings surveyed in the Load Line 6 & 9 are more than sixty years old buildings and have been abandoned without maintenance for more than two decades. All structural steel has not been painted for years. However, no major deficiency observed at the main steel truss frames, purlins, or joists.

The conclusions and recommendations are as follows:

1. For Building DT-20, 21, and 22 in the Load Line 9, the asbestos contractor should inspect the roof and canopy wood planks from underside and locate the rotten plank areas prior to the composition roofing removal operations. Canopy planks around the buildings might be missing or rotten completely, it is advisable to avoid stepping on them during the roofing removal operations.

2. The roof corrugated asbestos panels might be fragile due to aging. Exercise precaution during the asbestos roofing removal operations. The asbestos contractor should verify and familiar himself each asbestos panels support conditions related to his work such as main truss locations, locations and spacing of joists or purlins, and asbestos panel fastener conditions prior to the asbestos removal operations.

3. Some asbestos panel fasteners at roof, and end walls at the Building 2F-11 might be severely rusted. It should be expected that some fasteners might be sheared off during the panel removal operations due to its own weight. Precaution should be exercised and protection for the workers should be provided during the asbestos removal operations.

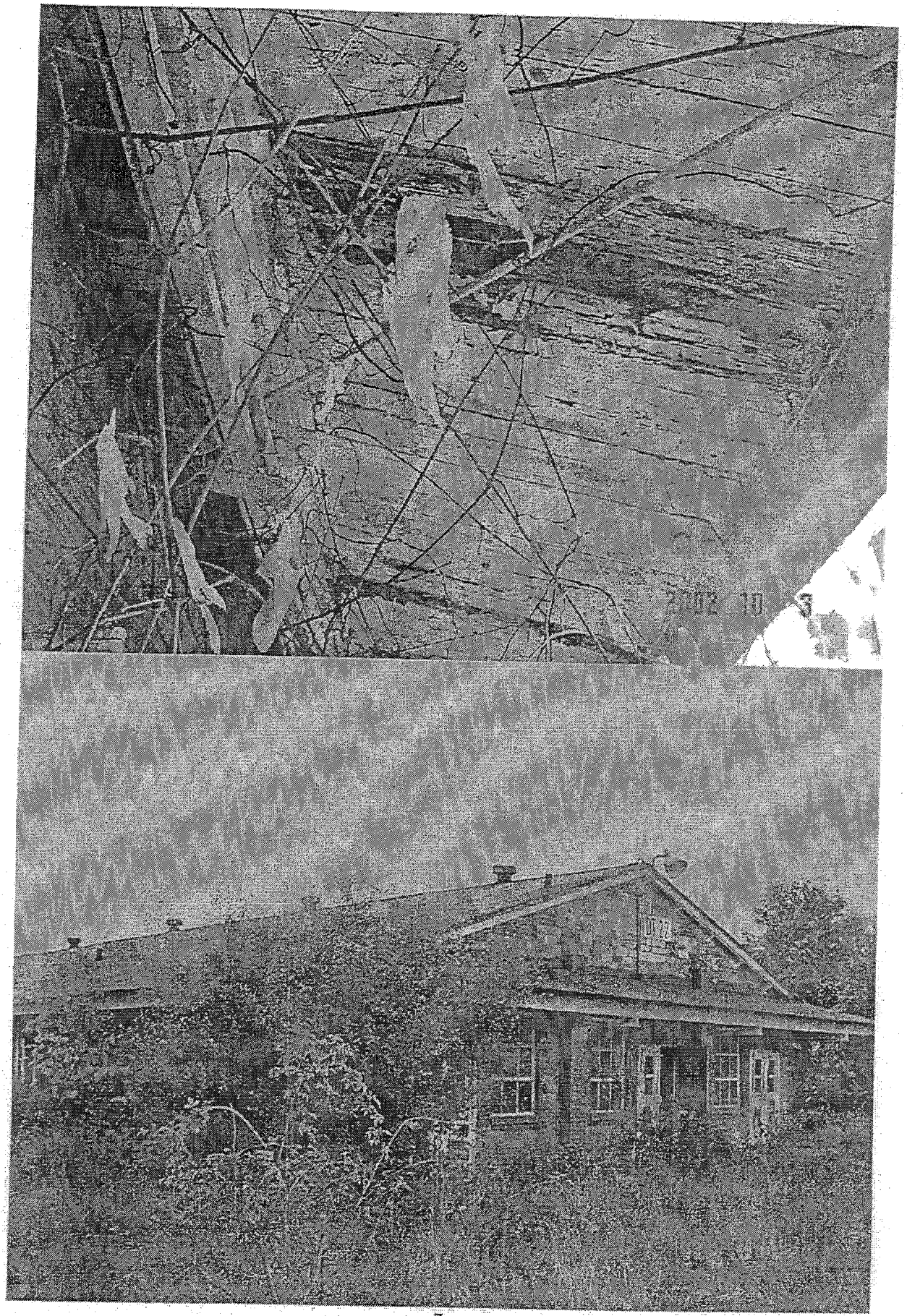
4. For Building 2F-11 & 2F-32 at the Load Line 6, it is our recommendation that the asbestos panel removal operations start at the central portions of the steel joists and proceed evenly towards the ends.

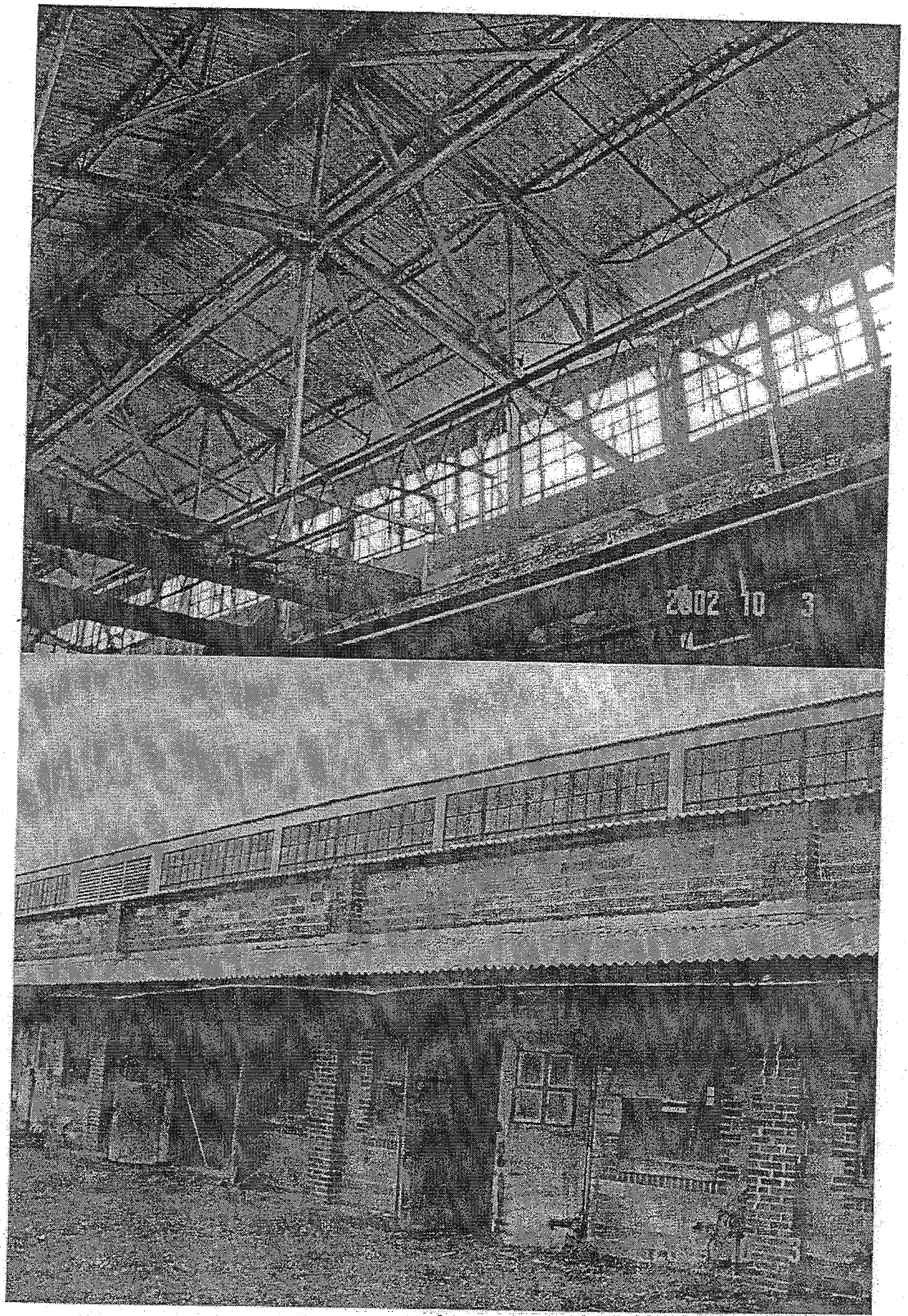
5. All transite removal operations should be executed from outside the buildings to avoid damaging the sag rods between purlins or horizontal bridging between joists.

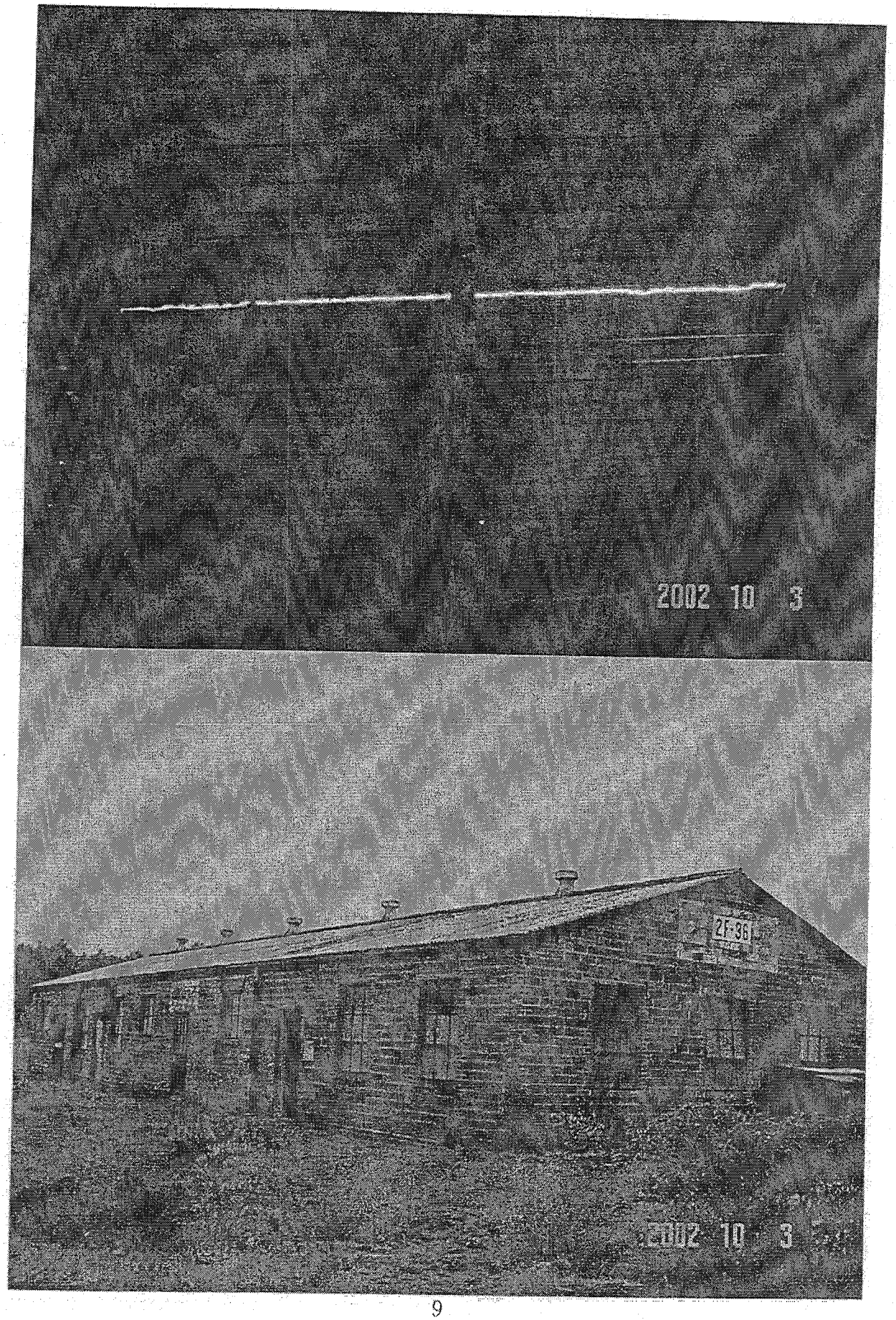
6. Fall protection for workers should be provided in accordance with the requirements and standards for the construction industry by the Occupational Safety and Health Administration (OSHA) and other governing regulations.

7. Stepping on the canopy roof along the perimeter of the building DT-20, 21, & 22 in the Load Line 9 by worker during the asbestos removal operations should be avoided since the wood planks supporting the composition roofing might be missing or rotten.

8. For the roof where asbestos panels are supported by steel joists in the buildings 2F-11 and 2F-32 and the workers need to walk on the roof during panel removal operations, it is our recommendation that the total weight of a worker including the tool and equipment carried should not be more than 200 pounds. As a reference, in accordance with the present steel roof deck design criteria of the Steel Deck Institute (SDI), roof decks are designed for construction live loads of 20 pounds per square foot uniform load or 150 pounds concentrated load on a one foot wide section of deck. Without the original design information and considering the age of these structures, conservative approaches and judgment shall be exercised.



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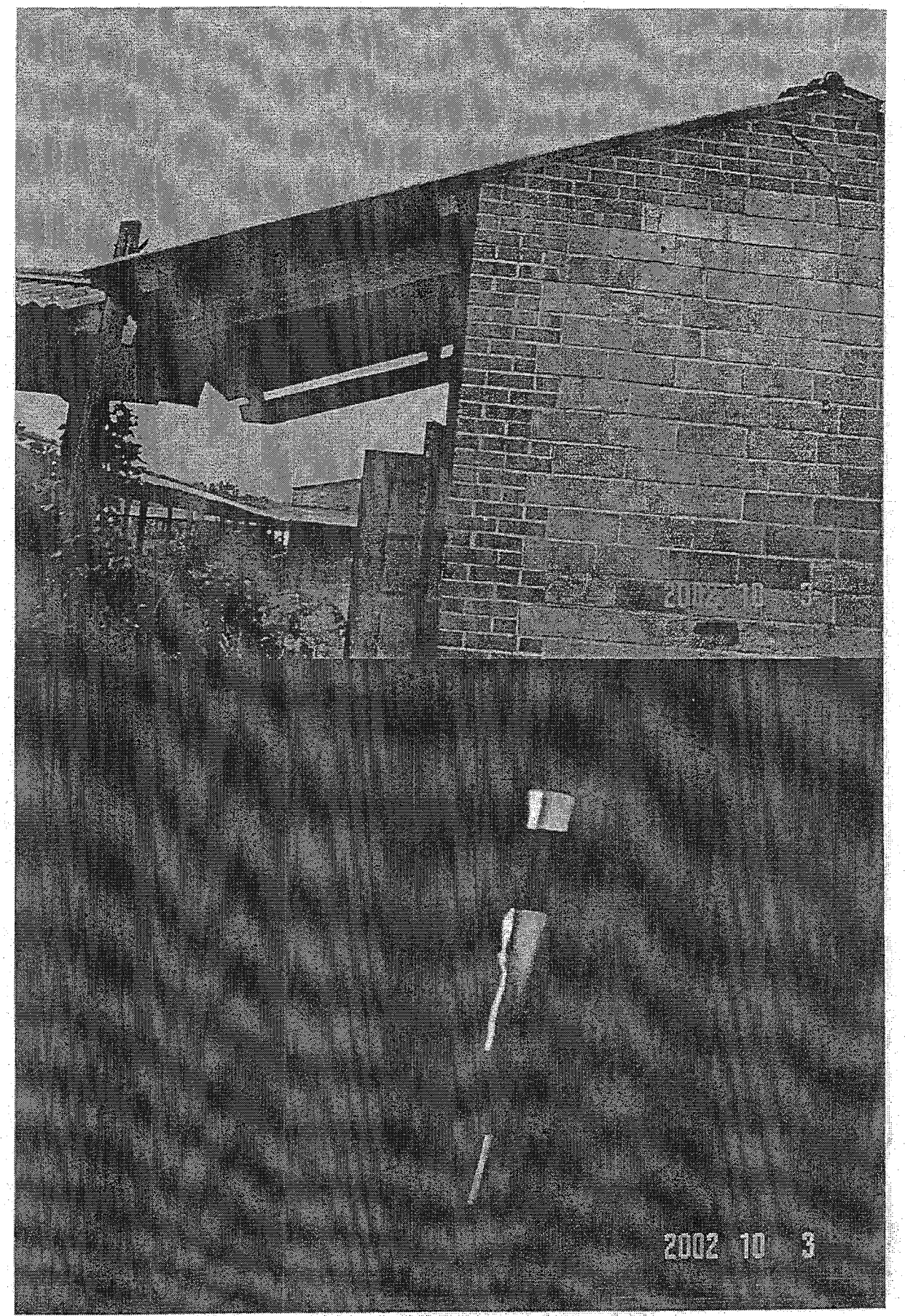
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ENGINEERING SURVEY REPORT #3

BUILDING 2F-1 THROUGH 2F-4, 2F-6 THROUGH 2F-10, 2F-12,

2F-13, 2F-15, 2F-18 THROUGH 2F-20, 2F-31, 6-51,

TEST CHAMBERS N0. 1 & No. 2,

AND

WALKWAYS BETWEEN BUILDINGS

AT

LOAD LINE 6

RAVENNA ARMY AMMUNITION PLANT

RAVENNA, OHIO

OCTOBER 28, 2002

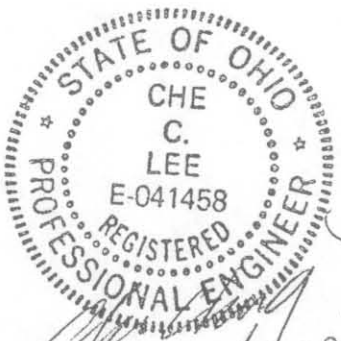
Prepared for:

MKM ENGINEERS, INC.

4153 Bluebonnet Drive
Stafford, Texas 77477

Prepared by:

BAT Associates, Inc.
981 Keynote Circle
Suite 29
Cleveland, Ohio 44131



10/28/2002

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1.0 INTRODUCTION

Seventeen buildings, two test chambers, and nineteen wood frame walkways connecting buildings at the Load Line 6 of the Ravenna Army Ammunition Plant in Ravenna, Ohio were inspected on October 15, 2002 to evaluate the structural conditions, overall structural stability, and integrity of the buildings and walkway structures related to the roof asbestos removal, burning of facilities, and the building demolition operations. These seventeen buildings and the walkways are the remaining structures in the Load line 6 to be surveyed.

The buildings, facilities, and walkways between buildings at the Load Line 6 are scheduled to be decontaminated, burned, and demolished from December 2002 to March 2003. Prior to the burning and demolition operations, all asbestos roof panels need to be removed to prevent any uncontrolled damages during the burning and demolition operations. The asbestos subcontractor has started the asbestos removal operations at the Building 2F-11 of Load Line 6 at the time of inspection. Following the asbestos removal operations, MKM personnel will be on site to perform the burn preparation activities, which include building modications for the placement of the dunnage materials. The burning and demolition operation is scheduled to start on December 2, 2002.

In accordance with request of MKM Engineers, Inc., recommendations of locations and details of building alterations for the placement of dunnage into the buildings for burning operations are to be included in this report. All existing design drawings available to us have been reviewed for locating the exterior non-load walls and steel framing. However, for those buildings without record drawings for review, our recommendations are based on the information obtained from the field inspections.

All seventeen buildings and nineteen walkways inspected are more than sixty years old and have not been in service for many years. These buildings and walkways have not properly maintained for more than thirty years. All seventeen buildings are in poor condition. Due to weathering and the lack of maintenance, most of the wood frame open walkways between buildings are in very poor condition. Some sections of the walkways are in danger of collapse. Verbal warning was given to MKM personnel on site and an advanced alert in writing of the unexpected collapse of portions of the wood frame walkway structures was faxed to MKM on October 18, 2002, the day after the inspection.

This report covers the results of the survey for the buildings and structures in the Load Line 6. Section 2.0 Background, of this report gives a brief background of the Load Line 6 at the Ravenna Army Ammunition Plant. Section 3.0 describes the purpose of BAT's survey included in this report. Section 4.0 presents a description of buildings surveyed for this report. Section 5.0 presents the findings from the walk-through survey and Section 6.0 provides BAT's recommendations and conclusions.

2.0 BACKGROUND

Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio was built in 1940 to produce artillery, mortar shell bombs and components for ammunition through 1943 and was reactivated during the Korean and Vietnam Wars. The facility was deactivated completely in 1993.

The Load Line 6 at the Ravenna Army Ammunition Plant was a fuze & booster area. Due to the nature of the explosive contaminants involved, it was decided that the burning of the facilities would be the most effective way to protect workers and public health and safety for decontamination and demolition of the facilities. MKM' s scope work at the Load Line 6 includes complete burning, demolition and removal of all buildings.

3.0 PURPOSE

The purpose of the walk-through engineering survey is to evaluate the general structural conditions or hazards related to the safety, integrity, and stability of the buildings or structures. It was not intended to inspect every single member, element, or steel connection of the buildings/ structures. It was also not intended to locate, identify or measure every single deficiency of the structures or connections. There are many areas such as the roof that were not accessible for a closer survey.

It is therefore the responsibility of the asbestos contractor to verify and inspect each local structural deficiency such as rusted-out steel members or connections related to the safety of his work prior to the transite removal operations.

The purpose of the engineering survey of the building and structures in Load Line 6 prior to the asbestos removal operations is to:

A. Identify any structural safety hazards related to the removal of the corrugated asbestos siding, roof panels.
B. Identify the possibility of an unexpected collapse of the structures or portion of the structures due to the operations of the asbestos removal.
C. Assess the condition of the overall structural integrity, stability, and safety for the operations of the asbestos removal.
D. Locate and identify any sustained structural damages, distresses or deformations that would affect the strength and integrity of the structures.
E. Recommend the locations and details of building alterations or modifications for the placement of dunnage.
F. Prepare and submit a written report summarizing the conclusions and recommendations regarding the asbestos removal operations.

4.0 DESCRIPTION OF BUILDING SURVEY

Building 2F-1 through 2F-4, 2F-6 through 2F-10, 2F-10, 12, 13, 15, 2F-18 through 2F-20, 2F-31, 6-51, and all the wood frame walkway structures between these buildings, and two concrete structures, Test chambers #1 & #2, were inspected on October 15, 2002 and are included in this report. Building 2F-21, and 22, and Building 1101 are located outside the fences of the Load Line 6 are not inspected.

5.0 FINDINGS AND DISCUSSIONS

A. Wood frame walkways between buildings

All walkways between the buildings at the Load Line 6 are identical in design. The typical walkway structure is a moment resistant rigid-frame type wood frame at the spacing from five feet to seventeen feet on centers. The wood frame consists of two 4"x 8" columns and a 4"x 8" overhead cross beam about seven feet high. Three longitudinal 4"x 8" wood purlins at the top of the cross beam provide the support for the corrugated asbestos roofing. The corrugated asbestos roof panels were designed to provide the roof diaphragm for the walkways and no horizontal cross bracing between structures or knee bracing at the top of column was provided. At the bottom of each column, a through-bolt connecting the column to the steel base plate which is anchored to the concrete pier by a 1/ 2 inch diameter anchor bolt. Top of the concrete pier is about 6 inches above the walkway slab.

Due to aging, weathering, and lack of maintenance, all the wood frame walkways at the Load Line 6 are in very poor condition. Most of the walkway columns at the bottom have rotted, splitted or been damaged by mowing vehicles. In addition, rusted through steel base plates, anchor bolts, and column connecting through-bolts are observed at various locations along the walkways.

Portions of the walkways between Building 2F-6 and 2F-7, and between Building 2F-7 and 2F-8 are in danger of collapse. These walkways have columns rotted at the bottom and completely shifted away from the concrete piers, thus without support. Any loads applied to the structures, including the weights of construction personnel, could cause the structures to collapse. Advanced warning should be given to all personnel performing the asbestos removal and demolition operations.

It should be noted that the corrugated asbestos roof panels were designed to provide the roof diaphragm action for the walkways. The open walkway wood frames structures become unstable if the corrugated asbestos roof panels are removed either partly or completely. It is our recommendation that after the removal of the corrugated asbestos roof panels, the remaining open wood frames should be demolished as soon as possible and precaution measures should be provided to avoid any casualties.

B. Test Chamber No. 1

Test chamber no 1 is a rectangular box shaped massive concrete structure with an underground test chamber. The structure has 12 inches thick exterior concrete walls reinforced by two counterforts at each side. An open steel stairway leads to the underground chamber from ground level. At the time of inspection, the underground chamber was not inspected due to the high standing water inside the chamber.

Due to aging, at the top of each corner of the structure above the ground, the concrete walls have deteriorated with large areas of spalling concrete, exposed rebars, cracks and separations of joints. The massive concrete structure was designed for tremendous testing pressure and impact loads. At present conditions without major structural deformations, the overall structural stability is not in danger of collapse and is still adequate for demolition operation.

C. Test Chamber No. 2

The building is an one-story rectangular building about 25 feet by 40 feet in plan dimensions and approximately 12 feet high and has 12 inches thick concrete exterior walls. The roof system consists of 5/8 inch plywood deck supported on 2'x 6" wood joists at 16" spacing. There is a small wood frame addition at the south end of the building, which is partially collapsed.

Portions of the roof deck have decayed with holes. Provide protective measures around the rotten deck areas and the partially collapsed addition during the removal and demolition operations.

The two non-load bearing exterior walls parallel to the roof joists can be opened for the placement of dunnage during the demolition operations.

D. Building 2F-1

Fulminate Dry House, Building 2F-1, is a brick building, 12 feet wide by 20 long by about 12 feet high at the ridge. A 12-inch concrete wall divides the building into two rooms. A wood frame addition with fiberglass siding, about 8 feet wide by 20 feet, was added to the south side of the brick building.

The roof system consists of corrugated asbestos roofing on wood purlins and rafters. The building has a plaster ceiling in the original brick building. No water stains were observed at the ceiling.

The end bearing of the 4' x 6' roof rafter in the middle of the wood frame addition has rotted. In general, the wood frame structure addition has decayed and the roof in this area is in poor condition. Provide protective measures during the removal and demolition operations.

The brick walls of the original building are load-bearing and should not be altered for demolition operations.

E. Building 2F- 2, 2F-10, 2F-15, 2F-18, and 2F-20

The five buildings are identical in design and size. These five building are 13 feet long by 12 feet wide by about 12 feet high at the ridge and have exterior tile/brick load bearing walls. The roof system consists of 4"x 8" wood rafters and 4"x 6" wood purlins and corrugated asbestos roofing.

The corrugated asbestos roofing has deteriorated due to aging but the wooden purlins are in reasonable condition for asbestos removal operations.

The exterior tile/brick walls are in poor condition. They are load-bearing walls and cannot be removed or altered for the demolition operations.

F. Building 2F-3

Fulminate Mix House, Building 2F-3, is a concrete frame structure with concrete columns, partition walls, and beams in both directions. The building is 26 feet wide by 47 feet long in plan dimensions and is about 16 feet high at the ridge. The southern half of the building has concrete load-bearing exterior walls and the northern half has non-load bearing brick exterior walls.

The roof system consists of corrugated asbestos roofing supported on steel purlins or joists. The roof steel is in poor due to rusting. Water stains on the plaster ceiling were observed at the west end of the building. No other major deficiencies at the roof steel were found.

Access opening for the placement of dunnage for demolition operations can be located at the non-load bearing brick walls at the west side of the building. The whole width of the double door, adjacent window, and the brick wall in between can be removed can be removed from the ground floor to the bottom of the concrete beam above.

G. Building 2F-4, 2F-8, 2F-13, and 2F-31

The four buildings are identical in structural design but different in size. Building 2F-4 is 40 feet wide by 122 feet long and is about 16 feet high at the ridge. Building 2F-8 and Building 2F-31 are 45 feet wide by 142 feet long by 18 feet high at the ridge. Building 2F-13 is 28 feet wide by 140 feet long by 14 feet high at the ridge.

All four buildings are one-story steel truss frame structures with non-load bearing exterior brick walls. There is a 5 feet wide sidewalk with a canopy around the perimeter of the buildings.

The roof construction is corrugated asbestos roofing supported on steel channel purlins or joists at approximately 4 feet spacing at the top of trusses. The typical steel frame of the buildings is a triangle roof truss spanning between two steel columns. The truss frames are at 20 feet spacing supporting the roof purlins or joists. Sag rods or bridging were provided at the one-third points of the purlins or joists.

These buildings have not been in use, and thus have not been properly maintained for the last thirty years. All roof steel has severe rusting. The roof of the Building 2F-4 has holes in the asbestos panels.

There are no excessive purlin deflections, missing members, rusted-through steel members, or structural damages to the roof steel observed. The roof steel structures are considered to be adequate for asbestos removal operations.

All exterior walls are non-load bearing walls and can be modified or removed to provide the access openings for the placement of dunnage for demolition operations. Our recommended opening locations are at the second or third bay of the sidewalls.
One full door width and one adjacent window width and the brick wall in between can be removed from the ground floor to the underside of the steel beam at the top of the wall.

H. Building 2F-6

The building is a small tile/brick building, 16 feet long by 15 feet wide by about 13 feet high at the ridge. The roof system consists of 4"x 8" wood rafters and 2" x 6" wood joists at 16 inches spacing and corrugated asbestos roofing.

The corrugated asbestos roofing has deteriorated due to aging but the wooden purlins are in reasonable condition for asbestos removal operations.

The exterior tile/brick walls are in poor condition. They are load-bearing walls and can't be removed or altered for the demolition operations.

I. Building 2F-7

The Powder Pelleting Building, 2F-7, is a concrete frame structure with non-load bearing brick exterior walls. The building is a steel frame structure with all the columns encased in the bricks pilasters. The building is 20 feet wide by 64 feet long in plan dimensions and is about 14 feet high at the ridge. Several 12-inch interior concrete walls divide the building into different rooms. An enclosed wood frame addition with fiberglass siding was added at the north side of the building.

The roof system consists of corrugated asbestos roofing supported on steel joists. The roof steel is in poor condition due to rusting. However, no major deficiencies at the roof steel were observed.

The exterior bricks are non-load bearing walls. The access opening for the placement of dunnage for demolition operations can be located at the southern brick walls. The whole width of the double door, one adjacent window and the brick wall in between can be removed from the ground floor to the bottom of the concrete beam above.

J. Building 2F-9

The building is a rectangular building, 21 feet wide by 32 feet long by 14 feet high at the ridge. An interior brick partition wall divides the building into two rooms. Portions of the exterior walls at the south side of the building are load-bearing concrete walls. The roof system consists of corrugated asbestos supported on light steel joists, and no major roof deficiencies were observed.

The exterior brick walls and the interior partition wall are non-load bearing walls. The access opening for dunnage can be located at either north or south side of the building. One double door, the adjacent window and the brick wall in between can be removed from the ground floor to the bottom of the steel beam above.

K. Building 2F-12

The Fuze Testing Building, 2F-12, is a one-story massive concrete frame structure with 12-inch thick interior concrete partition walls and brick exterior walls. The building is 20 feet wide by 50 feet long in plan dimensions and is about 14 feet high.

The roof consists of corrugated asbestos roofing supported on joists at about 4 feet spacing and are supported by the concrete beams. The roof is in poor condition due to rusting. No other major steel deficiencies were observed. The roof steel and the concrete structure are still adequate for asbestos removal operations.

Both east and west exterior walls are non-load bearing walls and can be altered to provide the access opening for the placement of dunnage for demolition operation. BAT's suggestion is at the east side of the building. One double door, adjacent window, and the brick wall in between can be removed from the ground floor to the bottom of the concrete beam above.

L. Building 2F-19

The main building of 2F-19 is a brick building, 10 feet wide by 12 feet long and is about 12 feet high at the ridge. The roof system consists of corrugated asbestos roofing supported on wood rafters and purlins. A wood frame addition, 8 feet wide by 12 feet long, was added to the east side and west side of the original building.

The exterior brick walls are load-bearing walls and should not be altered or modified for demolition operations.

The main building has a plaster ceiling and water stains were not observed on the ceiling. However, all wood frame additions including walls, door frames and window frames have decayed and are in danger of collapse.

Provide protective measures around the rotten deck areas and the partially collapsed addition during the removal and demolition

M. Building 6-51

The Gate House Building is a one-story steel truss frame structure with non-load bearing exterior brick walls. The building is 36 feet wide by 40 feet long and is about 16 feet high at the ridge.

The roof construction consists of corrugated asbestos roofing supported on steel channel purlins at approximately 4 feet spacing at the top of trusses. The typical steel frame of the building is a triangle roof truss spanning between two steel columns. The truss frames are at 20 feet spacing supporting the roof purlins. Sag rods or bridging were provided at the one-third points of the purlins or joists.

These buildings have not been in use, and thus have not been properly maintained, for the last thirty years. All roof steel has severe rusting.

Suggested access location for dunnage placement is at the south side of the exterior wall. The second and third door and the brick wall between can be removed for dunnage placement.

6.0 CONCLUSIONS AND RECOMMENDATIONS

All seventeen buildings and nineteen wood frame walkways inspected are more than sixty years old and have not been in service without maintenance for more than two decades. Most buildings are in poor condition. All roof steel of these buildings has not been painted for years, and thus severely rusted.

No major deficiencies such as excessive deflections, deformations, or missing members to the main steel framing of all steel structures were observed. However, locations of local weakened connections or members due to heavy rusting should be expected.

Access openings for the placement of dunnage into the buildings for the burning and demolition operations should be located at the non-load bearing walls of each building. A full width of double door, adjacent window and the brick wall in between can be removed from the ground floor to the bottom of steel or concrete beams above. For large buildings, the ideal locations of the openings are at the third bay from the end walls of the buildings. For other smaller buildings, recommended opening locations are sown on the individual building floor plan.

1. All wood frame walkways inside the Load Line 6 are in very poor condition. Many wood frame columns are rotted or split or damaged at the bottom of the column. Some columns shifted away from the concrete piers and are without support or only partially supported. Portions of the walkways between Building 2F-6 and 2F-7, and between Building 2F-7 and 2F-8 are in danger of collapse. Thus any loads applied such structures, including the weights of construction personnel, could cause the structures to collapse. Verbal warning was given to MKM personnel on site and an advanced alert in writing of the unexpected collapse of portions of the wood frame walkway structures was faxed to MKM on October 18, 2002, the day after the inspection. Protection measures and the advanced warning should be provided to all construction personnel during the asbestos removal operations and demolition operations.

   The corrugated asbestos roofing of the walkways was designed to provide the roof diaphragm action for the walkway. After the removal of asbestos panels, either partially or completely, the remaining open frame structures become unstable structures and should be demolished as soon as possible to prevent the sudden collapse.

2. In general, the roof joists in the buildings inspected are very light members designed barely for the roof loads. Most of the joists have flanges less than 2 inches in width. They are very flexible and can buckle easily after the removal of the asbestos roof panels either partially or completely. Protection measures should be provided for construction personnel working on the roof.

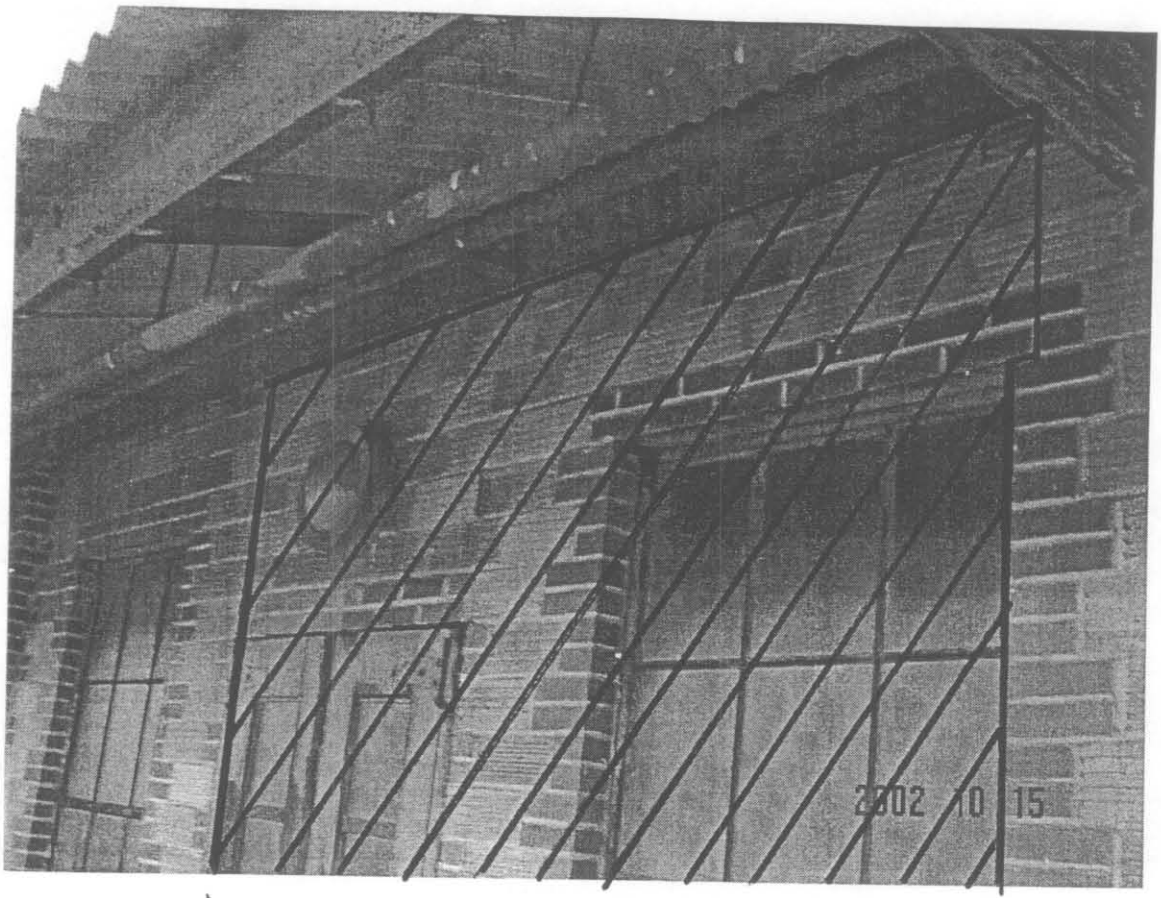
3. Due to aging and weathering, the roof corrugated asbestos panels might be very fragile. Exercise precautionary measures during the asbestos roofing removal operations. The asbestos contractor should verify and familiarize himself with each asbestos panels support conditions related to his work such as main truss locations, locations and spacing of joists or purlins, and asbestos panel fastener conditions prior to the asbestos removal operations.

4. Some asbestos panel fasteners at the roof might be severely rusted. It should be expected that some fasteners might be sheared off during the panel removal operations due to their own weight. Precaution should be exercised and protection for the workers should be provided during the asbestos removal operations.

5. All transite removal operations should be executed from outside the buildings to avoid damaging the sag rods between purlins or horizontal bridging between joists.

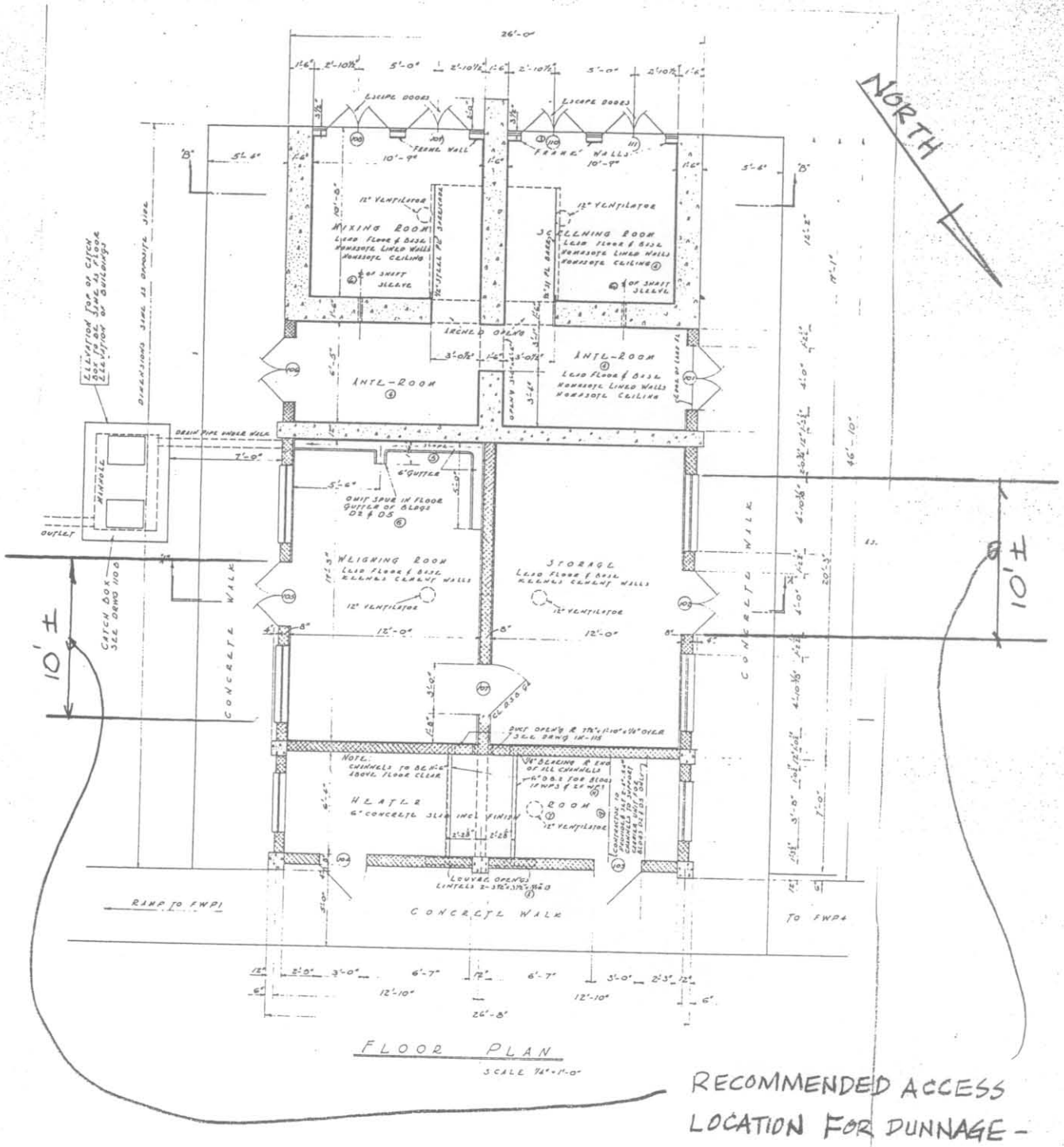
6. Fall protection for workers should be provided in accordance with the requirements and standards for the construction industry by the Occupational Safety and Health Administration (OSHA) and other governing regulations.

7. For the roof where asbestos panels are supported by the light steel joists, it is our recommendation that the total weight of a worker including the tool and equipment carried should not be more than 200 pounds. As a reference, in accordance with the present steel roof deck design criteria of the Steel Deck Institute (SDI), roof decks are designed for construction live loads of 20 pounds per square foot uniform load or 150 pounds concentrated load on a one foot wide section of deck. Without the original design information and considering the age of these structures, conservative approaches and judgment should be exercised.



REMOVE DOUBLE DOOR, WINDOW, & BRICK WALL INSIDE SHADED AREA FROM GROUND FLOOR TO BOTTOM/BEAM ABOVE

TYPICAL DUNNAGE ACCESS OPENING DETAIL

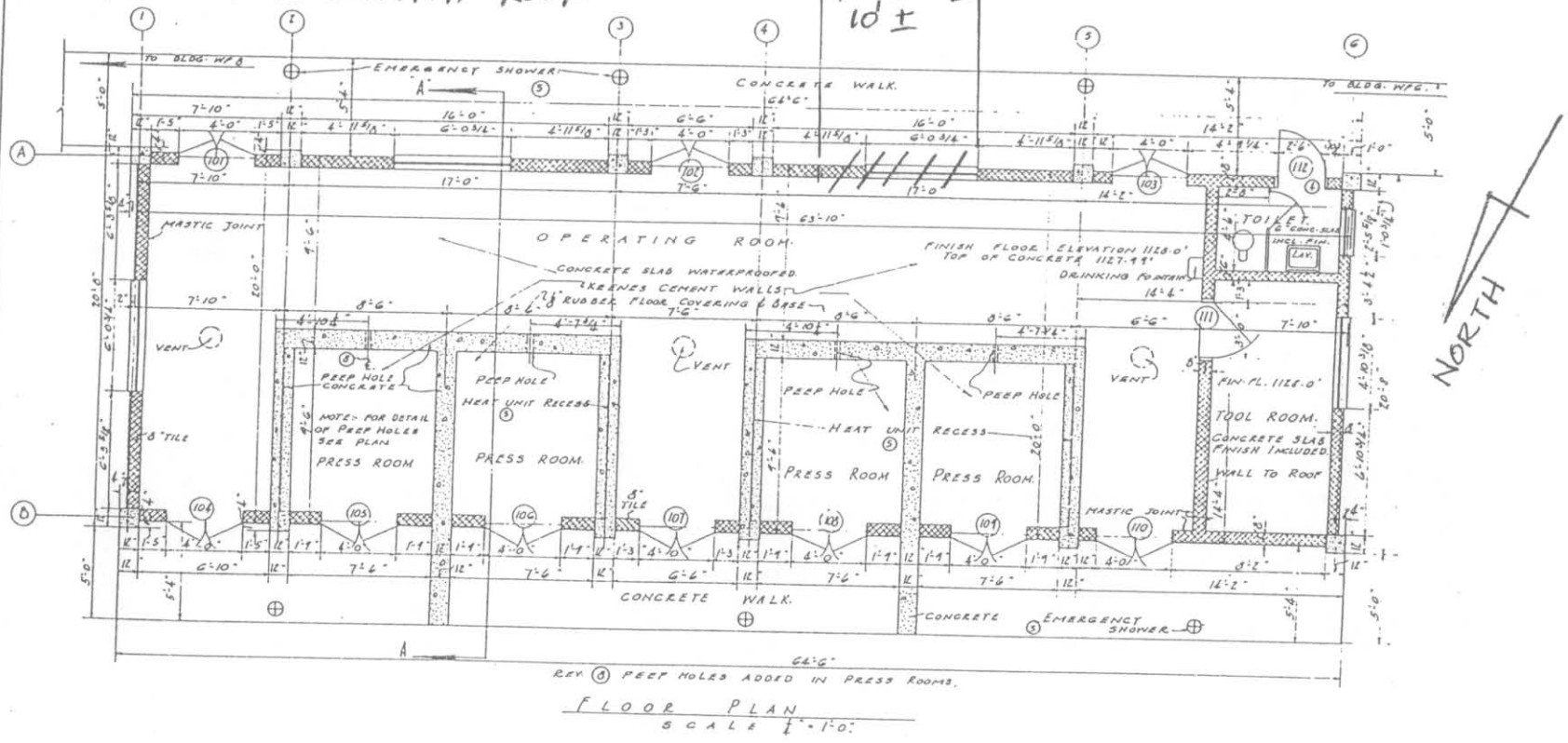


RECOMMENDED ACCESS LOCATION FOR DUNNAGE -

REMOVE DOUBLE DOOR, WINDOW AND BRICK WALL IN BETN. FROM GROUND FLOOR TO BOTTOM OF CONCRETE BEAM AT ROOF

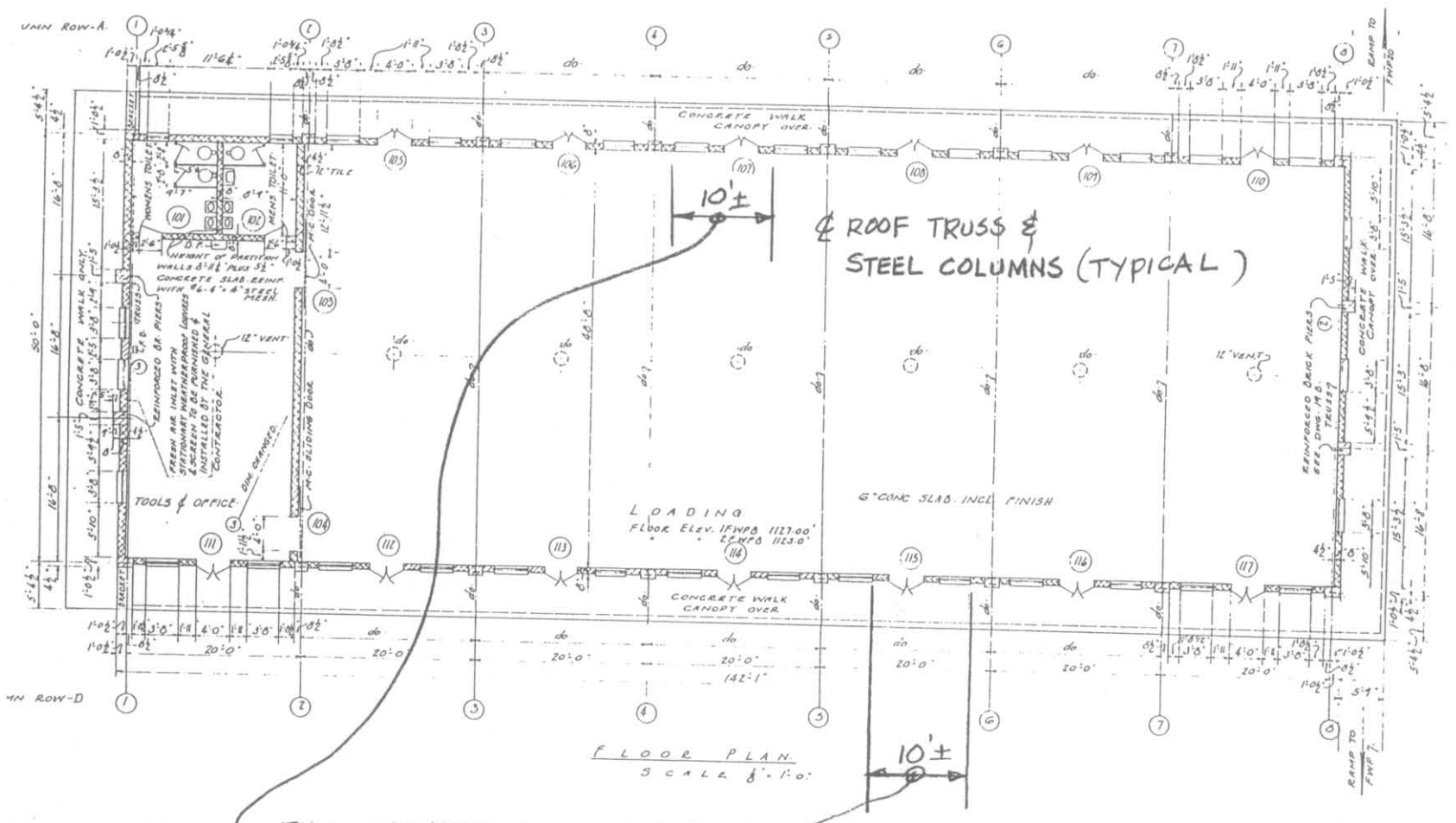
BUILDING 2F-3

RECOMMENDED ACCESS LOCATION FOR DUNNAGE
- REMOVE 10 FEET WIDE BRICK WALL AND WINDOW FROM GROUND FLOOR TO BOTTOM OF CONCRETE BEAM AT ROOF



FLOOR PLAN
SCALE 1" = 1'-0"

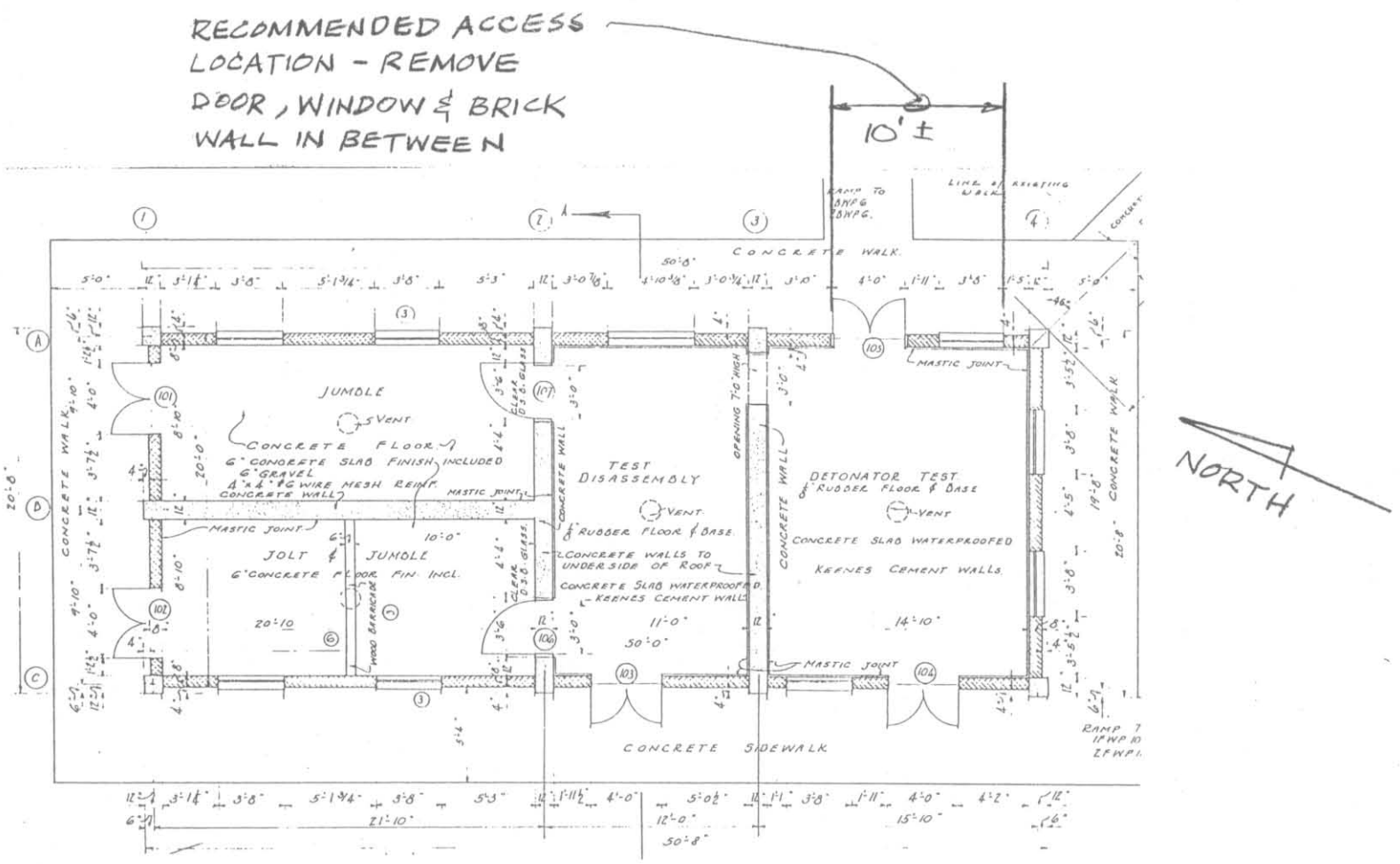
BUILDING 2F - 7



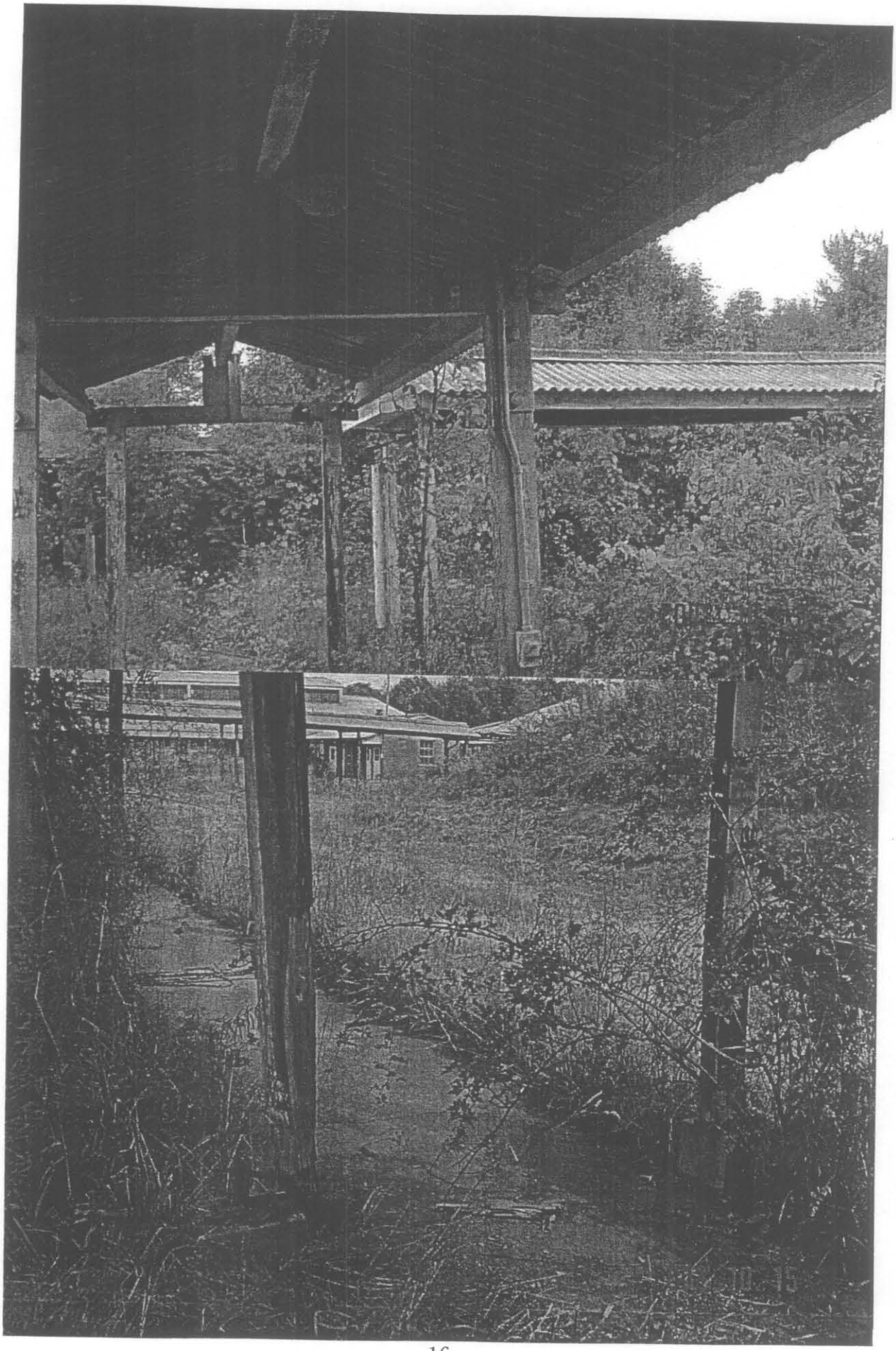
RECOMMENDED ACCESS LOCATION FOR DUNNAGE – REMOVE DOUBLE DOOR, WINDOW & BRICK WALL IN BETWEEN FROM GROUND FLOOR TO BOTTOM OF STEEL BEAM AT ROOF

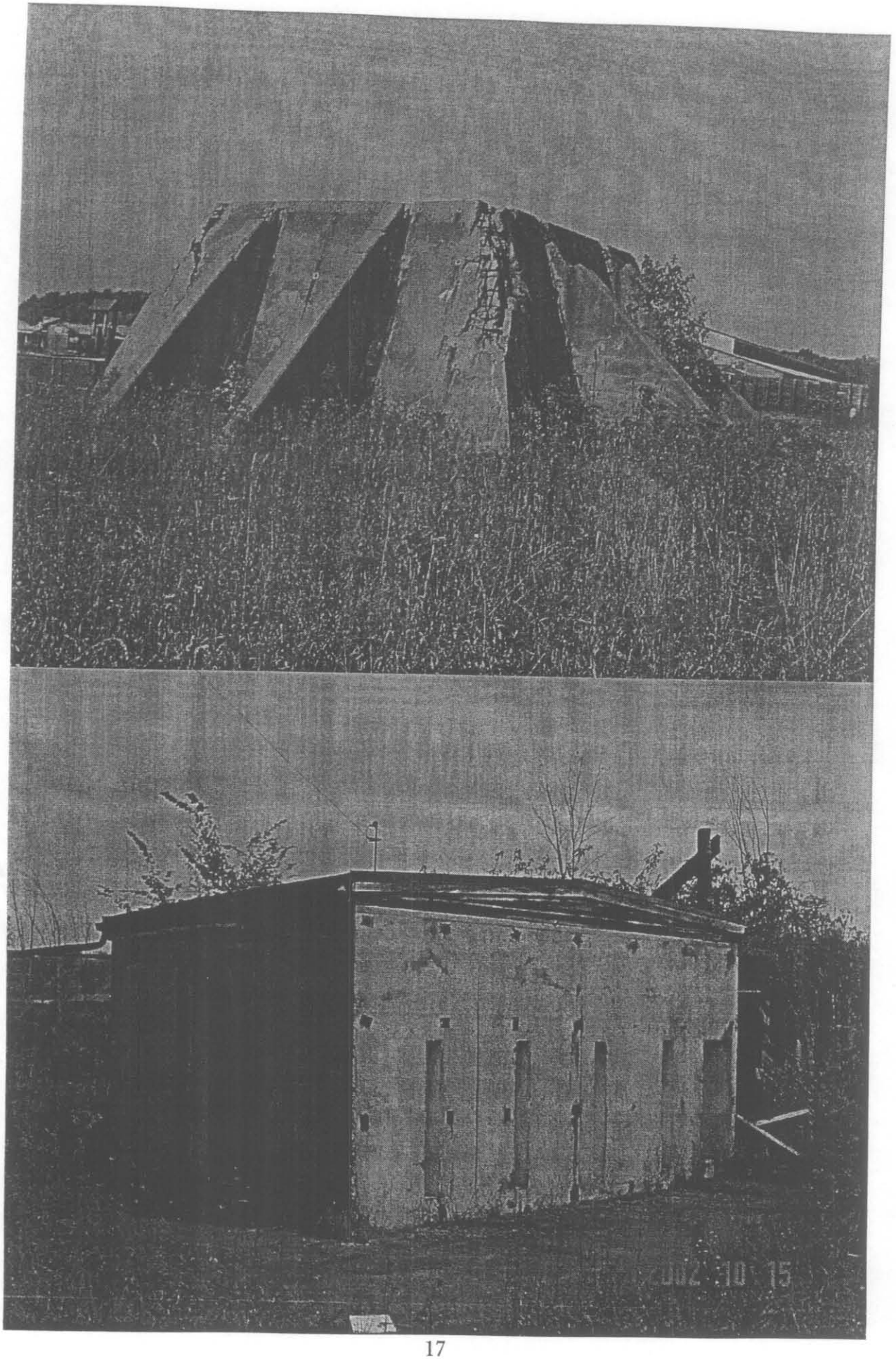
BUILDING 2F-8 (SHOWN)

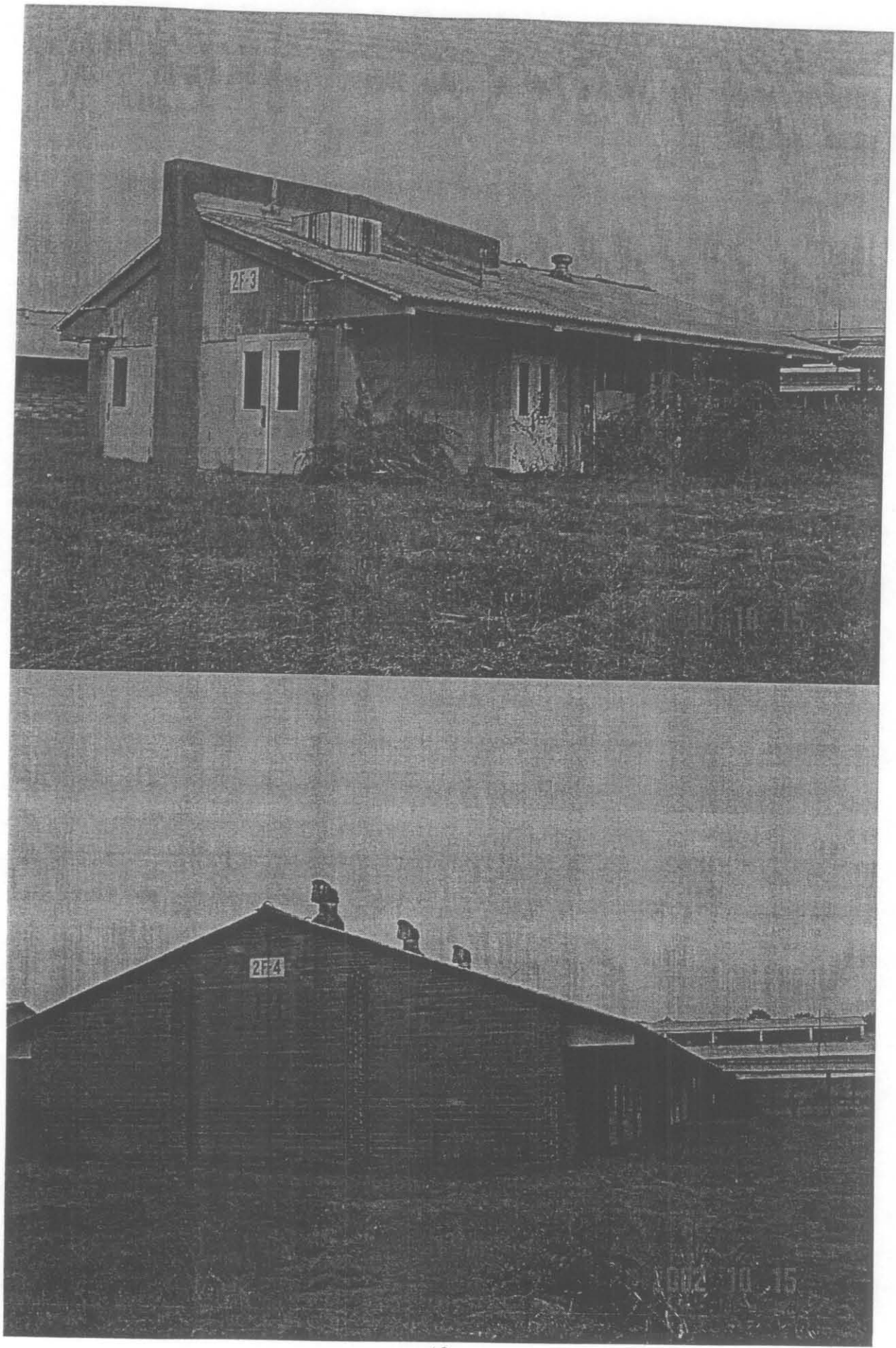
BUILDING 2F-4, 11, 13, 14, 31, 32 & 36 (SIMILAR)



BUILDING 2F-12

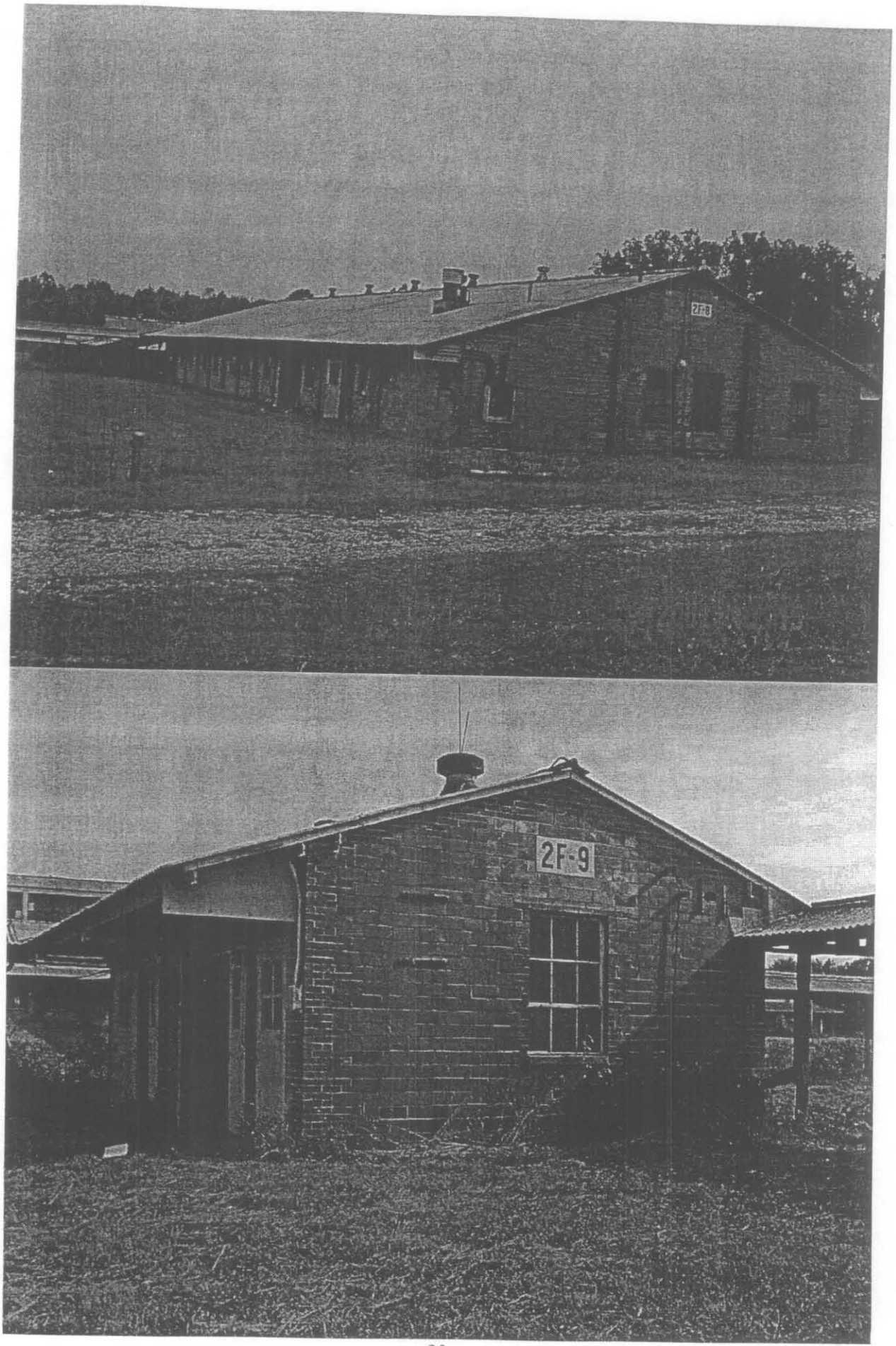


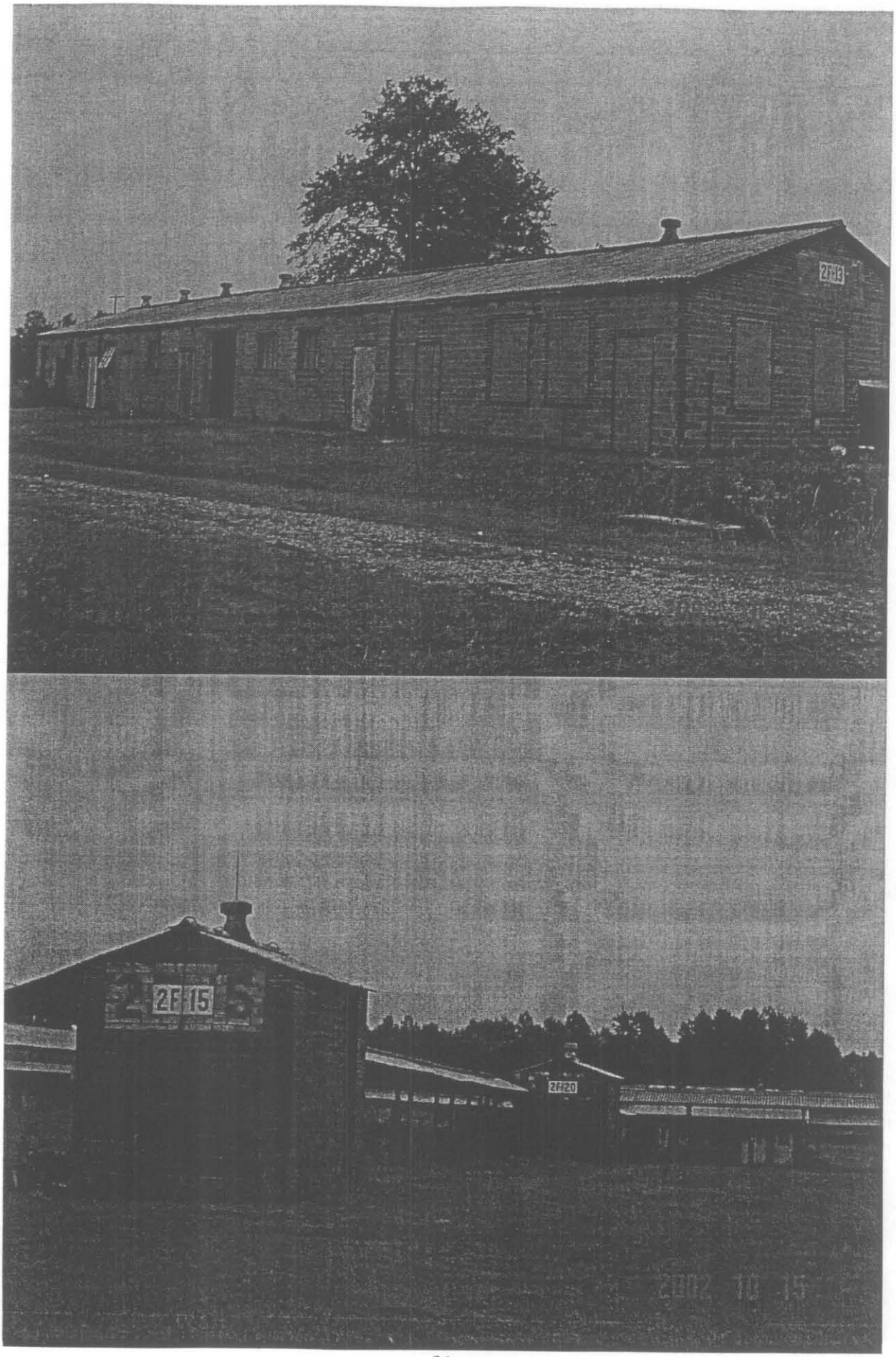



2F-3
2F-4

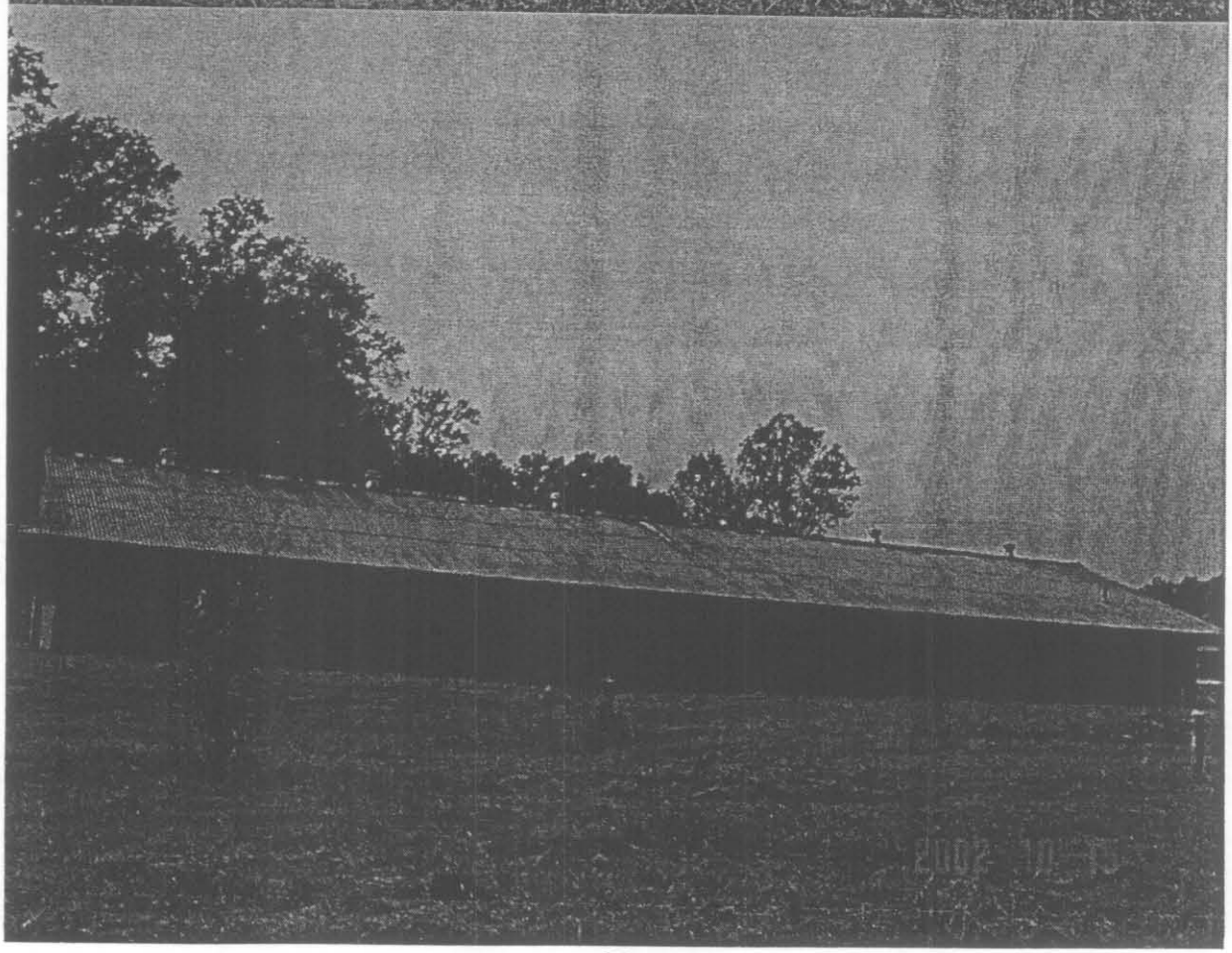

2F-6
2002 JO 15

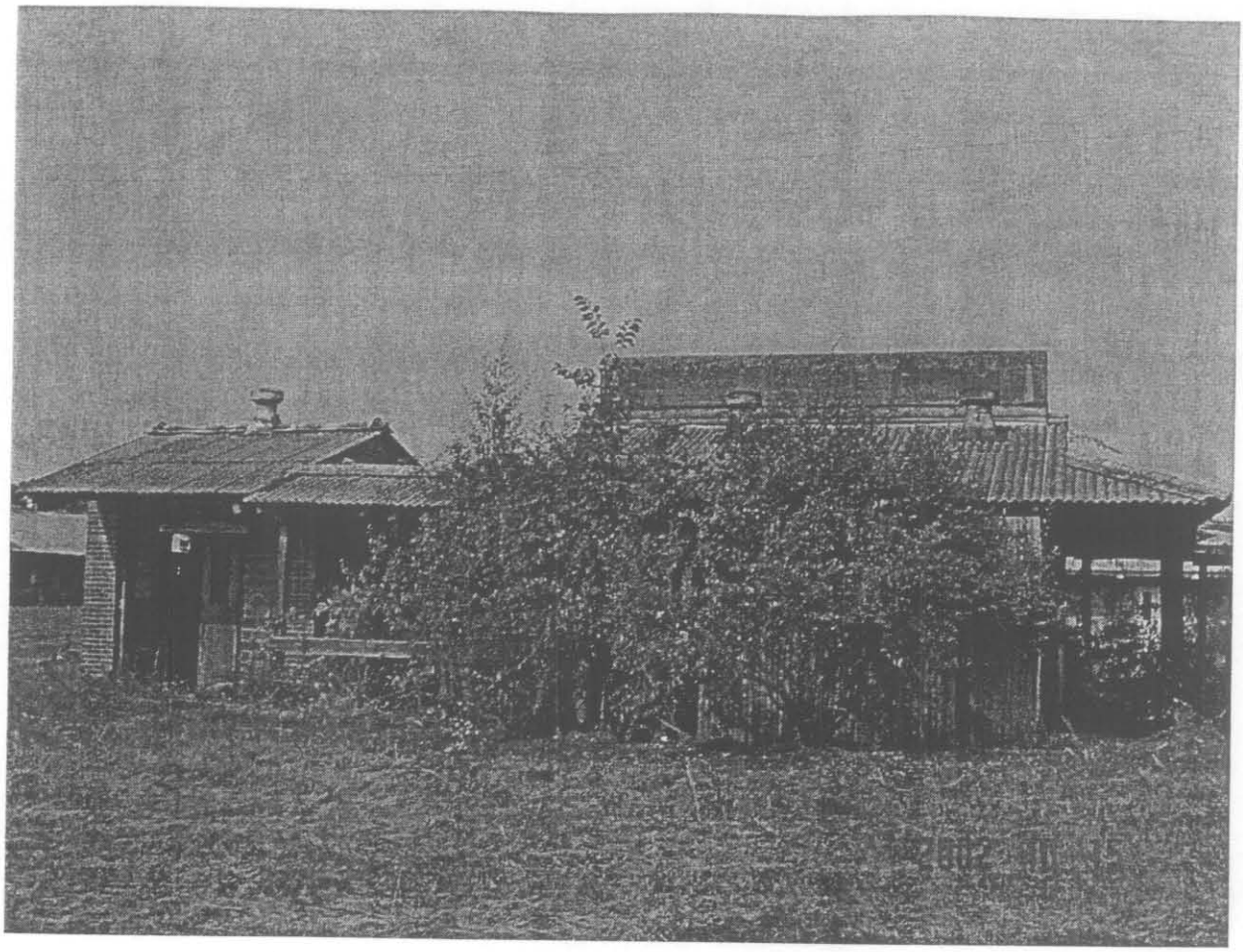

2F-7


2F-8
2F-9


2F13
2F15
2F20


2F 19





ENGINEERING SURVEY REPORT #4

BUILDING DT-1 THROUGH DT-19, DT-23 THROUGH DT-29

DT-32 THROUGH DT-35, DT-48, DT-52 THROUGH DT-56, 9-51

AND

WALKWAYS BETWEEN BUILDINGS

AT

LOAD LINE 9

RAVENNA ARMY AMMUNITION PLANT

RAVENNA, OHIO

December 4, 2002

Prepared for:

MKM ENGINEERS, INC.

4153 Bluebonnet Drive
Stafford, Texas 77477

Prepared by:

BAT Associates, Inc.
981 Keynote Circle
Suite 29
Cleveland, Ohio 44131

7.0 APPENDIX

1.0 INTRODUCTION

BAT Associates, Inc. (BAT) was retained by MKM Engineering (MKM) to provide structural engineering inspections and recommendations related to pre-demolition asbestos abatement activities for various buildings at Ravenna Army Ammunition Plant in Ravenna, Ohio. This report covers the results of the survey conducted by BAT on November 21, 2002 on the remaining buildings and structures in the Load Line 9 that were not covered by the previous report #2, dated October 9,2002.

Thirty seven (37) buildings, and nineteen (19) wood frame walkways connecting buildings at the Load Line 9 of the were inspected on November 21 to evaluate the structural conditions, overall structural stability, and integrity of the buildings and walkway structures related to the roof asbestos removal, burning of facilities, and the building demolition operations. These buildings and the walkways are the remaining structures in the Load line 9 to be surveyed.

These buildings, facilities, and walkways are scheduled to be decontaminated, burned, and demolished. Prior to the burning and demolition operations, all asbestos roof panels need to be removed to prevent any uncontrolled release of asbestos fibers during the burning and demolition operations. The asbestos subcontractor is ready to start the asbestos removal operations at the walkways between buildings in the Load Line 9. Following the asbestos removal operations , MKM personnel will be on site to perform the burn preparation activities, which include building modications for the placement of the dunnage materials. The burning and demolition operation is scheduled to start in December, 2002.

Recommendations of locations and details of building alterations for the placement of dunnage into the buildings for burning operations are included in this report. All existing design drawings available to us have been reviewed for locating the exterior non-load walls and steel framing. However, for those buildings without record drawings for review, our recommendations are based on the information obtained from the field inspections.

All thirty seven buildings and nineteen walkways inspected are more than sixty years old and have not been in service for many years. These buildings and walkways have not properly maintained for more than thirty years. All thirty seven buildings are in poor condition. Due to weathering and the lack of maintenance, all buildings and the wood frame walkways between buildings are in poor condition. A few wood frame buildings and portions of walkways are in danger of collapse.

Section 2.0 Background, of this report gives a brief background of the Load Line 9 at the Ravenna Army Ammunition Plant. Section 3.0 describes the purpose of BAT's survey included in this report. Section 4.0 presents a description of buildings surveyed for this report. Section 5.0 presents the findings from the walk-through survey and Section 6.0 provides BAT's recommendations and conclusions.

2.0 BACKGROUND

The Load Line 9 at the Ravenna Army Ammunition Plant in Ravenna, Ohio was a detonator line and has many buildings and facilities scattered throughout large area. The record drawing, Plot Plan 1500.9, indicated that these buildings were still in use in 1979.

The Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio was built in 1940 to produce artillery, mortar shell bombs, and components for ammunition through 1943 and was reactivated during the Korean and Vietnam Wars. The facility was deactivated completely in 1993.

MKM' s scope work at the Load Line 9 includes the complete burning, demolition and removal of all buildings after the operations of the asbestos removal from the buildings.

3.0 PURPOSE

The purpose of the walk-through engineering survey is to evaluate the general structural conditions or hazards related to the safety, integrity, and stability of the buildings or structures. It was not intended to inspect every single member, element, or steel connection of the buildings/ structures. It was also not intended to locate, identify or measure every single deficiency of the structures or connections. There are many areas such as the roof that were not accessible for a closer survey.

It is therefore the responsibility of the asbestos contractor to verify and inspect each local structural deficiency such as rusted-out steel members or connections related to the safety of his work prior to the transite removal operations.

The purpose of the engineering survey of the building and structures in Load Line 6 prior to the asbestos removal operations is to:

A. Identify any structural safety hazards related to the removal of the corrugated asbestos siding, roof panels.
B. Identify the possibility of an unexpected collapse of the structures or portion of the structures due to the operations of the asbestos removal.
C. Assess the condition of the overall structural integrity, stability, and safety for the operations of the asbestos removal.
D. Locate and identify any sustained structural damages, distresses or deformations that would affect the strength and integrity of the structures.
E. Recommend the locations and details of building alterations or modifications for the placement of dunnage.
F. Prepare and submit a written report summarizing the conclusions and recommendations regarding the asbestos removal operations.

4.0 DESCRIPTION OF BUILDING SURVEY

Building DT 1 through DT-19, DT-23 through DT-29, DT-32, DT-33, DT-34, DT-35, DT-48, DT-52 through DT-56, T-4514 and 9-51 and all the wood frame walkway structures between these buildings were inspected on November 21, 2002 and are included in this report.

Building DT 20, DT 21, and DT 22 were inspected on October 3, 2002 and were included in the reported #2. T-4514 is a small steel frame structure, 8'x 8' x 10', with metal siding and roof metal decking.

Nine heater houses in the Load Line 9, DT 41 through DT 47 and DT-50 shown on the 1979 Plot Plan, 1500.9, have been removed and have only four concrete piers left projecting above ground. Tracer Destroy House DT 57 was completely removed.

5.0 FINDINGS AND DISCUSSIONS

A. Wood frame walkways between buildings

All walkways between the buildings at the Load Line 9 are identical in design to those in the Load Line 6. The typical walkway structure is a moment resistant wood frame at the spacing from five feet to seventeen feet on centers. The wood frame consists of two 4"x 8" columns and a 4"x 8" overhead cross beam about seven feet high. Three longitudinal 4"x 8" wood purlins at the top of the cross beam provide the support for the corrugated asbestos roofing. The corrugated asbestos roof panels were designed for diaphragm action to provided stability for the walkways and no other horizontal cross bracing between columns or knee bracing at the top of column was provided. At the bottom of each column, a through-bolt connecting the column to the steel base plate which is anchored to the concrete pier by a 1/ 2 inch diameter anchor bolt. Top of the concrete pier is about 6 inches above the walkway slab.

All the wood frame walkways at the Load Line 9 are in **very poor** condition. Most of the walkway columns at the bottom have rotted, splitted or been damaged. Severely corroded steel base plates, anchor bolts, and column through-bolts are observed at many locations along the walkways. In addition, many concrete piers have caved in or displaced.

As discussed in the report # 3, the corrugated asbestos roof panels were designed for roof diaphragm action to provide the stability for the walkways. The open walkway wood frame structures become unstable if the corrugated asbestos roof panels are removed either partially or completely. The approach used in the Load Line # 6 by pulling the walkway structures down to the ground and then removing the asbestos panels is a good approach.

B. Gate House 9-51

The gate house building is a truss frame steel structure with a non-load bearing brick exterior. The building is about 22 feet wide by 28 feet long by 14 feet high at the ridge. A brick partition wall divides the building into two rooms.

The roof construction consists of corrugated asbestos roofing supported on C8 steel channels at approximately 4 feet spacing at the top of trusses. The typical steel frame of the buildings is a triangle roof truss spanning between two steel columns. The truss frames are at 14 feet spacing. Sag rods or bridging were provided at the one-third points of the joists.

The overall condition of the roof steel is poor. Due to roof leaking, fallen off plaster ceiling was observed inside the building.

There are no excessive steel deflections, missing members, or structural damages to the roof steel observed. The roof steel structures are considered to be adequate for asbestos removal operations.

All exterior walls are non-load bearing walls and can be modified or removed to provide the access openings for the placement of dunnage for demolition operations. BAT recommends to remove the third and the fourth doors and the brick wall in between on the north sidewall from the ground floor to the bottom of the steel beam above.

C. Building DT-1, 4, 10, 11, 12, 15, 19, 23, 25, 26, 27, 32, and 33

These thirteen buildings are identical in design and size. The buildings are 12 feet wide by 13 feet long by about 12 feet high at the ridge. The exterior walls are tile/brick load bearing walls. The roof construction consists of 4"x 8" wood rafters, 4"x 6" wood purlins and corrugated asbestos roofing.

The corrugated asbestos roofing has deteriorated due to aging, but the wooden purlins are in reasonable condition for asbestos removal operations.

The exterior load-bearing tile/brick walls are in poor condition and should not be modified or altered for the demolition operations.

D. Building DT-2 and DT-5

The two buildings are identical in size and design. The buildings are rectangular concrete frame structures with brick exteriors and are about 26 feet by 46 feet in plan dimensions and approximately 15 feet high at the ridge. There are 5 feet wide concrete walks and overhead canopies at the north and south sides of the buildings. The roof system consists of corrugated asbestos roofing on steel joists at 3 feet 4 inch. spacing.

Due to the presence of a drop ceiling, the conditions of the roof were not inspected. However, water stains were observed at the ceiling joints. Provide protective measures during the removal and demolition operations.

The middle door at the east wall or west wall of the building can be removed for the placement of dunnage during the demolition operations. (See Building Plan in Section 7 for details).

E. Building DT-3

The Dry House Fulminate is a wood frame building with exterior stud walls and is about 12 feet wide by 20 feet long by 14 feet high at the ridge. A 12-inch. concrete wall along the ridge line divides the building into two halves.

The roof system consists of corrugated asbestos roofing on 4" x 6" wood purlins supported by 4" x 8" rafters. The presence of the cement board ceiling inside the building prevents the inspection of roof purlins. However water stains were observed along the joints of the ceiling, thus the purlins could have rotted.

The overall condition of the wood frame building is poor due to weathering and a lack of maintenance. Exercise precaution and provide protective measures for demolition personnel during the asbestos removal and demolition operations.

The exterior stud walls are load-bearing walls. The exterior stud walls are in poor condition and are not recommended to be modified or altered to provide the access for the placement of dunnage for demolition operations.

F. Building DT-6

The Dry House Azide buildings is a wood frame structure with exterior stud walls and is about 8 feet wide by 24 feet long by 14 feet high at the ridge. The roof system consists of wood purlins and corrugated asbestos roofing supported by the wood purlins.

The presence of the cement board ceiling inside the building prevents the inspection of the purlins. Minor roof leaking was observed inside the building. The exterior stud walls are in very poor condition.

The corrugated asbestos roofing has deteriorated due to aging but the wooden purlins are in reasonable condition for asbestos removal operations. However, protective measures for demolition personnel should be provided during the asbestos removal operations.

The exterior tile/brick walls are load-bearing walls and are in poor condition. Modifications or reinforcements to provide access opening for the placement of dunnage are not recommended.

G. Building DT-7

Screen House Azide Building, DT-7, is a wood frame structure with exterior stud walls and is about 10 feet wide by 18 feet long by 14 feet high at the ridge. A 2 feet thick concrete barricade wall divides the building into two halves. The concrete barricade wall projects above the roof and extends beyond the east wall about 4 feet. The exterior stud walls are load-bearing walls supporting the wood purlins at about 3 feet spacing.. The roof is corrugated asbestos roofing on purlins. The roof has a 5 feet cantilever at the south end of the building.

The drop ceiling inside the building prevents roof inspection from inside. Visual inspection from outside revealed that the building is in very poor condition. The concrete barricade wall is spalled at the east face and has a large crack on the roof. The asbestos roof panels have deteriorated and are in very poor condition. The exterior load bearing stud walls are in poor condition

Precaution and protective measures should be provided to demolition personnel during asbestos removal and demolition operations.

Modification or reinforcements to the existing building to provide the access opening for demolition operations should be avoided.

H. Building DT-8 and DT--9

The two Dry House Azide buildings are wood frame structures with exterior stud walls and are about 10 feet wide by 22 feet long by 14 feet high at the ridge. The roof system consists of corrugated asbestos roofing supported by the wood purlins. The exterior stud walls are load-bearing walls supporting the roof purlins.

The presence of the cement board ceiling inside the building prevents the inspection of the purlins inside the building. Roof leaking was observed inside the two buildings. The exterior walls of both buildings have decayed. Portions of interior wall facing are completely gone and vines are creeping on the walls inside the building.

The corrugated asbestos roofing has deteriorated due to aging and is in poor condition. BAT's recommendation for these two buildings is to avoid stepping on the roof of these two buildings during the asbestos removal operations.

Modifications or reinforcements to provide the access for the placement of dunnage during the demolition operations is not recommended.

I. Building DT-13

The building is a one story steel structure, with non-load bearing exterior brick walls. The building is 26 feet wide by 40 feet long in plan dimensions and is about 16 feet high at the ridge. There is a 5 feet wide sidewalk with a canopy at the east side and west side of the building.

The roof construction of the buildings consists of composition rolled roofing over one and one half inches thick wood planks which are supported on 12" steel joists at approximately 5 feet spacing. The overall roof is in poor condition and has many locations of water leaking, around the joints and roof vents. Rotten planks at the canopy over the 5 feet wide sidewalks were observed at many locations of the building.

The typical structural steel frame of the building is rigid frames at 20 feet spacing supporting the steel joists at approximately 5 feet spacing. The structural steel inside the building is in fair condition with moderate rusting. Steel brackets and their connections over the sidewalls are also in fair conditions.

There are no excessive steel deflections, missing members, rusted-through steel members, or structural damages to the roof steel observed. The roof steel structures are considered to be adequate for asbestos removal operations.

All exterior walls are non-load bearing walls and can be modified or removed to provide the access openings for the placement of dunnage for demolition operations. Our recommended opening locations are at the second or third bay of the sidewalls.
One full door width and one adjacent window width and the brick wall in between can be removed from the ground floor to the underside of the steel beam at the top of the wall.

J. Building DT-14

The building is a concrete frame structure with concrete columns and girders supporting steel joists and brick exterior walls. The building is 26 feet wide by 54 feet long in plan dimensions and is about 14 feet high at the ridge. There is a 5 feet wide sidewalk with an overhead canopy around the buildings.

The roof system consists of corrugated asbestos roofing supported on steel joists at approximately 5 feet spacing. The roof steel is in poor condition due to rusting. However, no excessive steel deflections, missing members, rusted-through steel members, or structural damages to the roof steel were observed. The roof steel structures are considered to be adequate for asbestos removal operations.

The exterior bricks are non-load bearing walls. The access opening for the placement of dunnage for demolition operations can be located at the middle of the north or

south sidewalls between the concrete frames. The existing double door can be removed to provide a access opening for the placement of dunnage for demolition operations.

K. Building DT-16

The Detonator Assembly Building is a concrete frame structure with concrete columns and girders supporting the steel joists or C8 channels and brick exterior walls. The building is 30 feet wide by 70 feet long in plan dimensions and is about 16 feet high at the ridge. There is a 5 feet wide sidewalk with an overhead canopy around the building.

The roof construction of the building consists of composition rolled roofing over one and one half inches thick wood planks which are supported on 10" steel joists at approximately 4 feet spacing. The overall roof is in **very poor** condition and has many locations of water leakage around vents and rotten planks with large holes inside the building. Decayed planks at the canopy over the 5 feet wide sidewalks are also observed at many locations of the building.

The asbestos contractor shall inspect the condition of the roof and locate all the areas of rotten planks and holes in the planks before starting his work. Advanced warning should be given to all personnel performing the asbestos removal Protective measures should be provided to demolition personnel during asbestos removal and demolition operations.

The exterior bricks are non-load bearing walls. The access opening for the placement of dunnage for demolition operations can be located at the southern brick walls. The whole width of the double door, one adjacent window and the brick wall in between can be removed from the ground floor to the bottom of the concrete beam above.

L. Building DT-17

The building is a wood frame structure with exterior stud walls on three sides and a concrete wall at the east side. The building is 14 feet wide by 14 feet long by 12 feet high at the ridge. A concrete wall along the ridge divides the building into two rooms.

The roof system consists of corrugated asbestos roofing supported on 4" X 6" purlins at 4 feet spacing. No major roof deficiencies were observed.

The exterior stud walls and the interior partition walls are load-bearing walls. Modification or reinforcement to the existing building to provide the access opening for demolition operations should be avoided.

M. Building DT-18 and DT-18A

The DT-18 building is a steel frame structure with non-load bearing exterior brick walls. The building is 16 feet wide by 24 feet long in plan dimensions and is about 14 feet high at the ridge.

The roof construction of the buildings consists of corrugated asbestos roofing on 8" deep steel joists supported by rigid type steel frames at 12 feet spacing. No major deficiencies at the roof steel were observed at this building.

The DT-18A building is a wood frame structure with exterior brick walls and is about 16 feet wide by 54 feet long by 14 feet high at the ridge. The exterior brick walls are load-bearing walls.

The roof construction of the building DT-18A consists of corrugated asbestos roofing supported by the 2" x 10" wood joists at 2 feet spacing. No major deficiencies at the roof steel were observed at this building.

The corrugated asbestos roofing has deteriorated due to aging but is in reasonable condition for asbestos removal operations.

The exterior non-load bearing walls at the east side of the DT-18 building can be modified or removed to provide the access openings for the placement of dunnage for demolition operations.

N. Building DT-24

The building is a concrete frame structure with concrete columns and girders supporting steel joists and brick exterior walls. The building is 20 feet wide by 90 feet long in plan dimensions and is about 14 feet high at the ridge. There is a 5 feet wide sidewalk with an overhead canopy around the buildings.

The roof system consists of corrugated asbestos roofing supported on steel joists. The roof steel is in poor condition due to rusting. No major structural deficiencies at the roof steel were observed.

At the northern half of the building, the asbestos roofing is supported by very light weight steel joists. These joists are 6" deep and the flanges of the top chord and bottom chord are about 1 inch wide. Exercise precautionary measures and provide protective measures during the asbestos removal operations.

The exterior bricks at the south side of the building are non-load bearing walls. The access opening for the placement of dunnage for demolition operations can be located in middle portion of this wall.

One double door, adjacent window, and the brick wall in between can be removed from the ground floor to the bottom of the concrete beam above.

O. Building DT-28 and DT-29

The two change house buildings are identical in size and design. The buildings are one-story steel truss frame structures with exterior brick walls. The buildings are 30 feet wide by 110 feet long and are about 16 feet high at the ridge.

The roof construction consists of corrugated asbestos roofing supported on steel channel, C8, at approximately 4 feet spacing at the top of trusses. The typical steel frame of the buildings is a triangle roof truss spanning between two steel columns. The truss frames are at 18 feet spacing. Sag rods or bridging were provided at the one-third points of the joists.

The overall condition of the roof steel for both buildings is poor. These buildings have not been in use, and thus have not been properly maintained for the last thirty years. All roof steel has severe rusting

There are no excessive steel deflections, missing members, or structural damages to the roof steel observed. The roof steel structures are considered to be adequate for asbestos removal operations.

The exterior brick walls are non-load bearing walls and can be modified or removed to provide the access openings for the placement of dunnage for demolition operations. Our recommended access opening is on the north sidewall at the third door from the east end the building.

The 3 feet door, adjacent window, and the brick wall in between can be removed from the ground floor to the underside of the steel beam above.

P. Building DT-34

The Detonator Destroying House is a small wood frame structure with exterior stud walls and is about 8 feet wide by 10 feet long by 12 feet high. The roof system consists of composition rolled roofing supported on 2" x 6" wood beams. The exterior stud walls are load-bearing walls supporting the wood beams.

The roof and the supporting beams have decayed with large holes. The whole wood frame structure has deflected several inches to the south sides. The whole structure is **in danger of collapse.** BAT's recommendation is demolishing the building by pulling the structure to the ground and then removing the asbestos roofing on the ground.

Q. Building DT-35

The Control House is a small brick building and is about 6 feet wide by 6 feet long by 10 feet long by 10 feet high. The roof consists of corrugated asbestos roofing on 4"x 6" wood purlins supported by 4"x 8" wood rafters.

The corrugated asbestos roofing has deteriorated due to aging but no major deficiencies at the roof were observed at this building.

The exterior brick walls are load-bearing walls and should not be altered or modified for demolition operations

R. Building DT-48

The Heater House is a wood frame structure with exterior stud walls and is about 10 feet wide by 10 feet long by 12 feet high at the high point. The roof system consists of composition rolled roofing over wood planks supported on wood rafters.

The composition rolled roofing and planks have decayed with large holes in the roof. The exterior studs walls are load-bearing walls and are in **very poor** condition.

Do not step on the roof during the asbestos removal operations

S. Building DT-52

The Dining Building, DT-52, is a one-story wood frame structure with exterior concrete masonry walls. The building is 30 feet wide by 90 feet long and is about 16 feet high at the ridge. The exterior masonry walls are load-bearing walls.

The roof construction of the buildings consists of composition rolled roofing over roof sheathing supported on pre-engineered wood trusses at 2 feet spacing. The building has plaster ceiling at the bottom of the trusses.

The overall roof is in **very poo**r condition and has many locations of water leakage, rotten sheathing, and fallen plaster ceiling. The kitchen roof at the south side of the building has partially collapsed along the south masonry wall.

The exterior walls and wooden window frames at the south side of the kitchen have partially collapsed. Do not step on the kitchen roof during the asbestos removal operations.

The asbestos contractor shall inspect the conditions of the roof and locate all the areas of water leakage, rotten sheathing, decayed wood beams, and holes in the roof before starting his work on this building. Advanced warning should be given to all personnel performing

The asbestos removal. Precautionary and protective measures should be provided to all demolition personnel during asbestos removal and demolition operations.

The exterior concrete masonry walls at the north and south sides are load-bearing walls supporting the wooden roof trusses at 2 feet spacing. The east and west end walls are not load bearing walls. The access opening for the placement of dunnage for demolition operations can be located at the east end wall by removing one of the two existing six and a half feet wide windows and the concrete blocks below the window. Do not remove the concrete block walls and the lintel beam above the top of the window.

T. Building DT-54, DT-55, and DT-56

Buildings DT-54, DT-55, and DT-56 are small wood frame structures with exterior stud walls and are about 8 feet wide by 10 feet long by 12 feet high. The roof system consists of composition rolled roofing supported on 2" x 6" wood beams at 2 feet spacing. The exterior stud walls are load-bearing walls supporting the wood beams.

The roof and the supporting beams have decayed with holes. The stud walls at the south side of the Building DT-54 have partially collapsed. The overall structural condition of these three building are **very poor and are in danger of collapse**. BAT's recommendation is demolishing the three buildings by pulling the structures to the ground and then removing the asbestos roofing on the ground.

6.0 CONCLUSIONS AND RECOMMENDATIONS

All buildings and nineteen wood frame walkways in the Load Line 9 are more than sixty years old and have not been in service without maintenance for more than thirty years. Most buildings are in poor condition. All roof steel of these buildings has not been painted for years, and thus severely rusted.

No major deficiencies such as excessive deflections, deformations, or missing members to the main steel framing of all steel structures were observed. However, locations of local weakened connections or members due to heavy rusting should be expected.

Access openings for the placement of dunnage into the buildings for the burning and demolition operations should be located at the non-load bearing walls of each building. A full width of double door, adjacent window and the brick wall in between can be removed from the ground

floor to the bottom of steel or concrete beams above. For large buildings, the ideal locations of the openings are at the third bay from the end walls of the buildings. For other smaller buildings, recommended opening locations are sown on the individual building floor plan.

1. Wood frame walkways in the Load Line 9 and Load Line 6 were built at about the same time and with the same design. The overall structural conditions are in **very poor condition**. Many sections of the walkways are unstable and could collapse very soon. See report #3 for detailed discussions and recommendations.

2. Four wood frame buildings, DT-34, DT-48, DT-54, DT-55, and DT-56 are in **very poor** condition and could collapse. BAT' recommends demolishing the buildings and then removing the asbestos roofing on the ground. **Do not step** on the roofs of these buildings during the asbestos removal and demolition operations. Advanced warning should be given to all personnel performing the asbestos removal. Precautionary and protective measures should be provided to demolition personnel during asbestos removal and demolition operations.

3. The roofs for the buildings DT-16 and DT-52 are in **very poor** condition. The wood planks have decayed with large holes. The roof over the kitchen at the south side of the building DT-52 and its supporting walls are partially collapsed. The asbestos contractor should inspect these roofs and locate the decayed areas and the holes in the roofs prior to starting the asbestos removal operations. Advanced warning should be given to all personnel performing the asbestos removal. Precautionary and protective measures should be provided to demolition personnel during asbestos removal and demolition operations.

4. Building roofs and their members are designed for dead weights, snow loads (live loads), and wind loads. In accordance with the current Ohio Basic Building Code, the design snow load in the Ravenna area is 25 pounds per square foot (PSF). The design snow load was probably less than 25 PSF at the time those buildings were built. Considering the current structural conditions and the age of the buildings, asbestos removal personnel are recommended not to be out on the roofs of the buildings for any reasons during the time when the accumulated snow on the roof is more than four inches.

5. Due to aging and weathering, the roof corrugated asbestos panels might be very fragile. Exercise precautionary and protection measures during the asbestos roofing removal operations. The asbestos contractor should verify and familiarize himself with each asbestos panels support conditions related to his work such as main truss locations, locations and spacing of joists or purlins, and asbestos panel fastener conditions prior to the asbestos removal operations.

6. Some asbestos panel fasteners at the roof might be severely rusted. It should be expected that some fasteners might be sheared off during the panel removal operations due to their own weight. Precaution should be exercised and protection for the workers should be provided during the asbestos removal operations.

7. All transite removal operations should be executed from outside the buildings to avoid damaging the sag rods between purlins or horizontal bridging between joists.

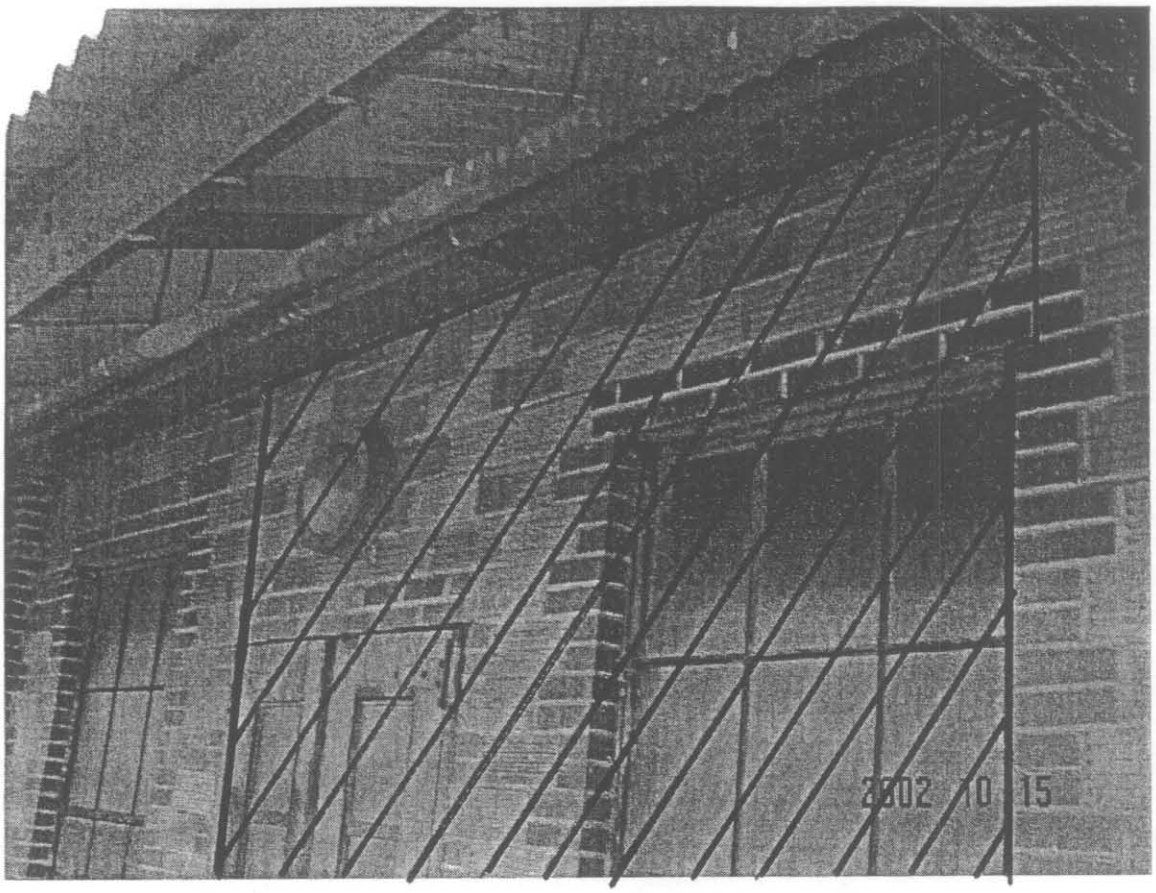
8. Fall protection for workers should be provided in accordance with the requirements and standards for the construction industry by the Occupational Safety and Health Administration (OSHA) and other governing regulations.

9. For the roof where asbestos panels are supported by the light steel joists, it is our recommendation that the total weight of a worker including the tool and equipment carried should not be more than 200 pounds. As a reference, in accordance with the present steel roof deck design criteria of the Steel Deck Institute (SDI), roof decks are designed for construction live loads of 20 pounds per square foot uniform load or 150 pounds concentrated load on a one foot wide section of deck. Without the original design information and considering the age of these structures, conservative approaches and judgment should be exercised.

10. Additional recommendation for buildings with open roofs (without corrugated asbestos roofing)

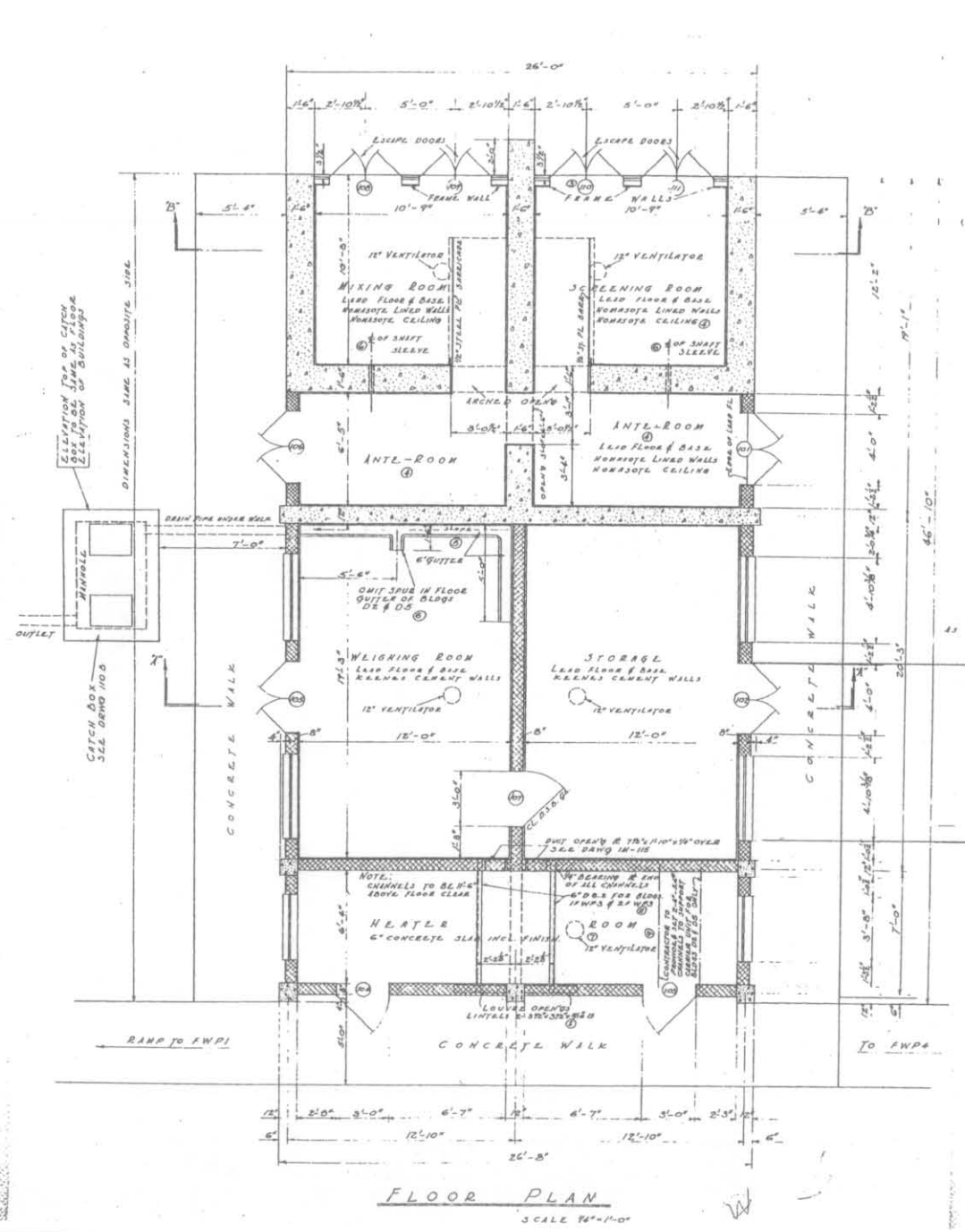
    Buildings and all components are designed to be stable and self-supporting after they are built to become complete structures. A building without roof decking (corrugated asbestos panels) or horizontal bracing to provide the roof diaphragm action is not a complete structure and is considered to be partially stable with reduced structural capacity to resist the external wind loads applied to the structure or its components such as exterior brick walls, interior partition walls, roof steel joists, etc.

    In the case of the buildings with their corrugated asbestos roofing being removed after the roof asbestos removal operations in the Load Line 6 & 9, BAT recommends that all personnel to stay away from these buildings during the time when the wind speed is more than 35 miles per hour. The strong wind loads could cause the walls (bearing walls, non-bearing walls, and interior partition walls) and other building components to collapse.

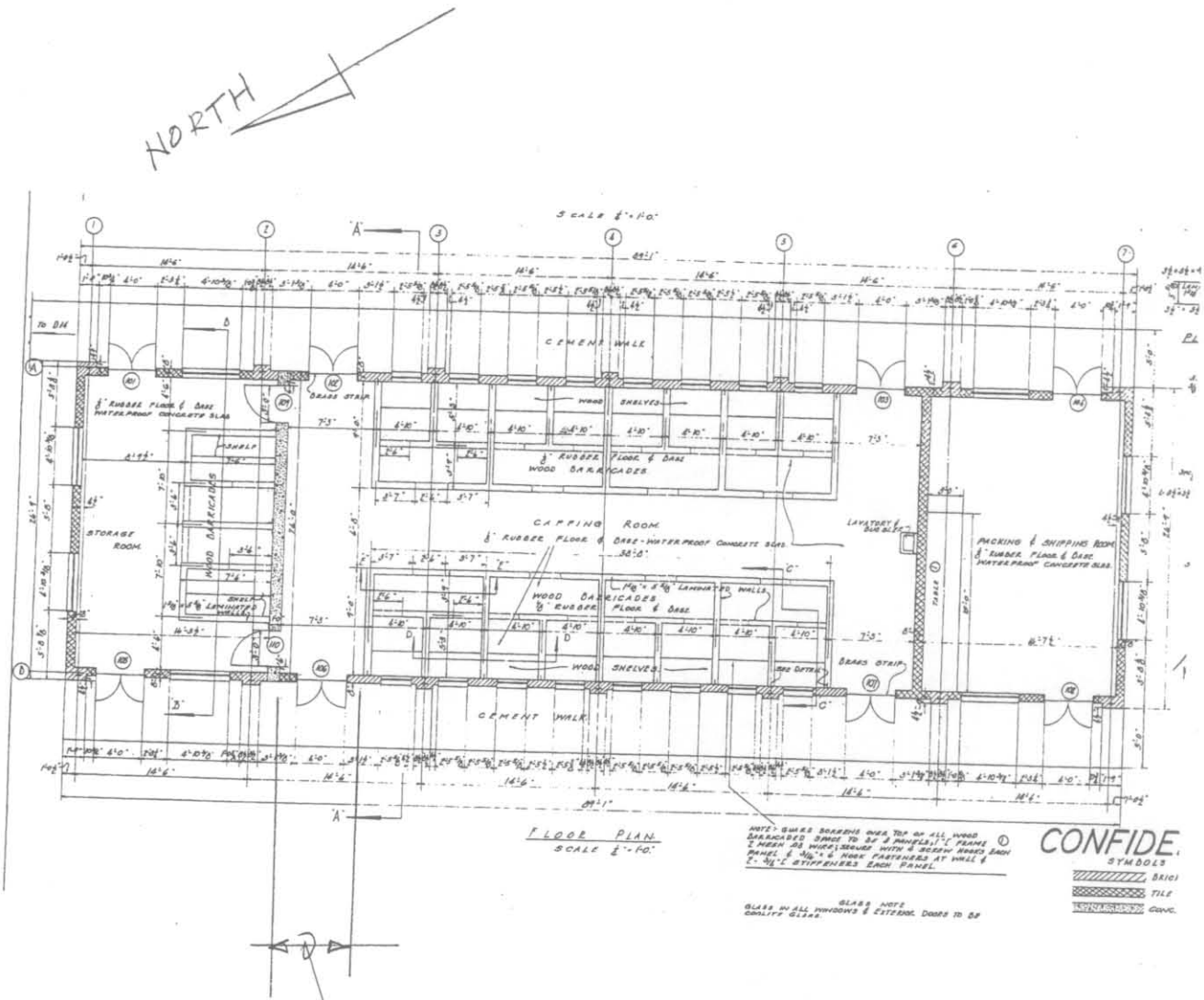


REMOVE DOUBLE DOOR, WINDOW, & BRICK WALL INSIDE SHADED AREA FROM GROUND FLOOR TO BOTTOM/BEAM ABOVE

TYPICAL DUNNAGE ACCESS OPENING DETAIL



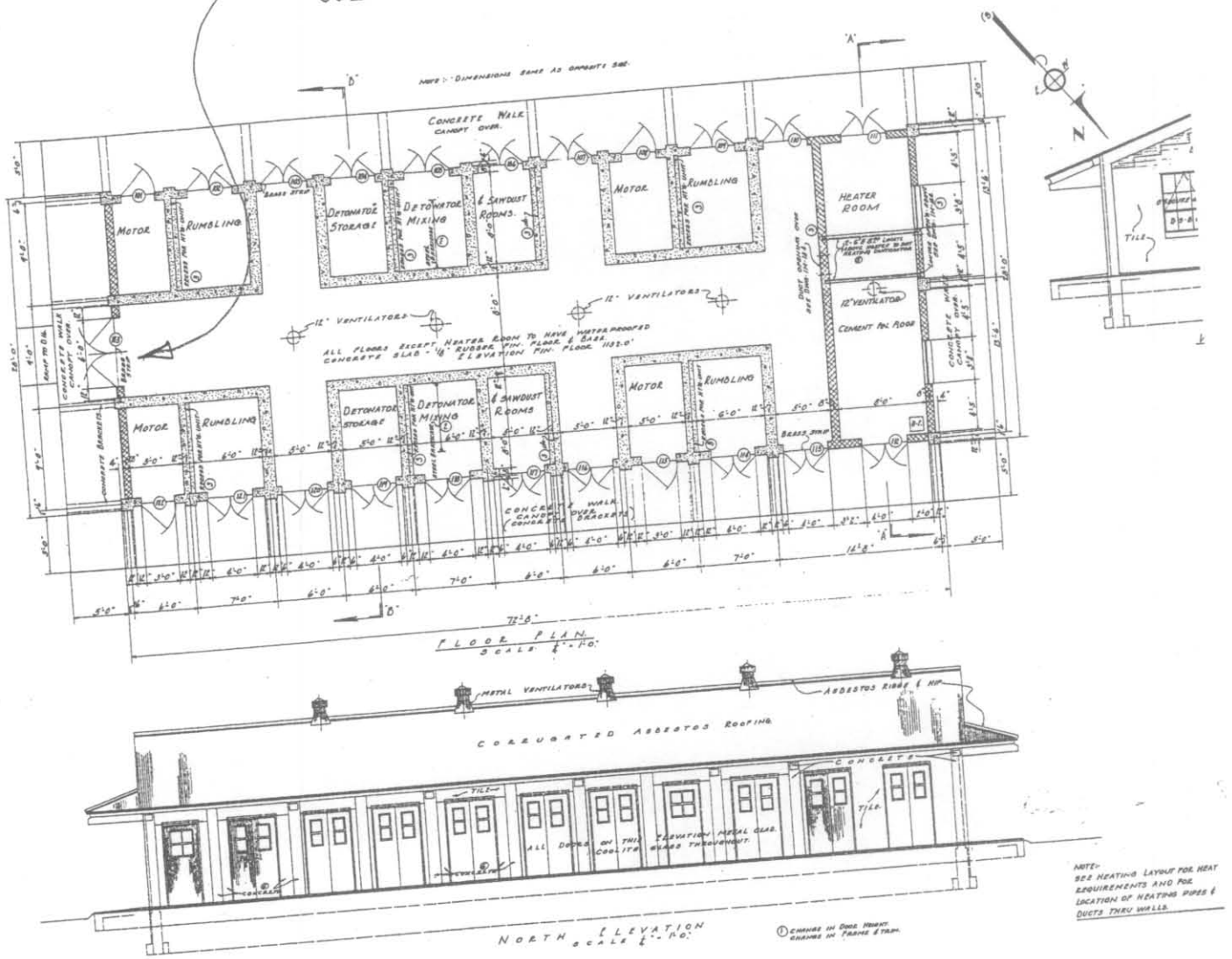
BUILDING DT-2 & DT-5



RECOMMENDED ACCESS LOCATION
-REMOVE DOOR AND BRICK WALL FROM GROUND FLOOR TO THE BOTTOM OF THE STEEL BEAM ABOVE.

BUILDING DT-13

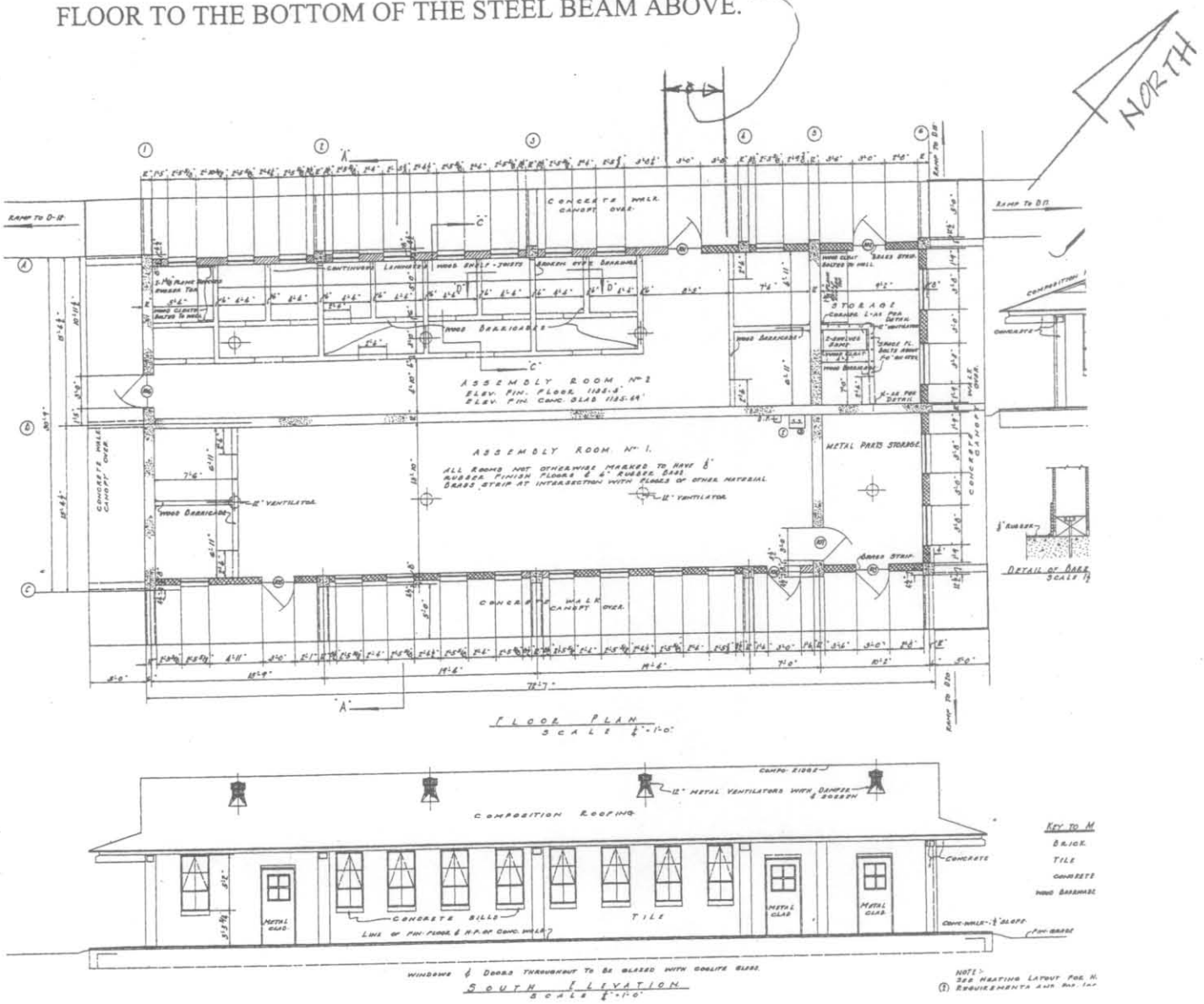
ACCESS FOR DUNNAGE PLACEMENT
- USE EXISTING 6'-0" WIDE DOUBLE DOOR.



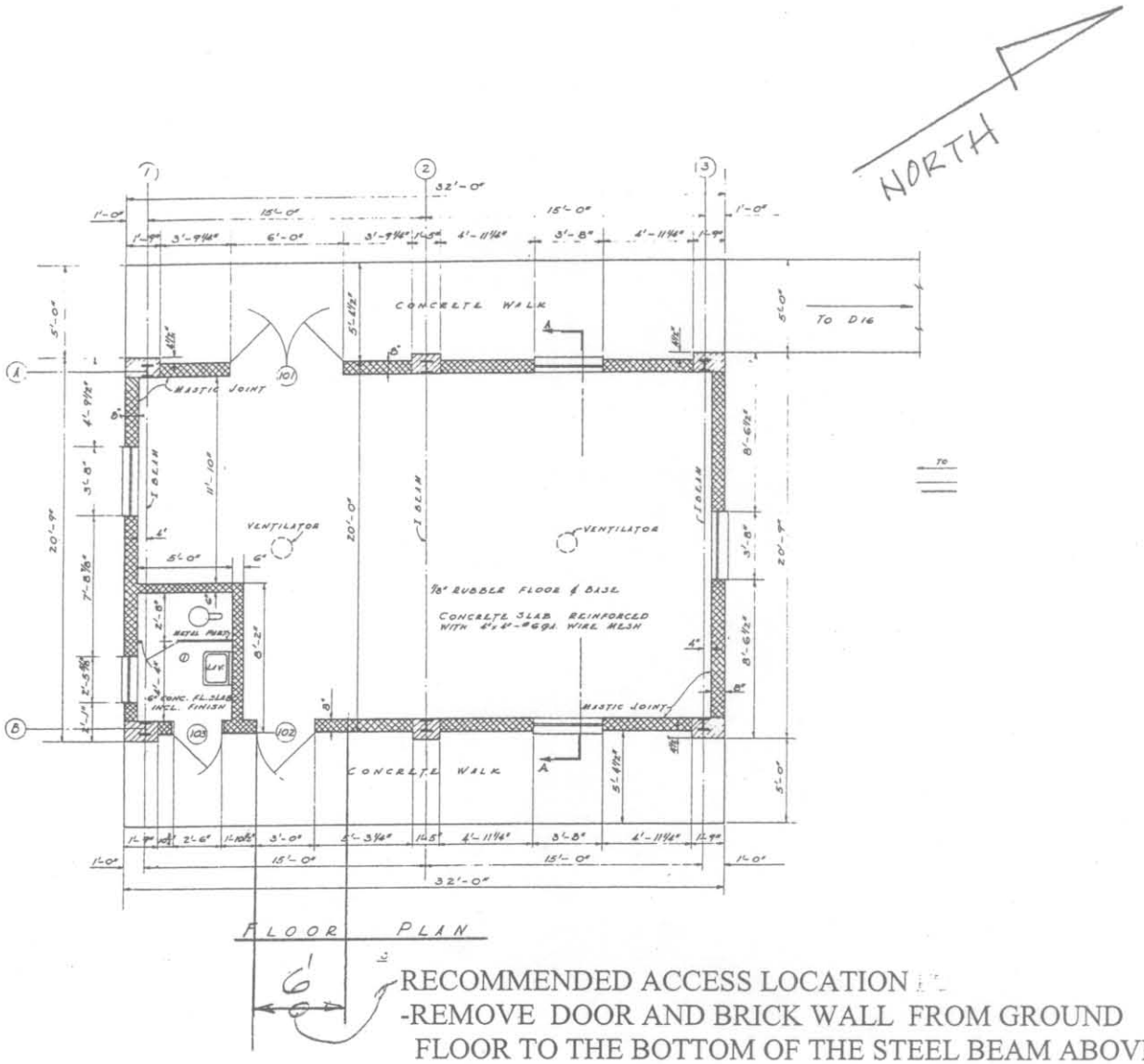
NOTE:
SEE HEATING LAYOUT FOR HEAT REQUIREMENTS AND FOR LOCATION OF HEATING PIPES & DUCTS THRU WALLS.

BUILDING DT-14

RECOMMENDED ACCESS LOCATION
-REMOVE DOOR AND BRICK WALL FROM GROUND FLOOR TO THE BOTTOM OF THE STEEL BEAM ABOVE.

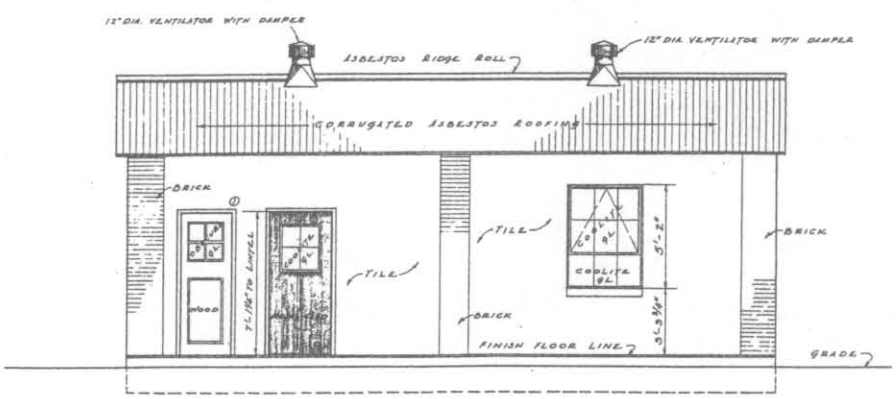


BUILDING DT-16



FLOOR PLAN

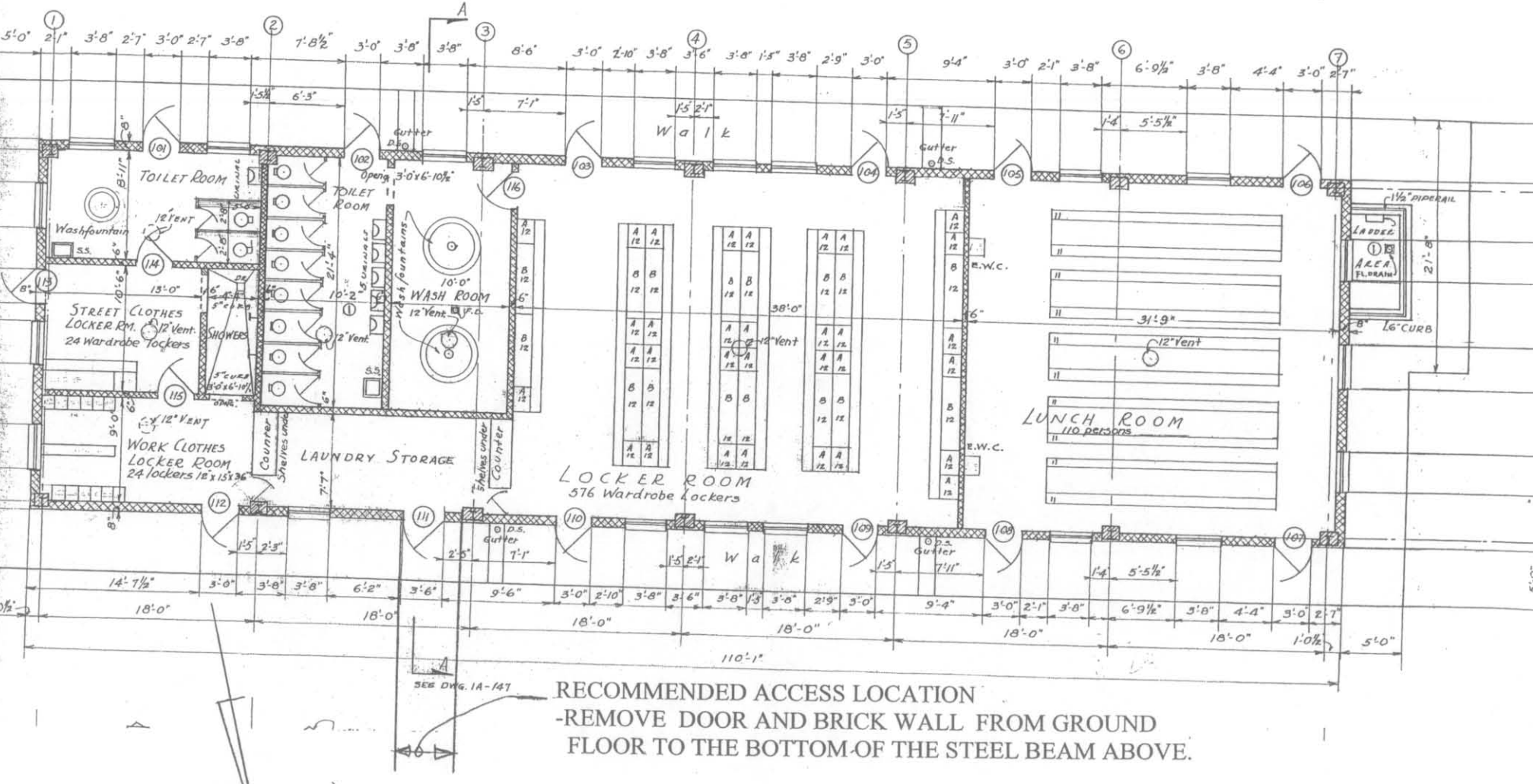
RECOMMENDED ACCESS LOCATION
-REMOVE DOOR AND BRICK WALL FROM GROUND FLOOR TO THE BOTTOM OF THE STEEL BEAM ABOVE.



SOUTH ELEVATION

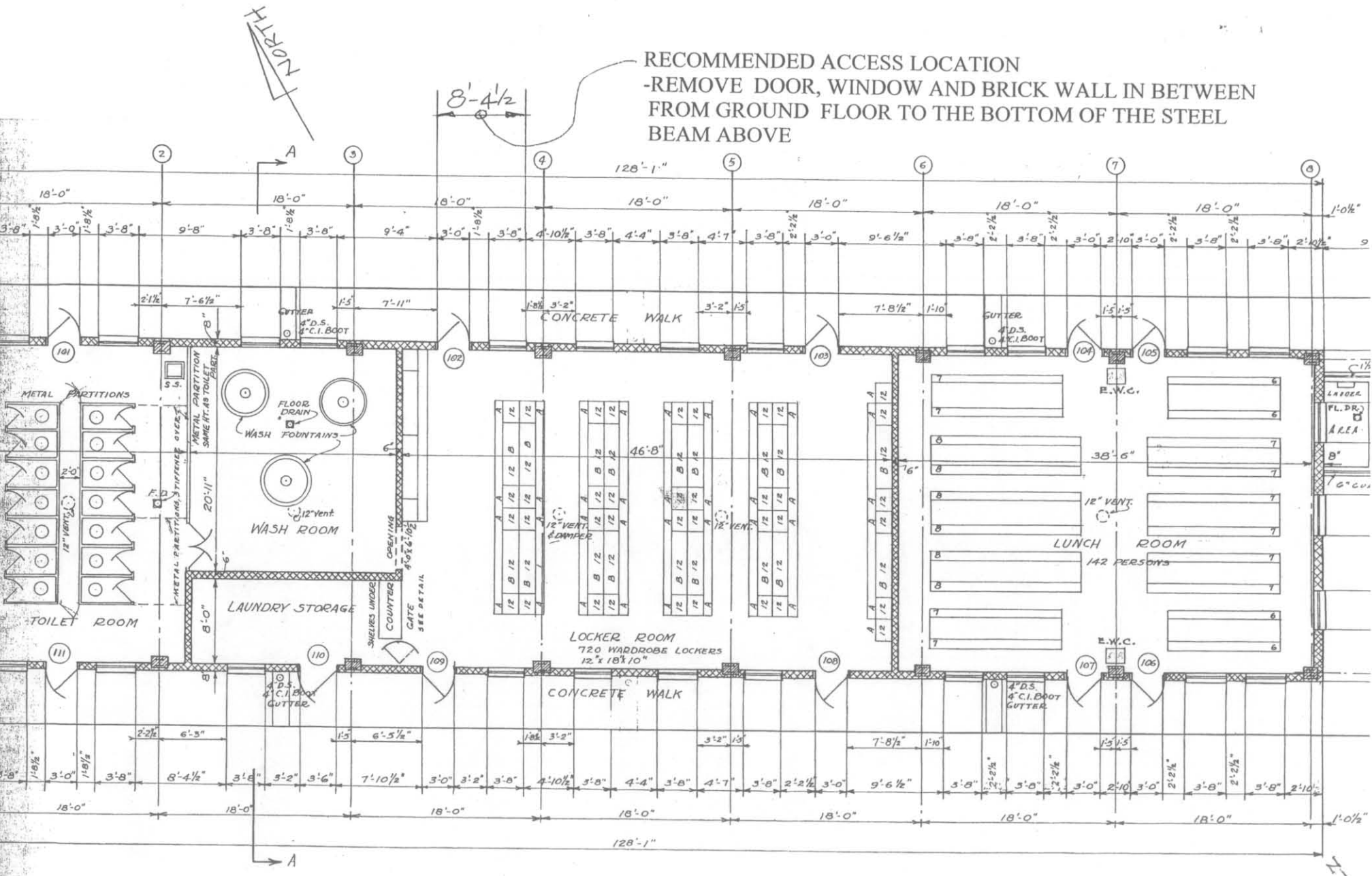
SCALE ¼"=1'-0"

BUILDING DT-18



RECOMMENDED ACCESS LOCATION
-REMOVE DOOR AND BRICK WALL FROM GROUND FLOOR TO THE BOTTOM OF THE STEEL BEAM ABOVE.

BUILDING DT-28

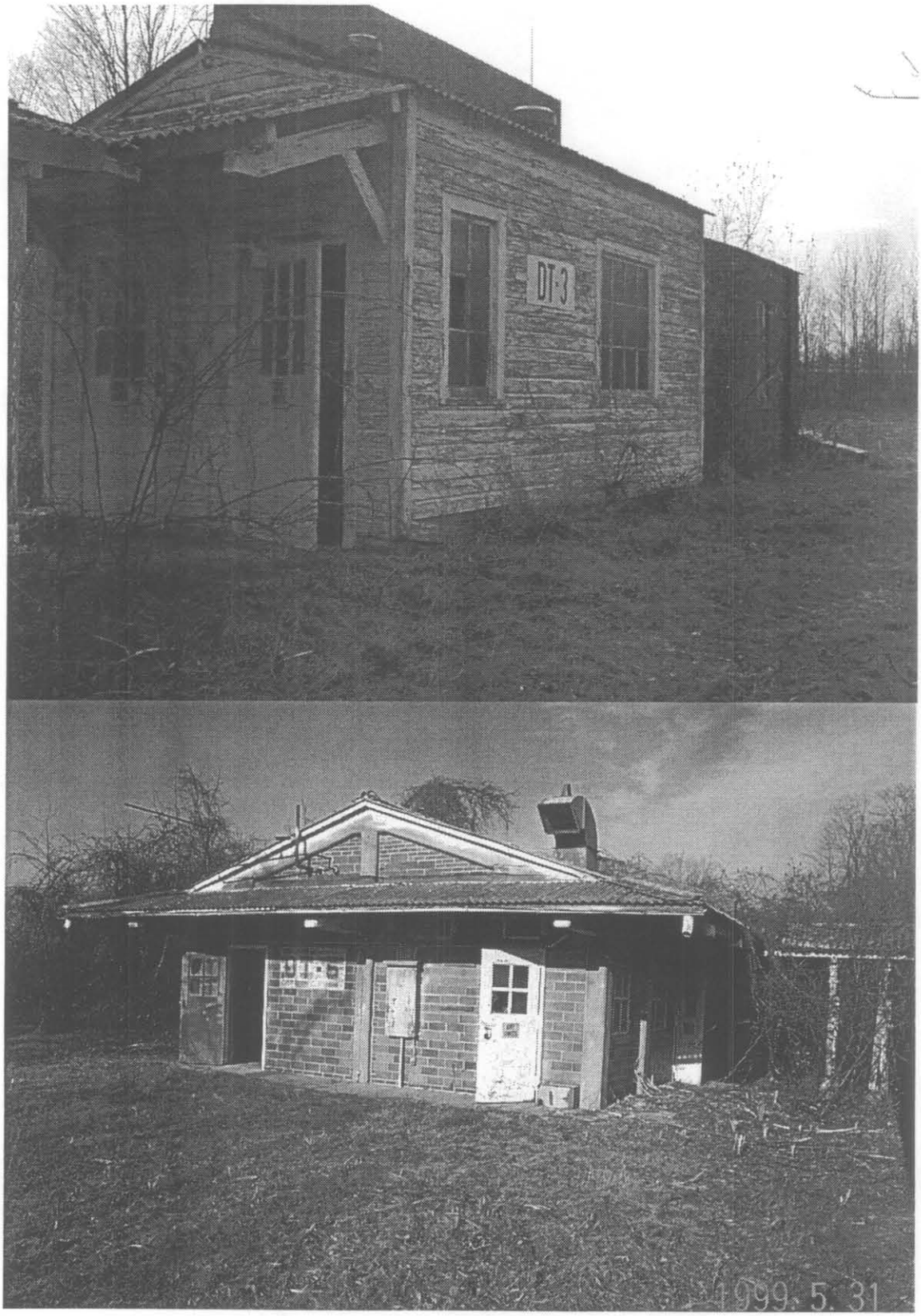


GROUND FLOOR PLAN
SCALE 1/8"=1'-0"

BUILDING DT-29


DT-1


DT-2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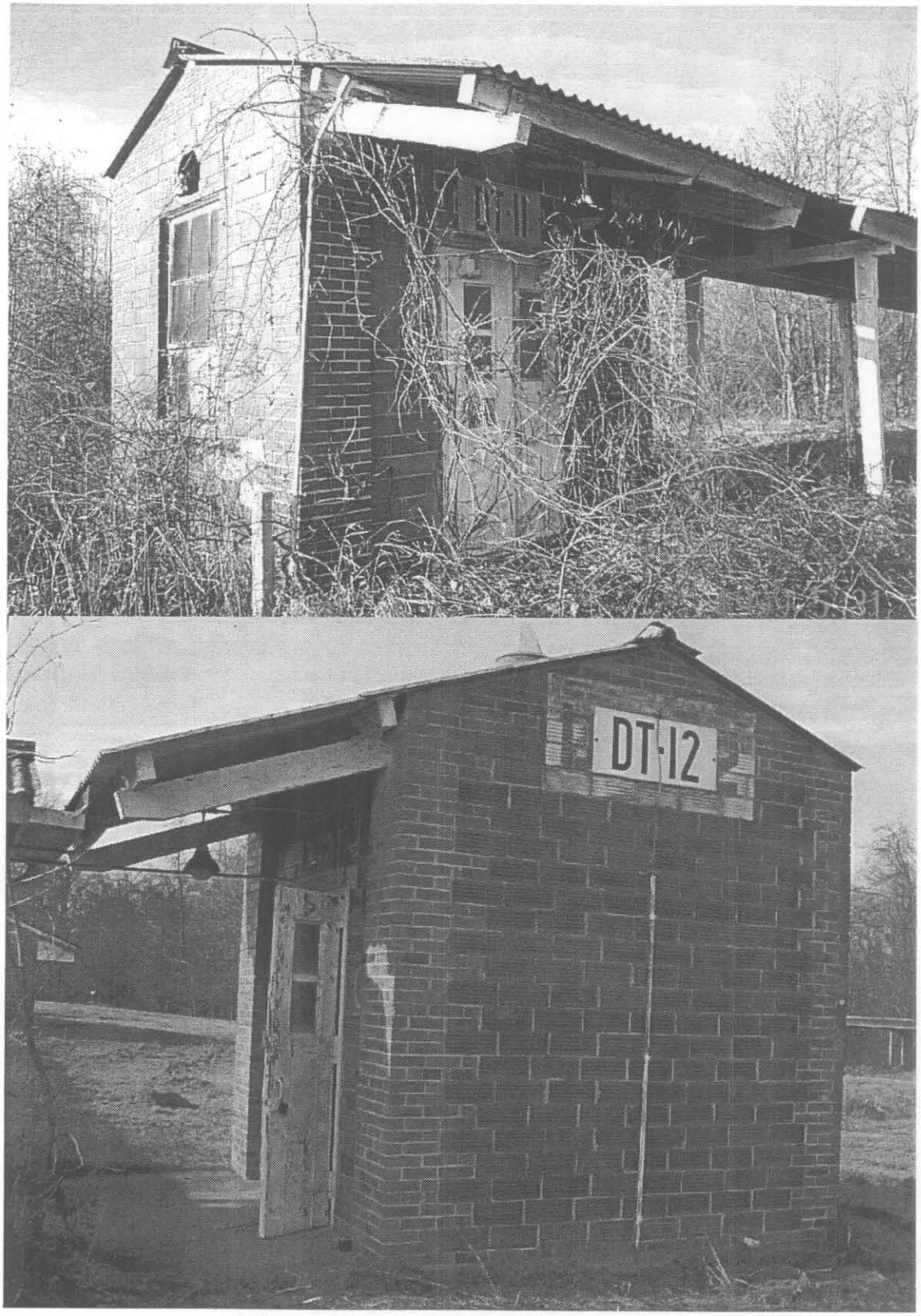
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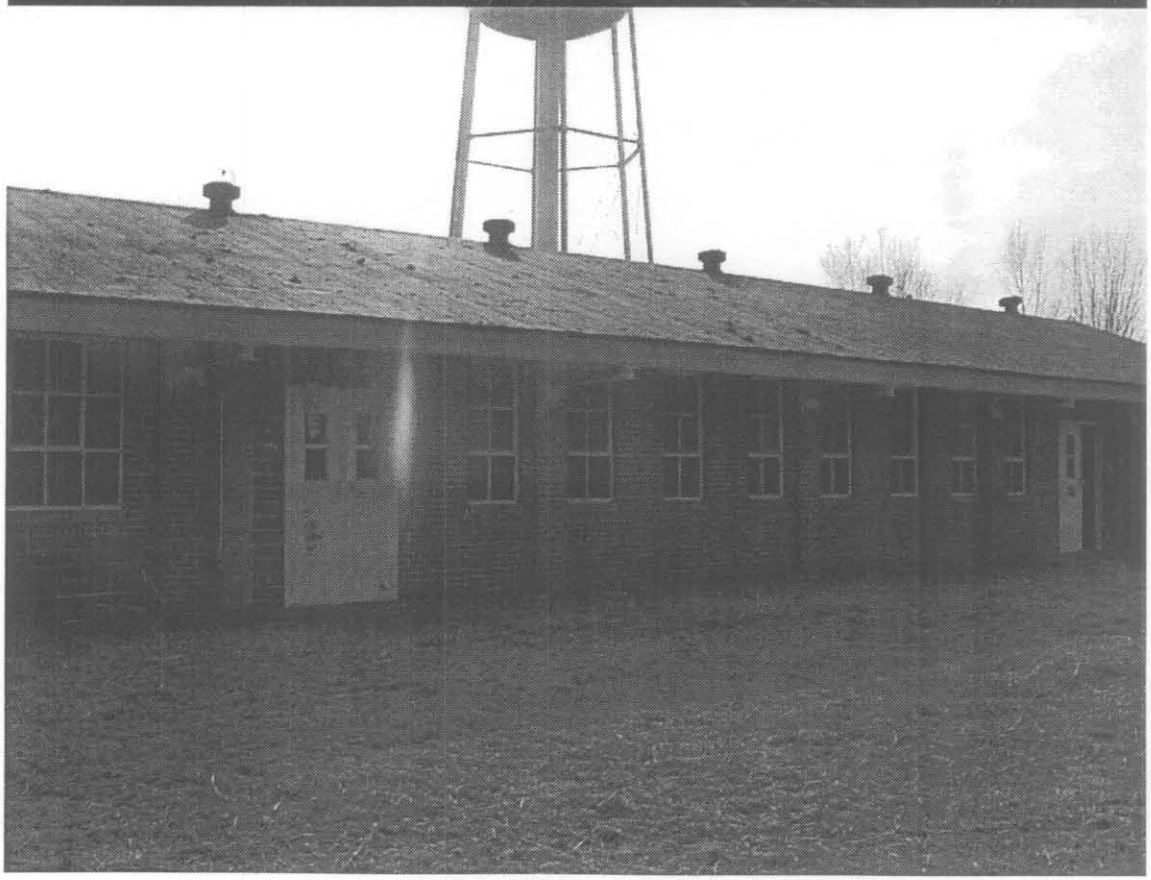
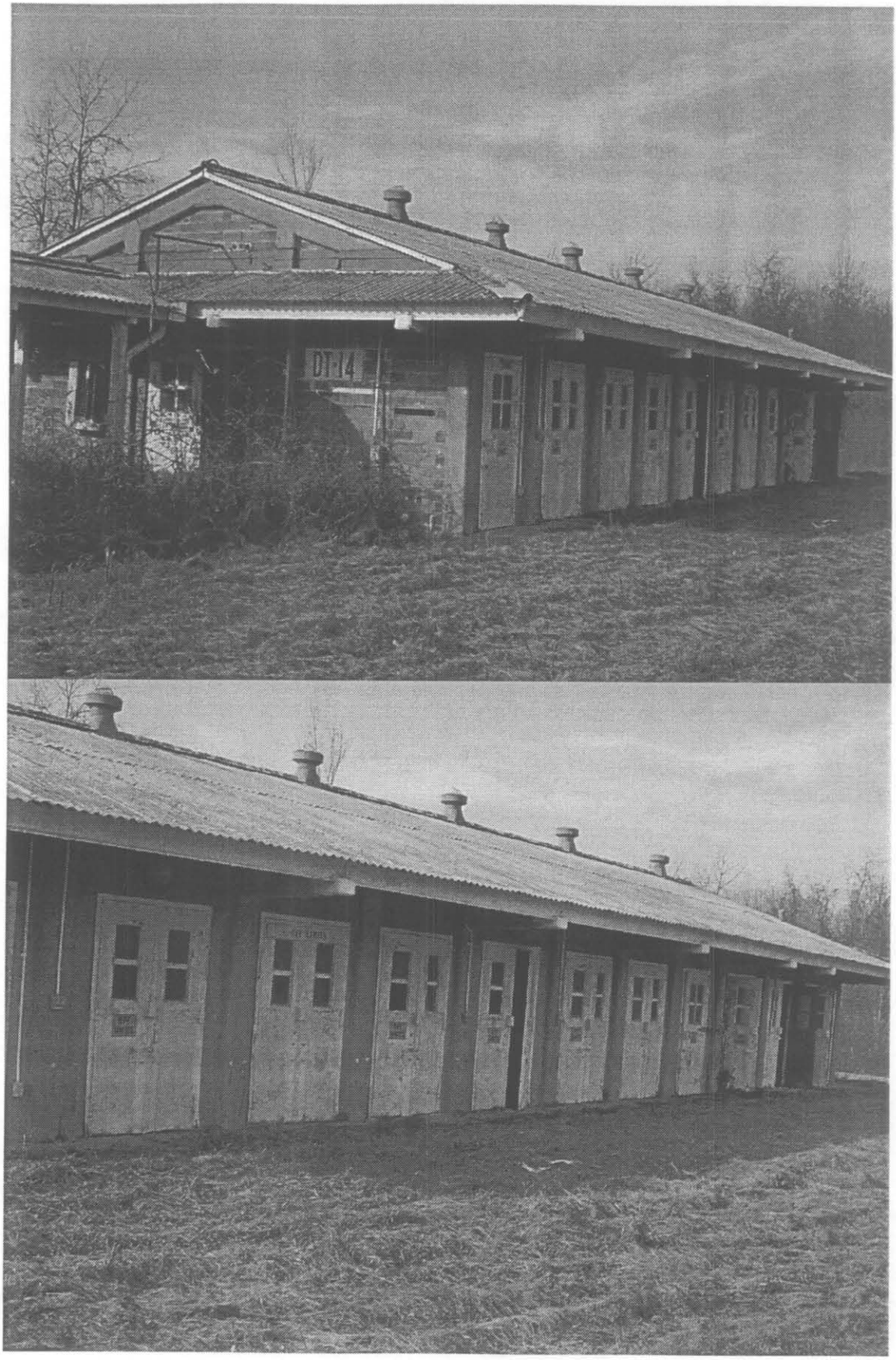
DT-13

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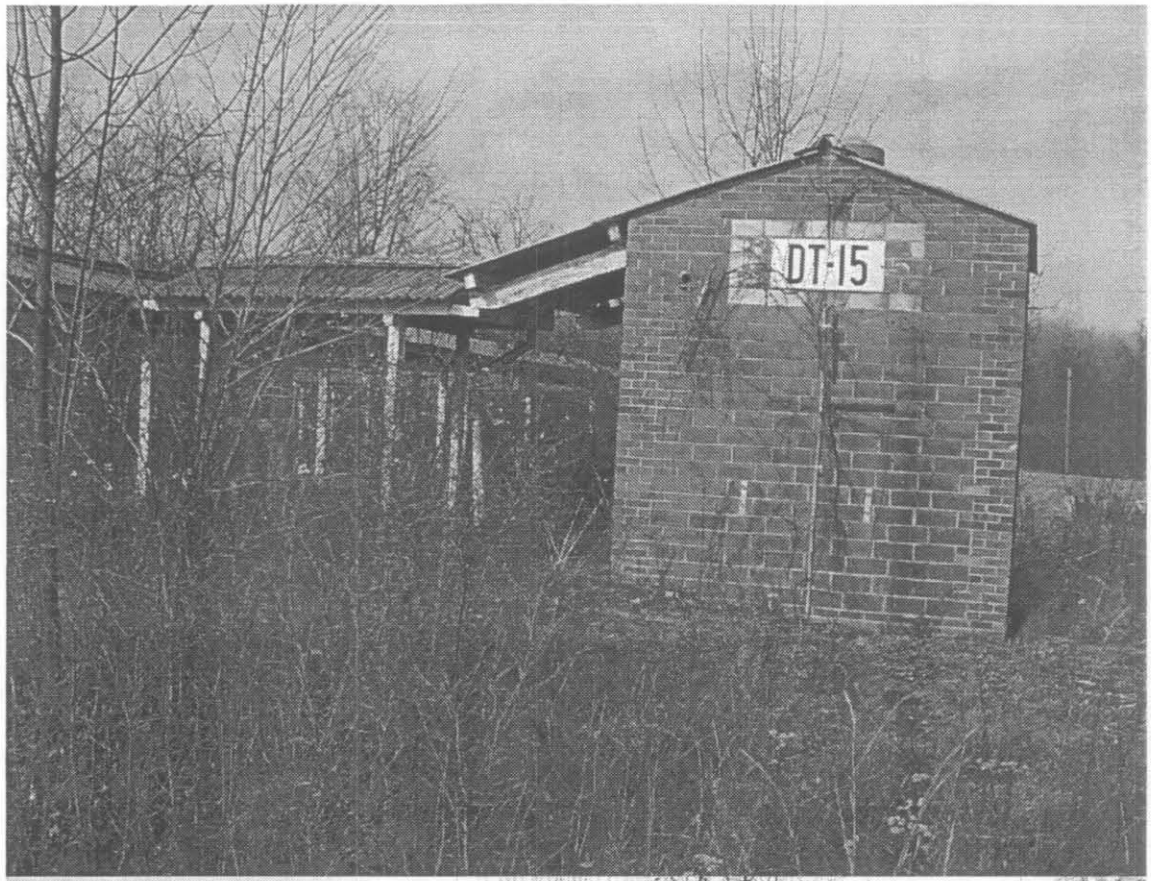
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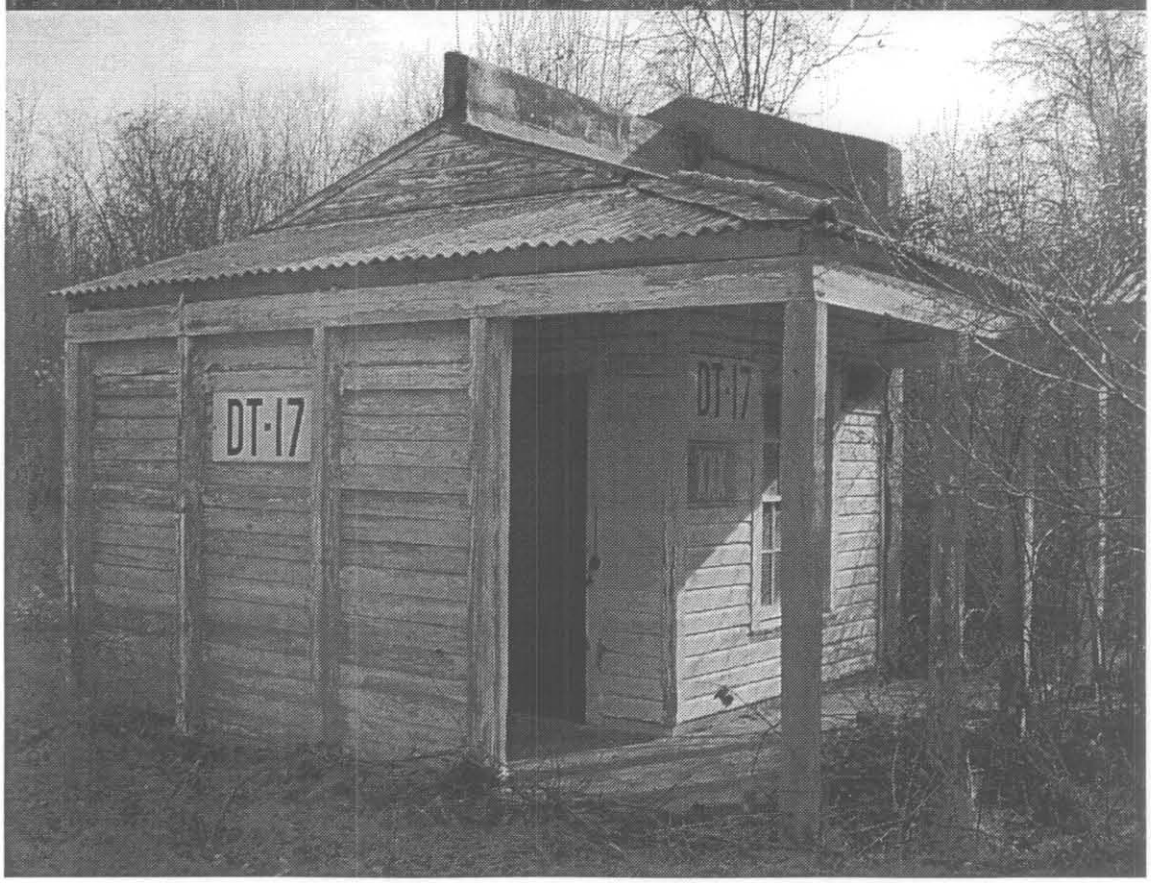
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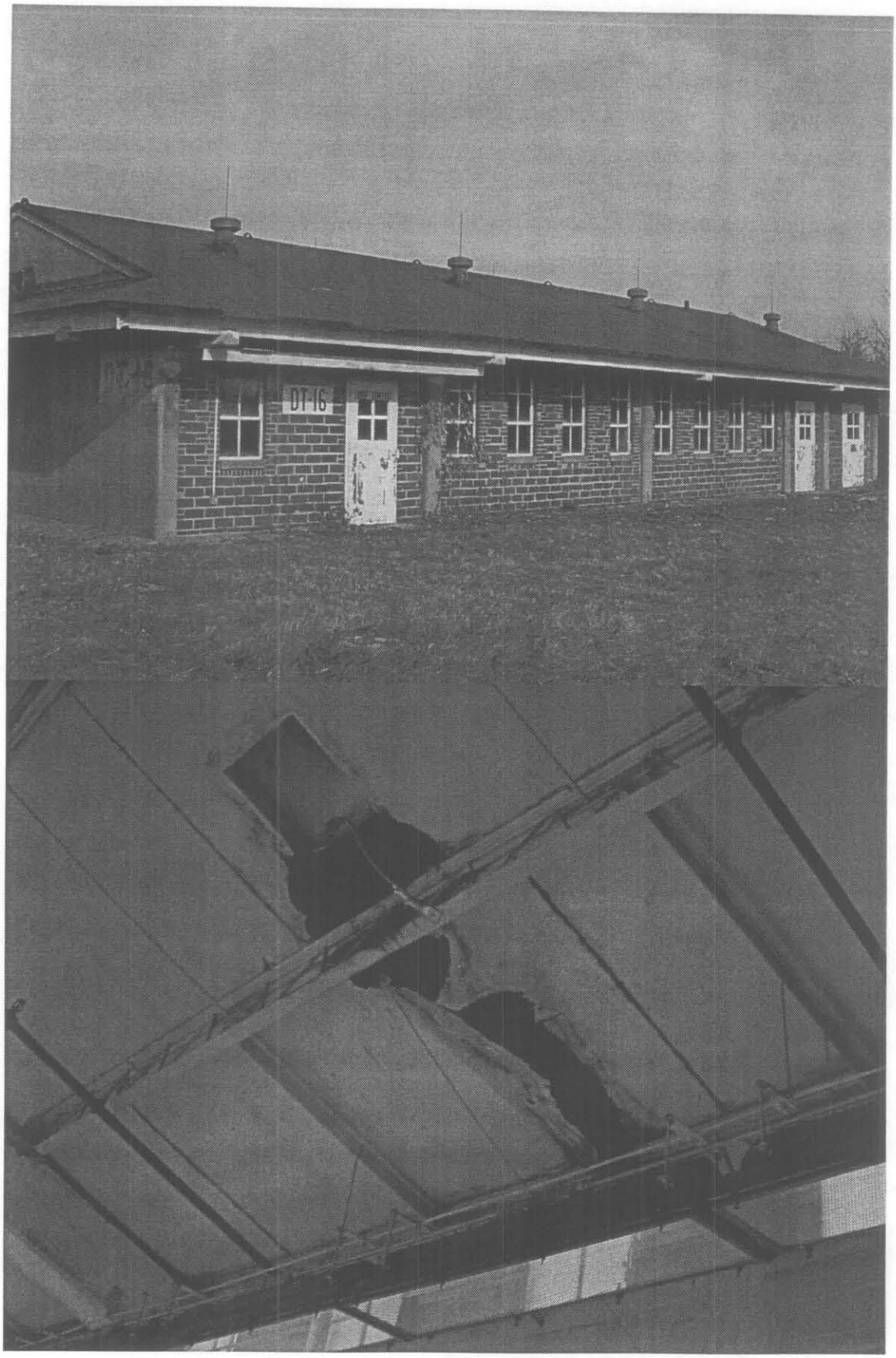
DT-17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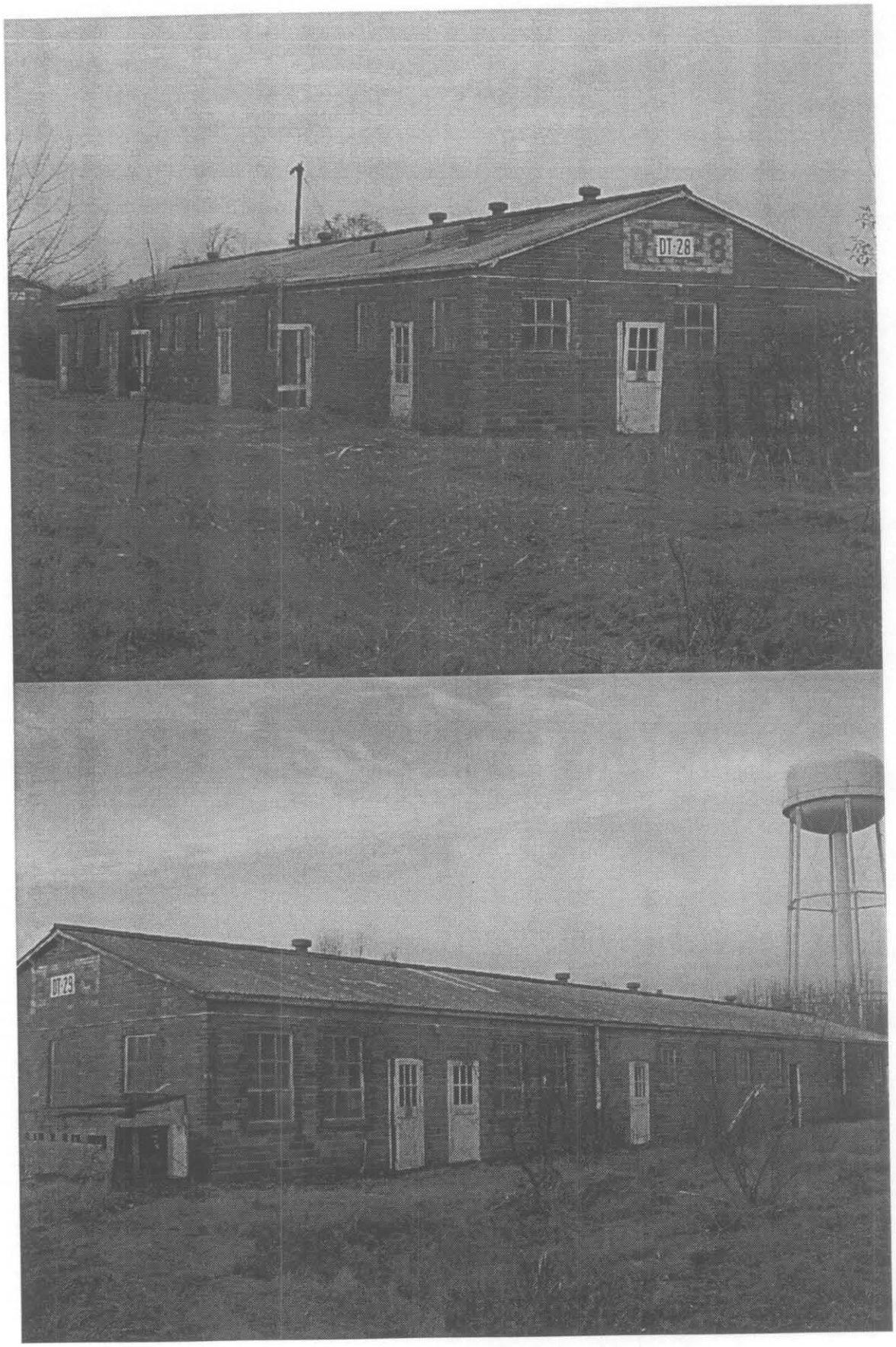
DT-18
DT-25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DT-28


DT-34


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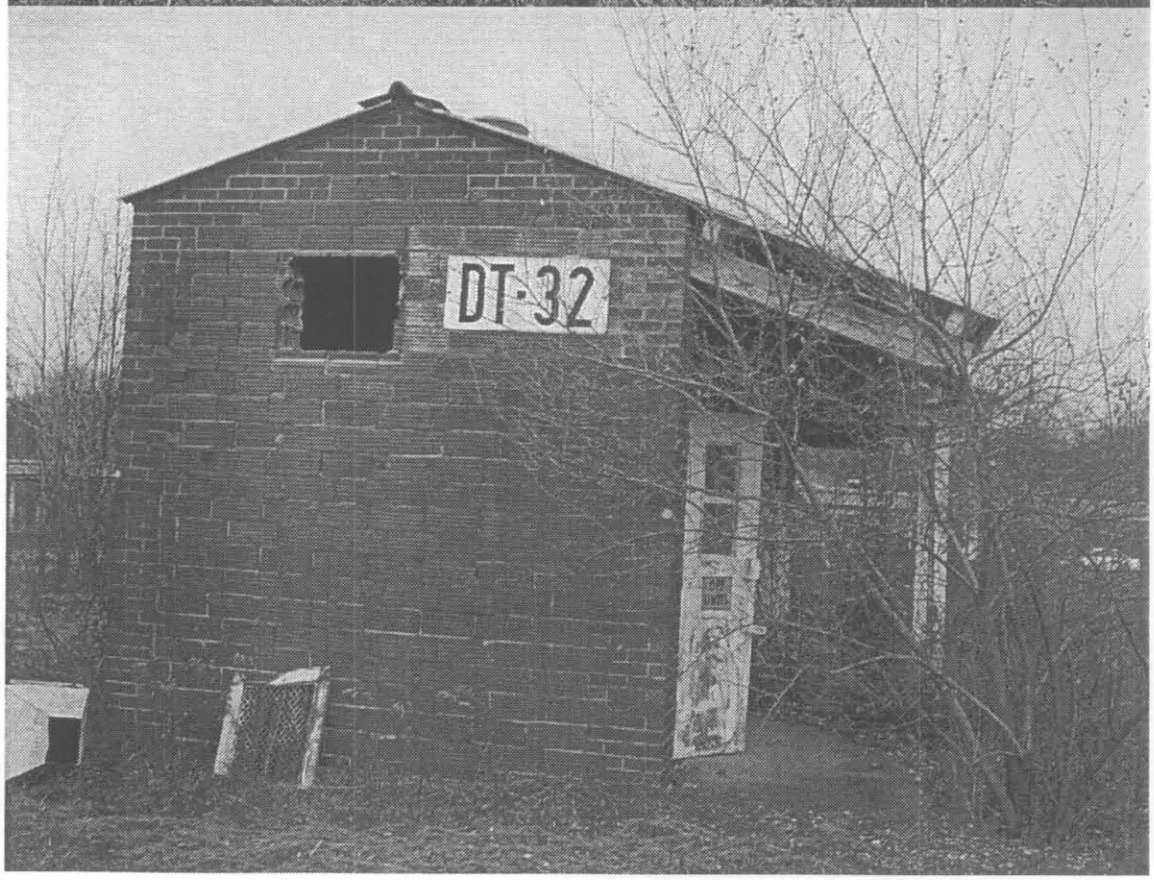
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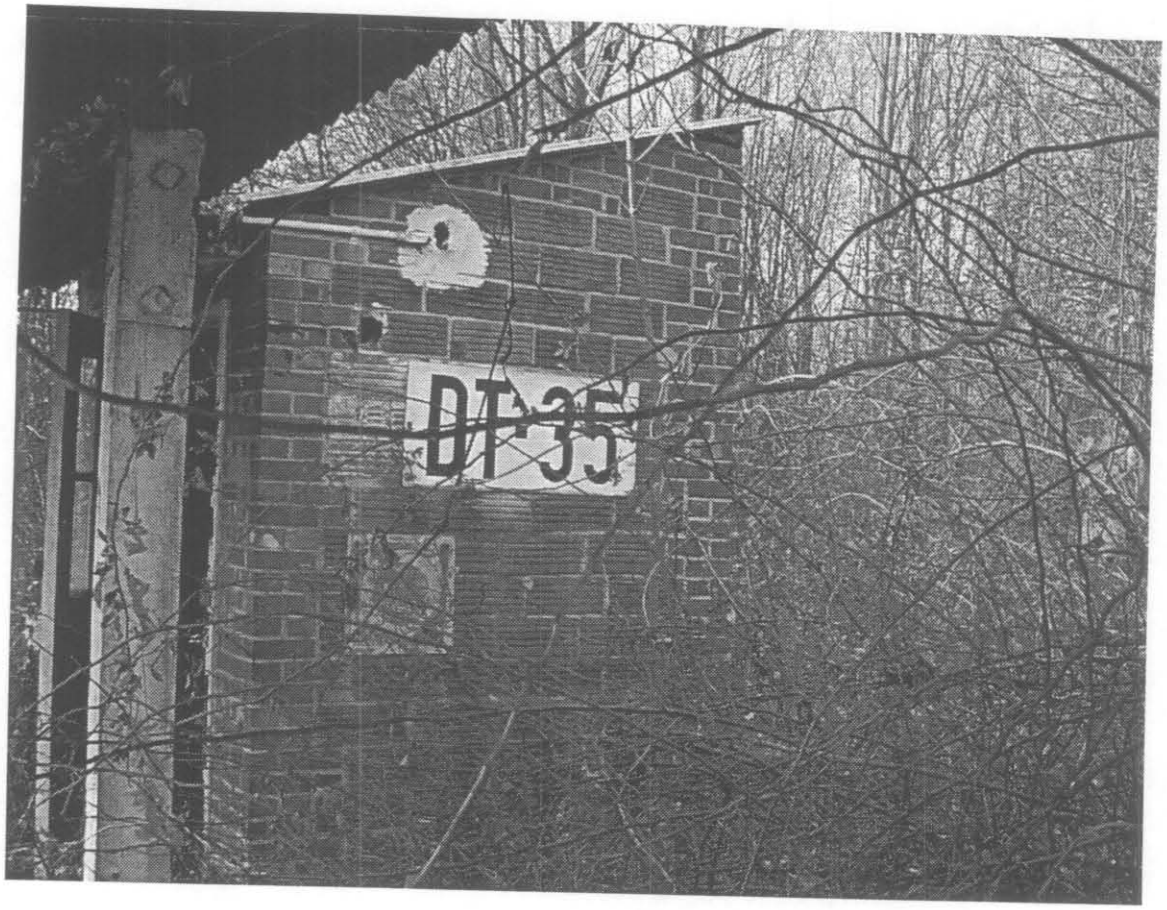
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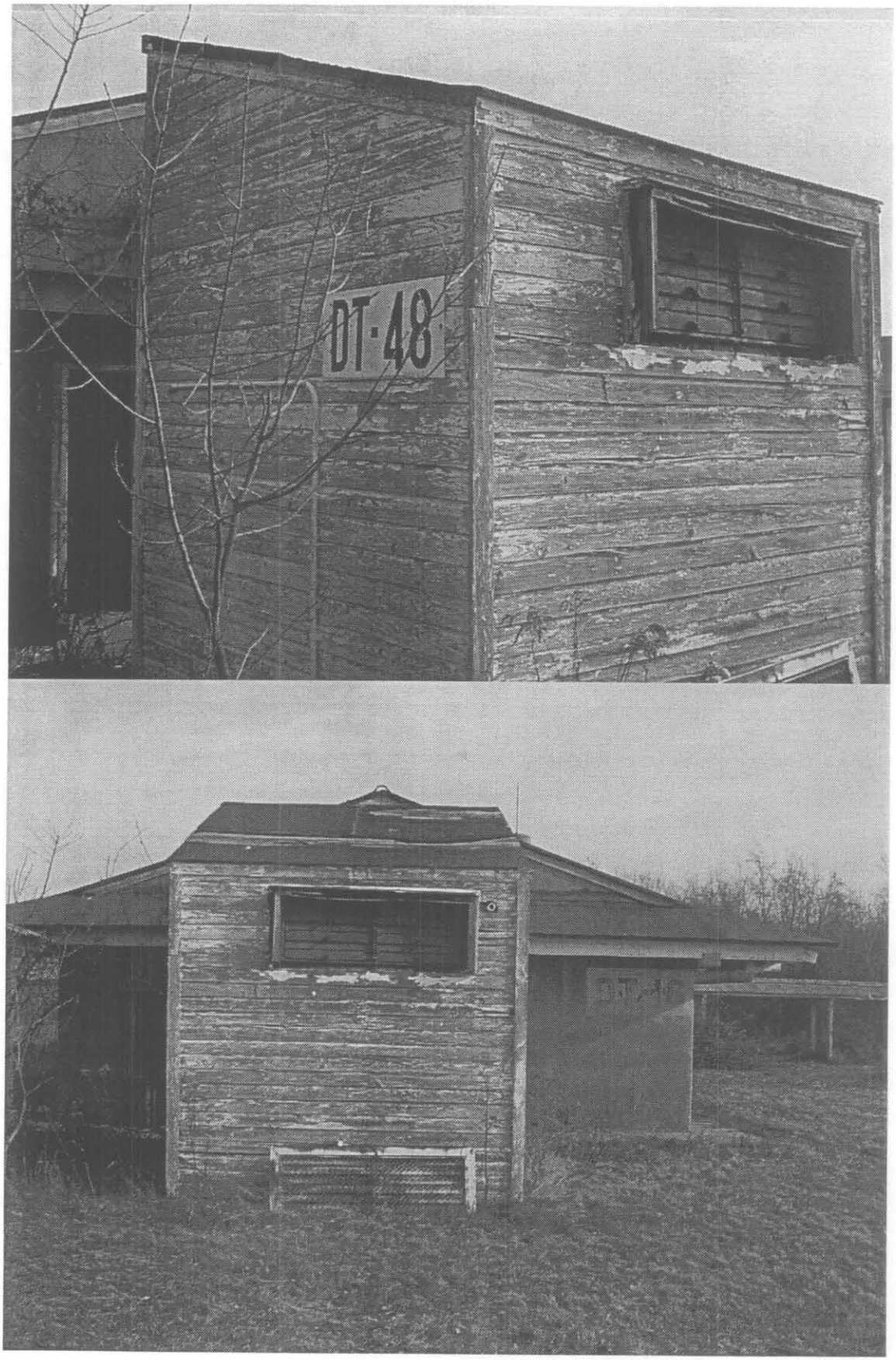
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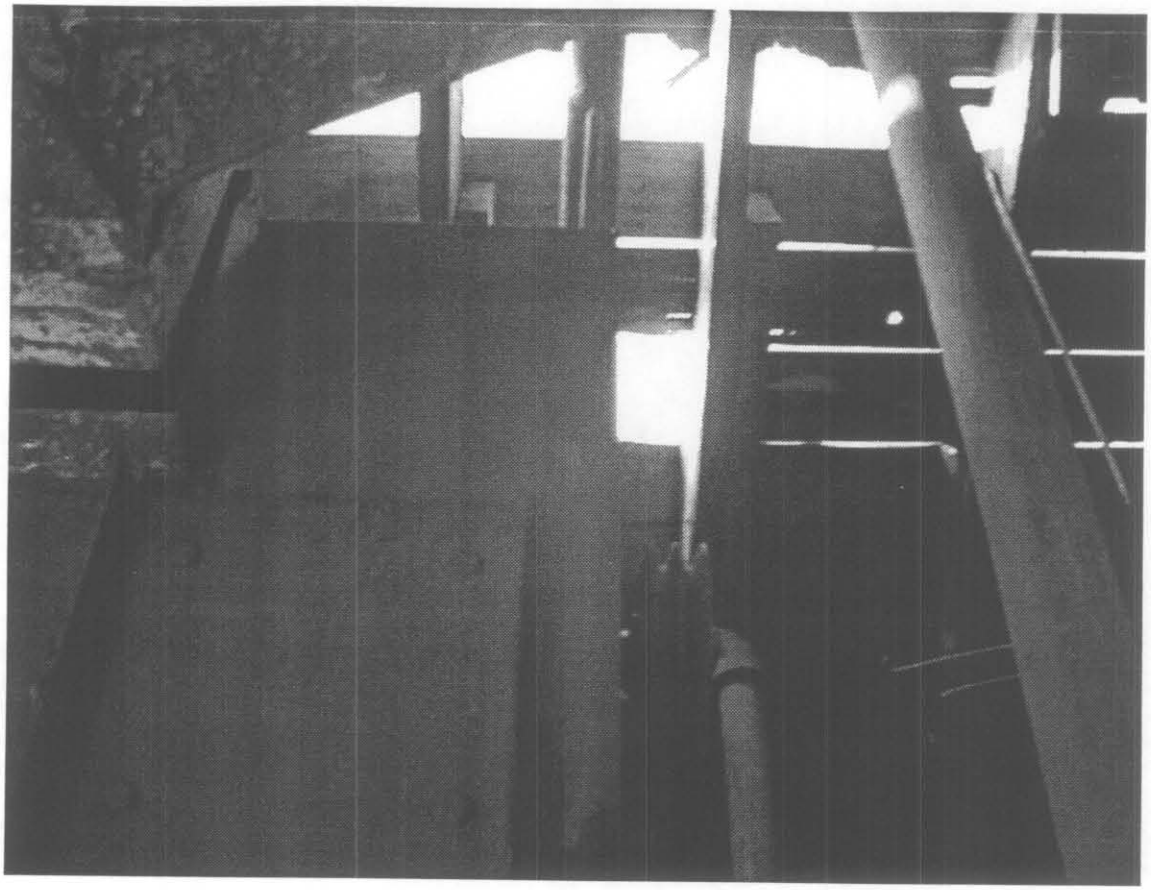

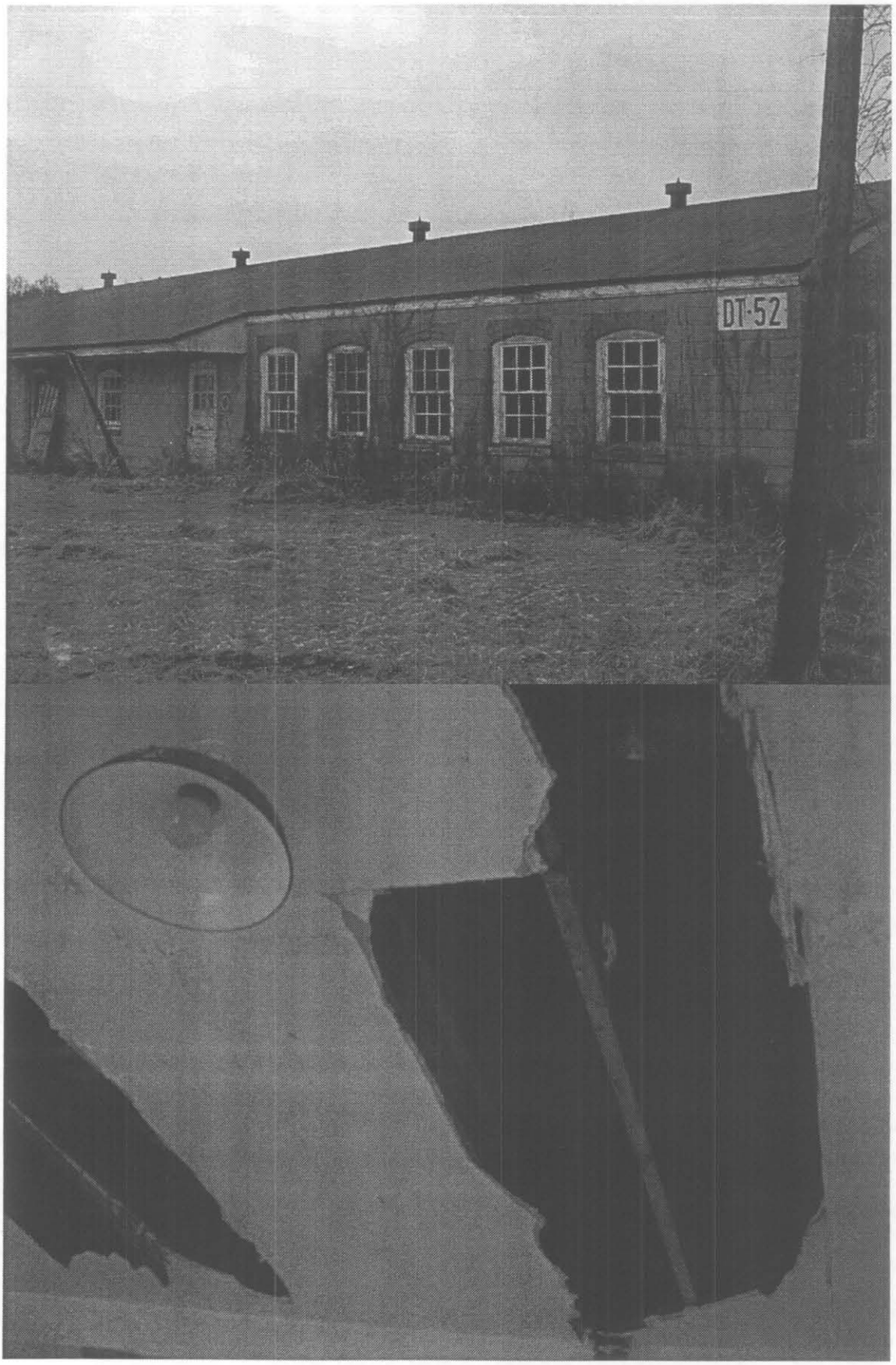
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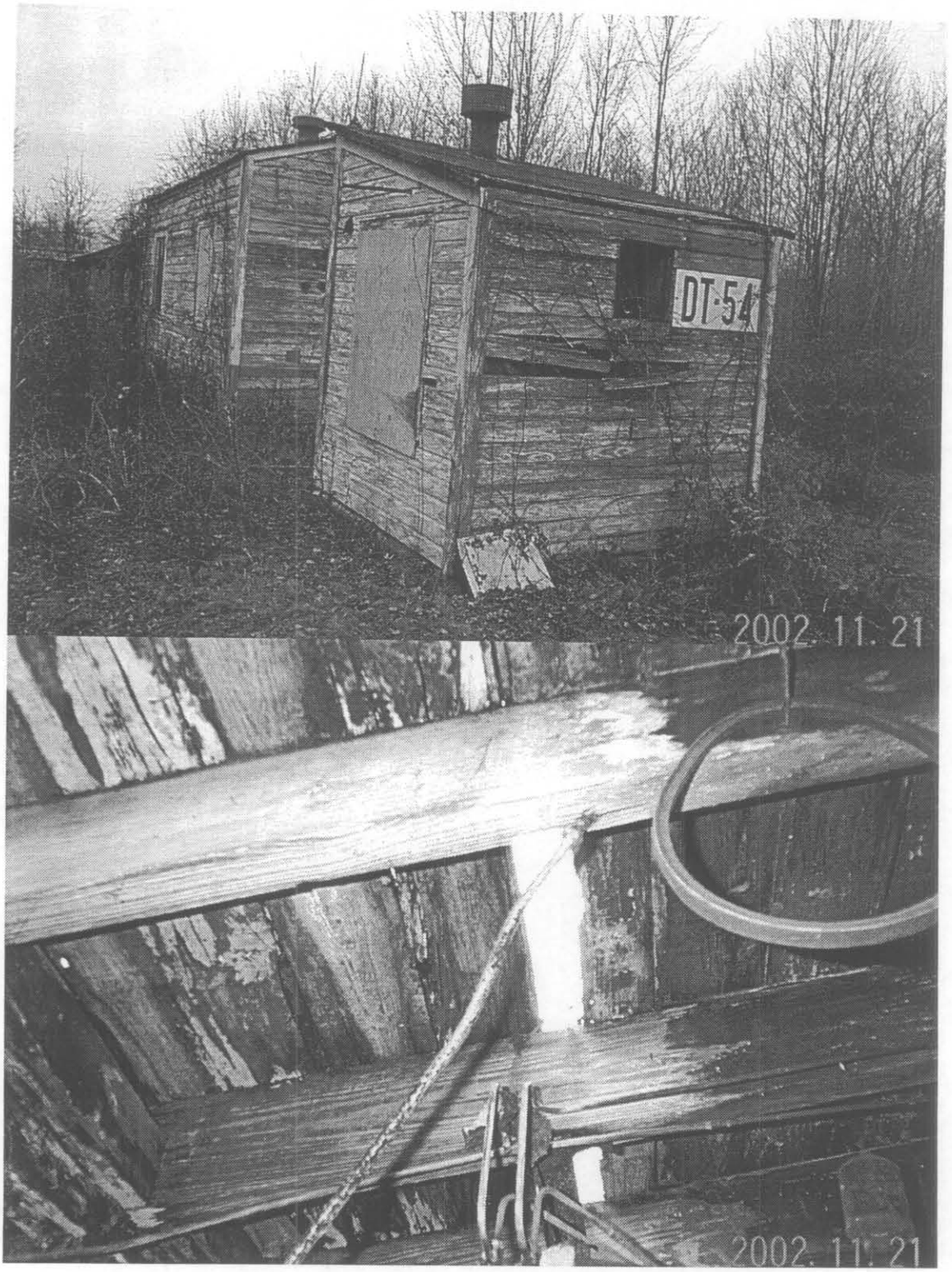
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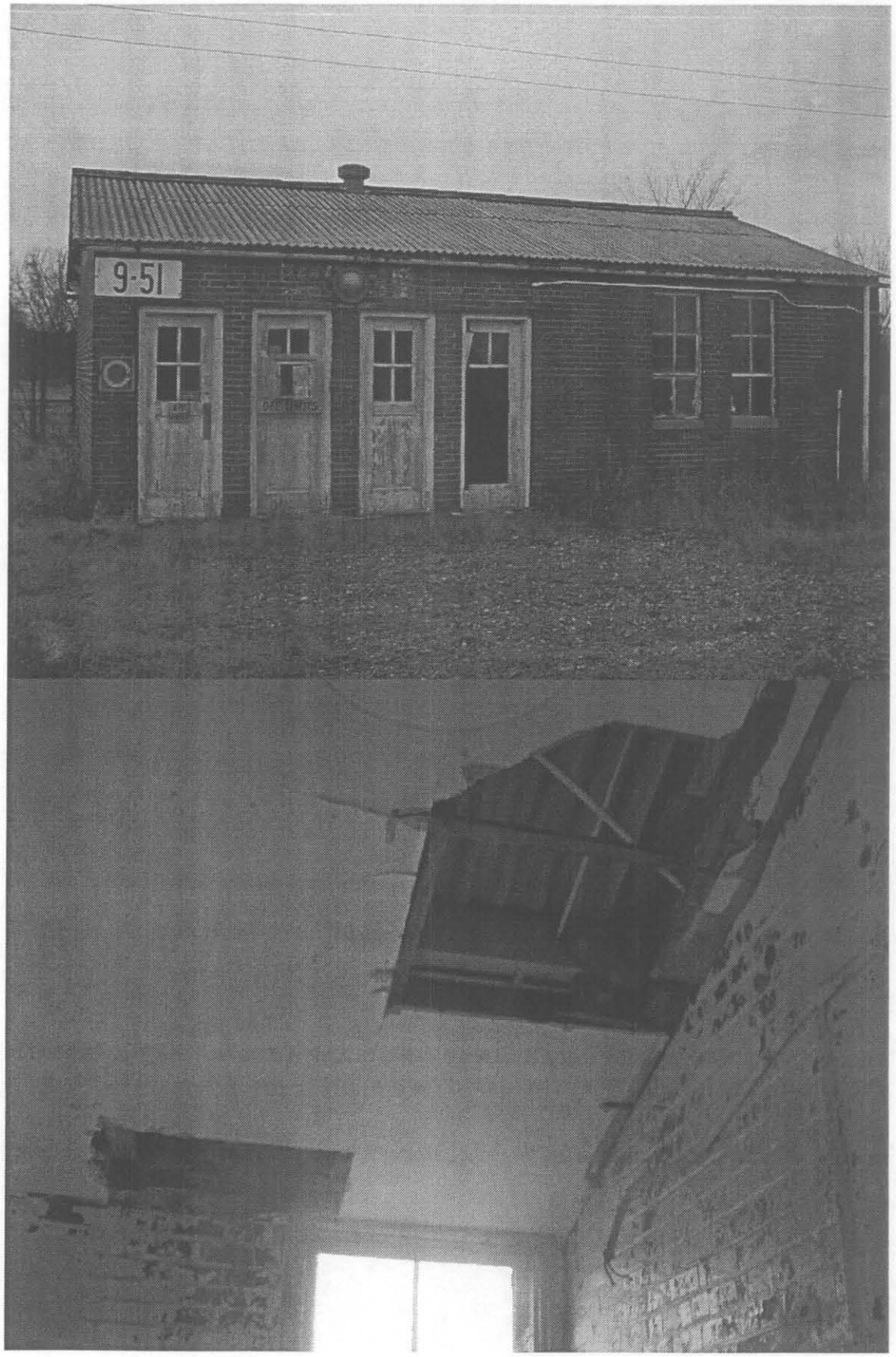

9-51

ENGINEERING SURVEY REPORT #5

UNDERGROUND STORAGE MAGAZINES
WS1, WS1A, WS2, AND WS2A

AT
WET STORAGE AREA

RAVENNA ARSENAL ARMY AMMUNITION PLANT

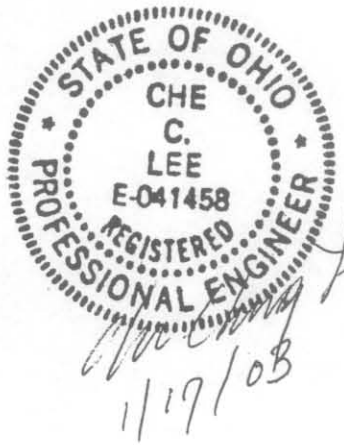
RAVENNA, OHIO

Revised January 17, 2003

***Prepared for*:**

MKM ENGINEERS, INC.

4153 Bluebonnet Drive
Stafford, Texas 77477



1/17/03

***Prepared by*:**

BAT Associates, Inc.
981 Keynote Circle
Suite 29
Cleveland, Ohio 44131

TABLE OF CONTENTS

1.0 INTRODUCTION

This report includes the results of engineering survey and evaluations for the four underground storage magazines, WS1, WS1A, WS2, and WS2A in the Wet Storage Area of the Ravenna Army Ammunition Plant in Ravenna, Ohio. With the structural design drawings not available for review and analysis at that time, the Engineering Survey Report #4 could not include the four underground storage magazines. With Engineering Survey Report #3 and #4, this report concludes the work in this contract. This report addresses the results of structural evaluations, findings, and recommendations related to the excavation and modifications of the roof of the underground structures during the excavation, burning and demolition operations for these four underground storage structures.

Following the desensitizing operation, ventilation holes will be installed on the roof of each underground structure to provide enough ventilation for complete thermal destruction of the structures. To install the ventilation holes on the roof of the underground structures, the contractor will first remove the trees and soil on top of the underground structures by using a long boomed excavator. The contractor will then install the ventilation holes on the roof of the structures by using a jackhammer attached to the end of the long boom of the excavator. BAT was informed by MKM Engineers, Inc. that the heavy excavator will stay outside the underground storage structures during the entire excavation and operations of installation of ventilation holes. The excavator to be used is the Kamatsu PC 300 and weighs about 75000 pounds. The total weight of the jackhammer and attachments is about 3500 pounds.

On January 10, 2003, BAT faxed the original structural design plans and cross sections of the four underground storage structures to the office of MKM in Ravenna. The original design plans and sections provide information about the size and locations of the underground structures, and the depth of earth fill over the underground structures. This information is to be used by the excavation contractors for reference. The excavation is scheduled to start on January 13, 2003.

A brief site visit was made on November 21, 2002 to the underground storage structures. Due to the nature of the explosive contaminants involved, the site inspection was limited to the vestibule area and front wall only and not to the storage house.

Section 2.0 describes the purpose of the engineering survey and the evaluation of the existing structures. Section 3.0 describes the four existing underground structures. Section 4.0 provides the findings, conclusions, and recommendations related to the excavation, burning, and demolitions operations.

2.0 PURPOSE

The purpose of this engineering survey and report for these four underground structures related to the excavation, burning, and demolition operations is to:

1. Evaluate and analyze the existing underground structural capacities for the additional equipment weights during the excavation and demolition operations.
2. Based on the results of structural analysis, recommend the sizes and locations of ventilation holes for each underground structure.
3. Recommend the staging locations for the excavator during the excavation and ventilation hole installation operations.
4. Prepare and submit a written report summarizing the conclusions and recommendations.

3.0 DESCRIPTION OF THE UNDERGROUND STRUCTURES

Located in the Wet Storage Area of the Ravenna Army Ammunition Plant in Ravenna, Ohio, the four underground concrete storage structures, WS1, WS1A, WS2, and WS2A are high explosive magazines. The four underground magazines were built 1969 and are more than thirty years old.

The WS1 and WS1A magazines are identical in size and design. Each structure consists of storage house, vestibule, and headwall. The storage house has a 7-inch thick concrete arch roof with 15 feet outside radius and is about 20 feet in length. Between the headwall and the storage house is a vestibule of 8 feet wide by 8 feet long by about 9 feet high. The headwall is a 10-inch thick by 62 feet long concrete wall and is about 17 feet high at the entrance.

The two WS2 and WS2A magazines are also identical in size and design. Each structure consists of storage house, vestibule, and headwall. The storage house is about 12 feet wide by 12 feet long by 10 feet high. Between the headwall and the storage house, the vestibule is about 6 feet wide by 6 feet long by about 9 feet high. The headwall is a 10-inch thick by 45 feet long concrete wall and is about 15 feet high at the entrance.

4.0 FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

1. BAT recommends that the maximum ventilation hole size for the WS2 and WS2A magazines be 10 inches in diameter and located at the center of the arch roof as shown on the sketches on page 4. Install two ventilations holes of 10 inches in diameter if one ventilation hole is not sufficient for ventilation consideration. Ventilation hole locations are shown on page 5.

2. BAT recommends that the maximum ventilation hole size for the WS1 and WS1A magazines be 14 inches in diameter and located at the quarter points of the roof span (in the north-south direction) as shown on the sketches on page 7.

3. The existing four underground structures were designed for the soil surcharge over the underground structures only. Therefore, prior to excavation operation, to avoid the beyond-design pressures due to the excavator weight on the roof and side walls of the underground structures, the heavy excavator shall be staged at least 20 feet (clear distance) away from the **centerline** of the structures at WS2 and WS2A magazines and at least 14 feet (clear distance) from the **centerline** of the structures at WS1 and WS1A magazines. The required clear distances are calculated based on the slopes of the finished grade shown on the 30-year old design drawings. However, the present grade slope over the four underground structures might be very different from the original design grade slopes (see the sketches on page 6).

4. At the WS2 and WS2A magazines, BAT recommends:

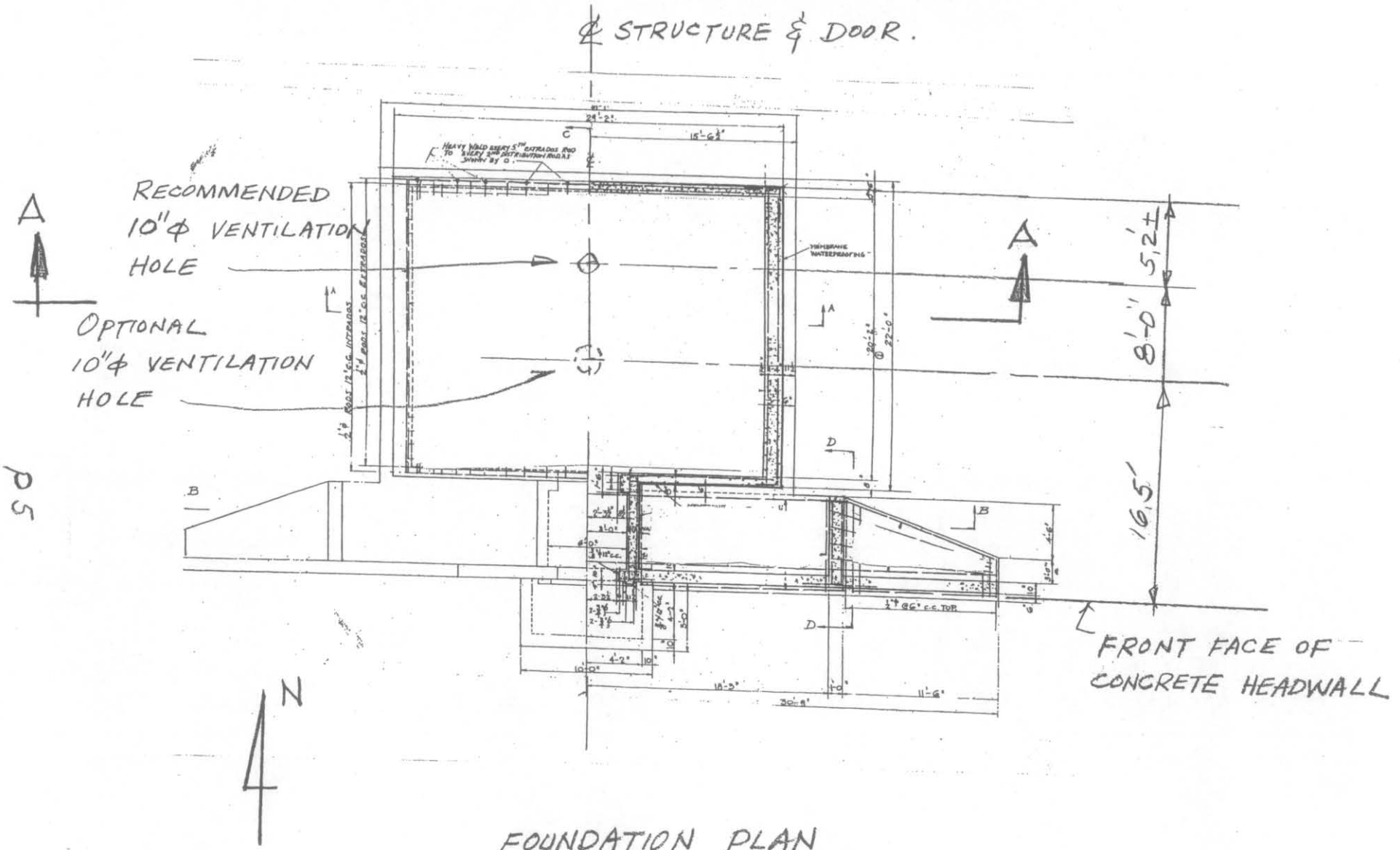
   A. With the excavator staged at about 30 to 35 feet clear distance from the centerline of the structure, excavate the staging area, which is to be located at about 8 feet above the entrance concrete slab elevation and with a 20-foot clear distance from the centerline of the structures.
   B. After moving the excavator to the newly excavated staging area, proceed to excavate the remaining earth and trees over the top of the underground structures.
   C. Exercise extreme care during ventilation hole installation. The roof of these two structures is a 7-inch thick concrete arch with a 15-foot radius.

5. Excavation operations should be performed in accordance with the safety requirements and standards for the construction industry by the Occupational Safety and Health Administration (OSHA) and other governing regulations.

6. The existing slope of the finished grade shown on the 30-year old drawings over the four underground structures is 33.7, which is considered to be a steep slope for finished grade. At this slope, a landslide could occur once the trees and vegetation have been removed. The presence of surface water or the moisture in the soil due to snow could also increase the probability of landslide at such a steep slope. The excavator contractor shall verify his excavator capacities for such a steep grade slope operation. Conservative approaches and judgment should be exercised during the excavation operations.

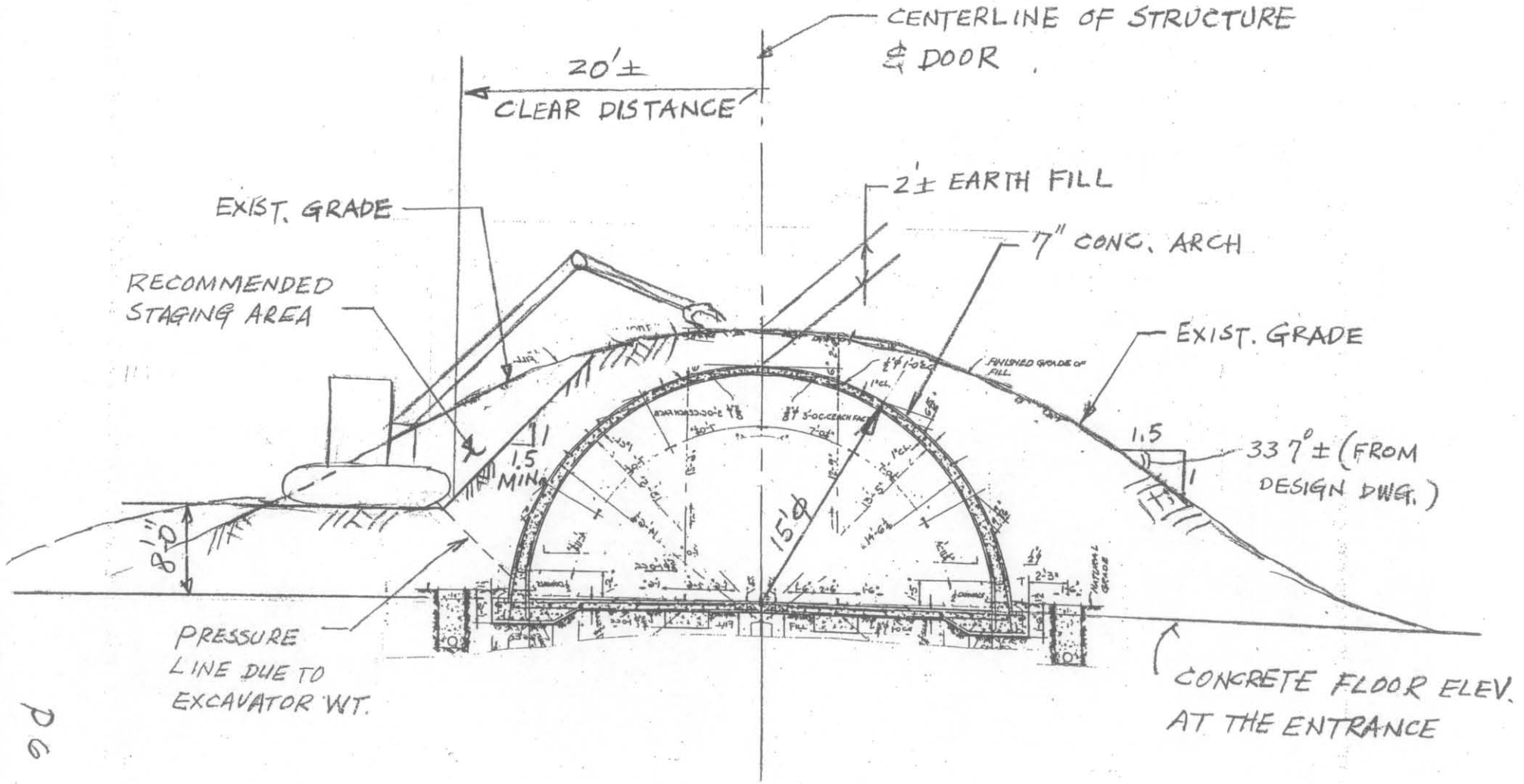
7. The doors at WS1 and WS1A underground storage magazines, 3-foot wide by 6.5-foot height, shall be used as the access for the placement of pallets. No modification to the existing 10-inch concrete wall is recommended.

8. The doors at WS2 and WS2A underground storage magazines, 4.5-foot wide by 6.5-foot height, shall be used as the access for the placement of pallets. No modification to the existing 10-inch concrete wall is recommended.



FOUNDATION PLAN

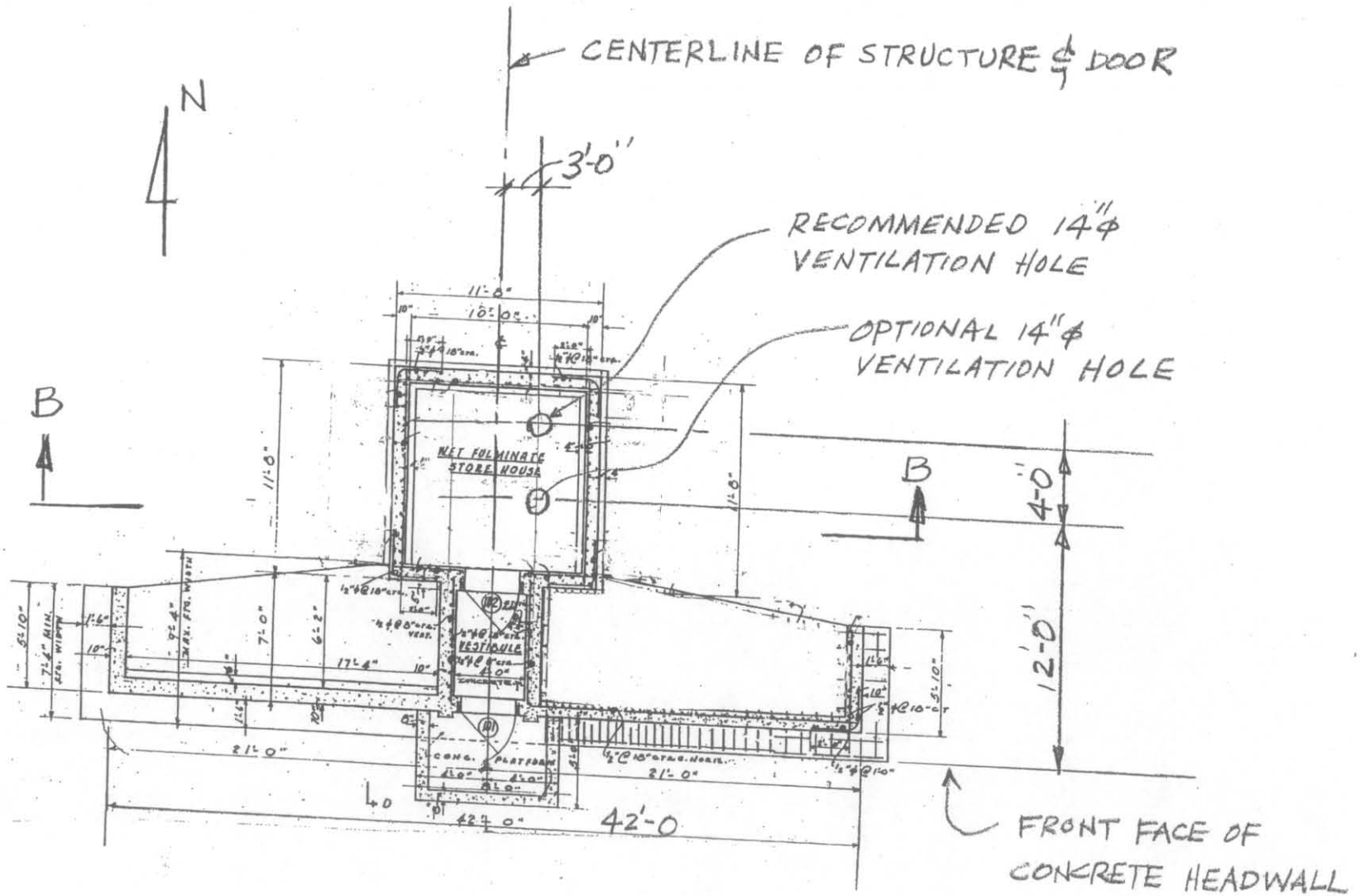
MAGAZINE WS2 & WS2A



SECTION A-A

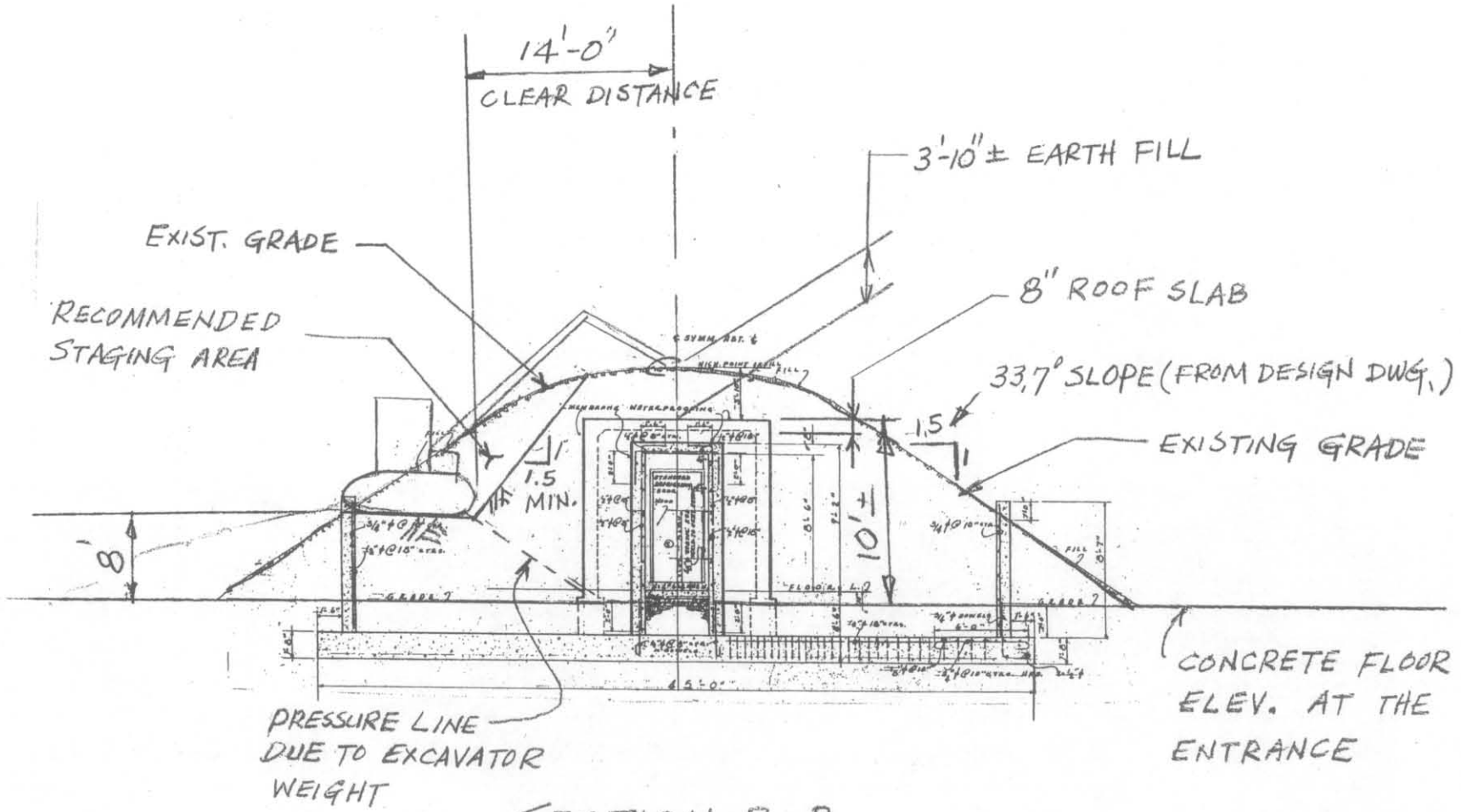
MAGAZINE WS2 & WS2A

D6



FOUNDATION PLAN

MAGAZINE WS1 & WS1A



SECTION B-B

MAGAZINE WS1 & WS1A

P.8