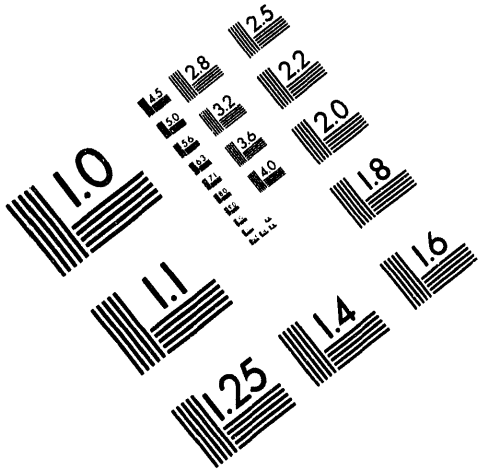

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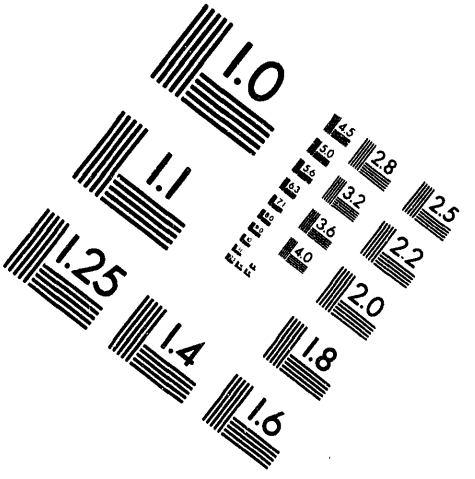

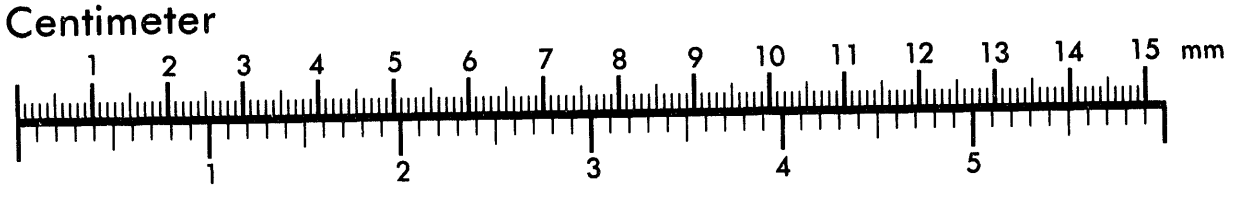


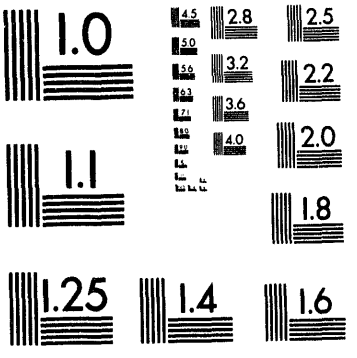

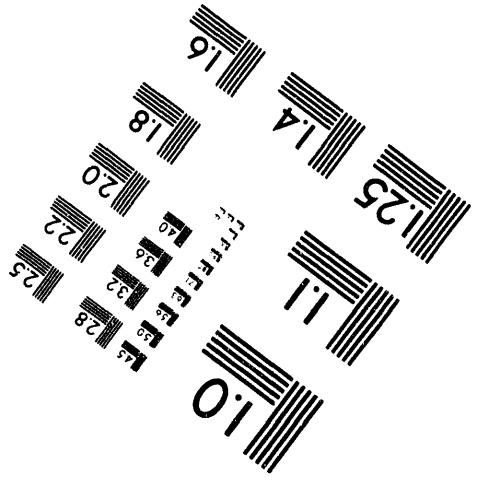

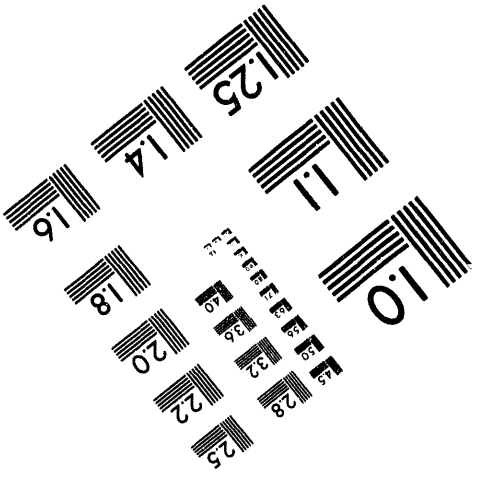

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# SUPPORTING DOCUMENT

1. Total Pages 101

| 2. Title | 3. Number | 4. Rev No. |
|---|---|---|
| FIRE LOADING CALCULATIONS FOR 300 AREA N REACTOR FUEL FABRICATION AND STORAGE FACILITY | WHC-SD-NR-TI-053 | 0 |

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7. Abstract

Fire loading analyses were provided for the N Reactor Fuel Supply buildings 3712, 3716, 303A, 303B, 303E, 303G, and 303K. Fire loading calculations, maximum temperatures, and fire durations were provided to support the safety analyses documentation. The "combustibles" for this document include: wood, cardboard, cloth, and plastic, and does not include the uranium and fuel assembly loading. The information in this document will also be used to support the fire hazard analysis for the same buildings, therefore, it is assumed that sprinkler systems do not work, or the maximum possible fire loss is assumed.

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# FIRE LOADING CALCULATIONS

# FOR

# 300 AREA N REACTOR FUEL

# FABRICATION AND STORAGE FACILITY

Westinghouse Hanford Company

October 1993

Prepared by
C. F. Myott
Fire Protection Programs

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## DEFINITIONS/CLARIFICATIONS

| | | |
|---|---|---|
| RS3 | - | Red Shipping Box - This is the name given to a particular shipping box. This box is red in color and is 28-inches wide by 48-inches long by 22 5/8-inches high. |
| G4255 | - | Billet Box - This shipping box is 25 5/8-inches wide by 35-inches long by 10-inches high. |
| G4214 | - | Scrap Box - This shipping box is 16 3/8-inches wide by 34 1/2-inches long by 10-inches high. |
| NRFF&SF | - | N Reactor Fuel Fabrication and Storage Facility |
| Uranium (U) | - | A very hard, heavy, radioactive metallic chemical element used as fuel for the N Reactor. Uranium in massive form is not pyrophoric by itself but will burn if there are other "combustibles" ignited. |
| Zircaloy-2 (Zr-2) | - | A zirconium alloy consisting of tin, iron, chromium, nickel and nitrogen in small percentages. This is used as the cladding for the fuel. |
| Thorium (Th) | - | A rare, grayish radioactive chemical element, used in making electronic equipment and as a nuclear target to produce $U^{233}$. |
| Billet | - | Large pieces of uranium that are cold extruded with Zr-2 into a form that can be used for fuel in the N Reactor. |
| Scrap | - | Chunks of cladding (Zircaloy-2) and uranium removed during the fuel machining process. |
| Fines, chips | - | Finely divided metal pieces (uranium, Zircaloy-2) that are pyrophoric and require special handling and storage techniques since they can spontaneously ignite. |
| MPFL | - | The Maximum Possible Fire Loss is the value of property, excluding land, within a fire area. This assumes the failure of both automatic fire suppression systems and manual fire fighting efforts. (DOE 5480.7A) |

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## TABLE OF CONTENTS

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# FIRE LOADING CALCULATIONS FOR THE 300 AREA N REACTOR FUEL FABRICATION AND STORAGE FACILITY

## 1.0 INTRODUCTION

Fire Protection Programs was requested to supply fire loading analyses for N Reactor Fuel Fabrication and Storage Facility (NRFF&SF) Buildings 3712, 3716, 303-A, 303-B, 303-E, 303-G, and 303-K. The scope of this document is to supply fire loading calculations, maximum temperatures, and fire durations for the above buildings. The fire loading analyses are needed for safety evaluation purposes. The definition of "combustibles" for the purpose of this document is wood (including wooden boxes used for uranium billet and fuel storage), cardboard, cloth, and plastic. The amounts of radiological release from the uranium billets, fuel, and other metal scrap are NOT considered in this document. This fire loading analysis can not be used without taking the radiological consequences, of the uranium (U) and the thorium (Th), into consideration.

The reason that the "combustibles" are considered separate from the U, Zr-2, and Th is that the elements and alloys alone will not burn. They will burn in conjunction with other combustibles, and they will continue to burn only as long as the combustible loading allows. How much of these elements released, during different accident scenarios, will be determined in other safety analyses based on this combustible loading analysis.

The 303-K Building contains drums of radioactive chips and fines underwater. The chips and fines of U and Zr-2 are pyrophoric. These are looked at in an abbreviated analysis in this document to see if it could be the worst case for "combustibles" but shall be analyzed further as required in other safety documents.

NOTE: The calculations supplied for the "combustible" per the scope of this report are supplied to be used in conjunction with further safety analysis of the buildings.

## 2.0 DOCUMENT PURPOSE

The purpose of this supporting document is to prepare and document the fire loading calculations for the seven NRFF&SF Buildings being utilized for U storage. These calculations will be referenced in future documents and will also be used in some of the safety analyses of the buildings.

## 3.0 PROCEDURE

Fire Protection Engineers walked the buildings down and took inventory of the building contents. Conversations were held with employees knowledgeable of the NRFF&SF. Conservative fire load standards were developed by using the references in Section 5. Calculations were then performed, and layout sketches were produced for each building.

## 4.0 DOCUMENT ARRANGEMENT

Attachment "A" contains the British Thermal Unit (Btu) loading standards for the shipping boxes developed from the references in Section 5.

Attachment "B" through "H" contain the individual total Btu loading calculations and sketches for each building. Standards developed for the miscellaneous storage and building materials specific for each building are also contained in the attachment for that building.

Attachment "I" contains the time-temperature curve and other data used to support the material presented in this supporting document.

Attachment "J" contains the inventory and arrangement during the first walk through of the 3712 Building. This information is the basis for several of the safety analyses and is included to show how conservative the analyses are. The combustible load inventory has decreased since the first walk through.

## 5.0 DISCUSSION

Since the information in this document will be referenced in future safety documentation, all the building evaluations are based on the assumption that the sprinkler system does not work. This is a requirement in evaluating the Maximum Possible Fire Loss (MPFL) in a Fire Hazard Analysis (FHA). The MPFL is considered to be the "worst case" scenario. This document and the information herein is technical in nature and does not cover all the items required for an FHA (WHC-CM-4-41, Section 3.4); therefore, this document cannot be substituted for a FHA, and the information in this document can not be used, without further analysis or fire modeling, in the FHA.

The 303-K Building contains drums of radioactive chips and fines underwater. In the abbreviated analysis (see Attachment "H") these U and Zr-2 chips and fines were found to be approximately 13% of the total "combustible" load. When this additional loading from the chips and fines was added to the "combustibles," the fire duration was still less than 30 minutes.

The 303-B Building was found to have the greatest fire load density. It has 45 $lb/ft^2$. The fire duration of 5 3/4 hours was obtained by using the standard time-temperature curve (Figure I1). The building contains 480 G4255 Billet Boxes.

Figure I2 (Figure 5-8Q and 5-8R from Reference 2) found in Attachment "I" illustrates the fire endurance for concrete mixed with various types of aggregate. Since the type of aggregate used in the 303-K and 303-B Buildings is not known, the least supportive will have to be assumed. With that in mind and using the above figures to evaluate the 303-K and 303-B Buildings during the potential fire durations, it is predicted that the 303-K Building could withstand the fire duration, but the 303-B Building could not withstand a fire of its predicted duration. Anything greater than 2 1/2 hours would probably cause structural failure of the building.

The 3712 Building has 25 $lb/ft^2$ fire loading and a fire duration of 2 1/2 hours. A fire of this duration is predicted to cause structural failure of the 3712 Building. Of the seven NRFF&SF Buildings analyzed, the 3712 Building contains the most uranium, and may pose the greatest offsite radiological exposure because of this fact. The building contains a total of 893 Red Shipping Boxes, 321 Billet (G4255) Boxes, and 8 Scrap Boxes.

The 303-B and 3712 Buildings are the worst cases for combustible loading for the two basic structural types looked at in this report. Both buildings contain automatic fire alarms and dry pipe sprinkler systems. The 303-B Building is classified as non-combustible construction and the 3712 Building is classified as unprotected steel construction. The 303-B Building contains the greatest fire loading, but the 3712 Building contains the greatest amount of shipping boxes (and thus greatest radioactive source) and has the greatest potential for structural failure if the sprinkler system did not function.

The 3712 Building was surveyed twice. The building had more combustibles during the first survey, and the first survey is used in some of the safety documentation as the worst or limiting case. Both of the 3712 Building surveys are included in this document (Attachment "B" & "J"). The shipping box Btu loading is higher on the preliminary (first) analysis because Reference 1 (see Figure I3, Attachment "I") had not been located, and the estimates were made conservatively.

## 6.0 REFERENCES

1. WHC-EP-0558 "TEST AND EVALUATION DOCUMENT FOR D.O.T. SPECIFICATION 7A TYPE A PACKAGING," Section 4.12, June 1992.

2. "FIRE PROTECTION HANDBOOK," National Fire Protection Association, Fifteenth Edition.

3. "FLAMMABILITY HANDBOOK FOR PLASTICS", Carlos J. Hilado, Second Edition.

4. NFPA 220, Appendix "D", 1992 Edition.

5. CRC, 1992, "HANDBOOK OF CHEMISTRY AND PHYSICS", 72nd Edition, 1991-1992, The Chemical Rubber Company, Boca Raton, Florida.

## 7.0 ATTACHMENT INDEX

Attachment "A" - Standards
Attachment "B" - 3712 Building Calculations
Attachment "C" - 3716 Building Calculations
Attachment "D" - 303-A Building Calculations
Attachment "E" - 303-B Building Calculations
Attachment "F" - 303-E Building Calculations
Attachment "G" - 303-G Building Calculations
Attachment "H" - 303-K Building Calculations
Attachment "I" - Time-Temperature Curve, ETC.
Attachment "J" - 3712 Building Calculations based on an earlier inventory

**ATTACHMENT "A"**

**STANDARDS**

**FOR**

**SHIPPING BOXES**

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# SHIPPING BOXES



The weights for the billet and scrap boxes were taken from WHC-EP-0558. (Figure I3, Attachment "I")

The 8,000 Btu/lb and 40 lb/ft$^3$ are means for the heat value and density of wood, respectively. These values were obtained from NFPA 220, Appendix C. These values are used throughout this document as the potential heat, weight basis and density for wood and related products (paper, cardboard, etc.).

BILLET (G-4255)

107 lb/billet x 8,000 Btu/lb = **856,000 Btu/billet**

SCRAP (G4214)

70 lb/scrap x 8,000 Btu/lb = **560,000 Btu/scrap**

RED SHIPPING BOX (RSB)

There was no reference readily available for the red shipping boxes so the value is calculated on the box measurement.

| | | |
|---|---|---|
| Bottom: | 28" x 45 3/4" x 1 1/2"/1,728 in$^3$ | = 1.11 ft$^3$ |
| Back & Front: | 22 5/8" x 48" x 1 1/8"/1,728 in$^3$ x 2 | = 1.42 ft$^3$ |
| Ends: | 22 5/8" x 28" x 1 1/8"/1,728 in$^3$ x 2 | = 0.82 ft$^3$ |
| 2 stacks of spacers | 1 holes: 4 (5" x 45 1/2" x 1 1/2") - 36 [$\pi$ (1 7/16)$^2$ x 1 1/2"]/1,728 in$^3$ x 2 | = 1.17 ft$^3$ |
| 3 skids: | 3 1/2" x 3 1/2" x 30 1/4"/1,728 in$^3$ x 3 | = 0.64 ft$^3$ |
| 8 space guides: | 1 1/2" x 2 1/2" x 19 1/4"/1,728 in$^3$ x 8 | = 0.33 ft$^3$ |
| | Total | 5.49 ft$^3$ |

5.49 ft$^3$ x 40 lb/ft$^3$ = 219.60 lb

219.60 lb x 8,000 Btu/lb = **1,756,800 Btu**

# SHIPPING BOXES



SHIPPING PLASTIC

The 20,000 Btu/lb for the plastic was obtained from Reference 3, Table 2.25. This value is used throughout this document as the potential heat, weight basis for plastic and related products.

The plastic was conservatively estimated at 1/2 pound per box.

.5 lb x 20,000 Btu/lb = **10,000 Btu**

The above amount will be added to ALL the boxes.

Red Shipping Box Cardboard

Red shipping boxes with finished fuel assemblies have a 1.20 pound (scale weight) cardboard sheet over the top layer.

1.20 lb x 10,000 Btu/lb = **12,000 Btu**

The above amount will be added to ALL Red Shipping Boxes.

**ATTACHMENT "B"**

3712 BUILDING
CALCULATIONS

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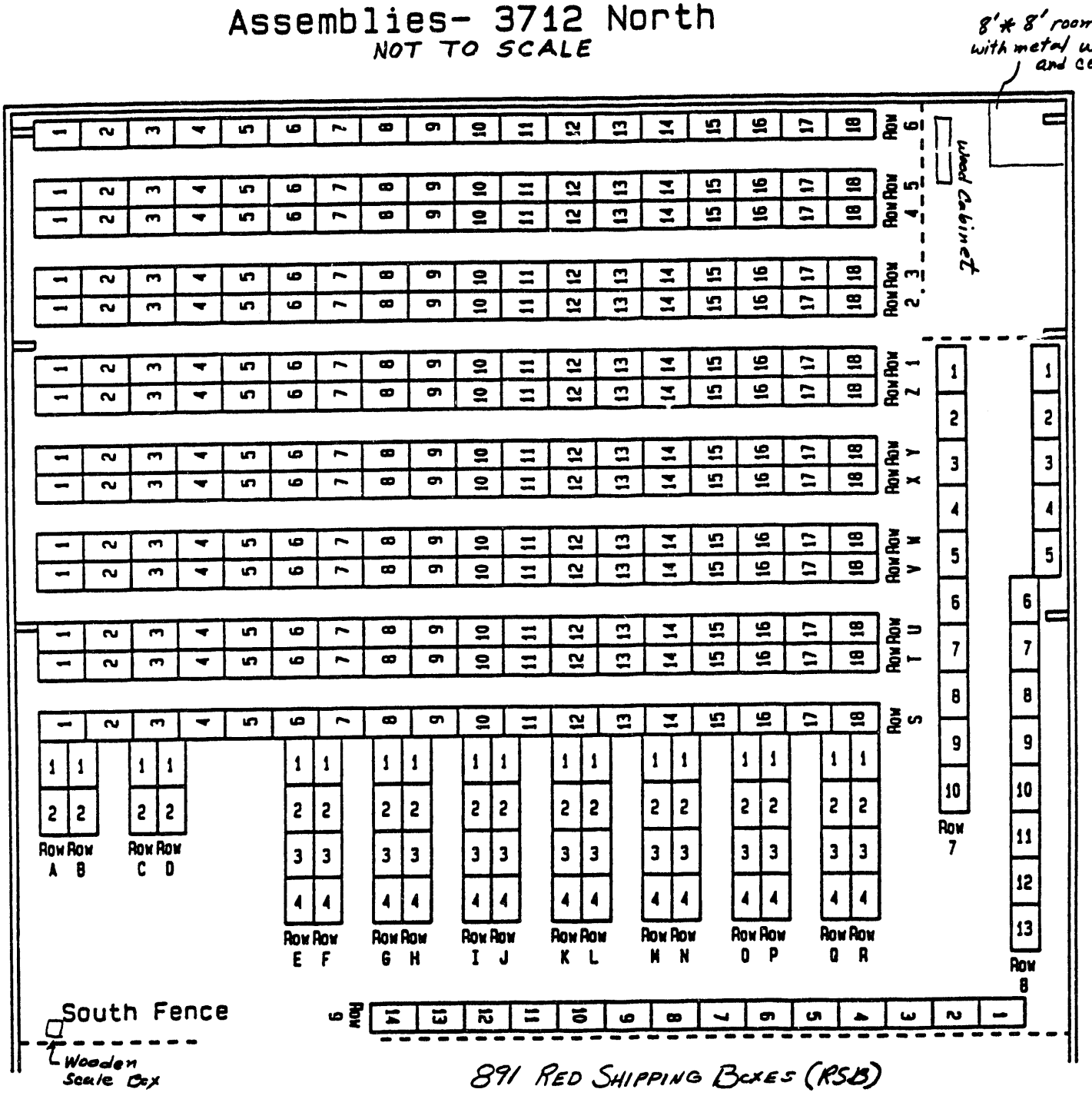
# Assemblies- 3712 North

NOT TO SCALE



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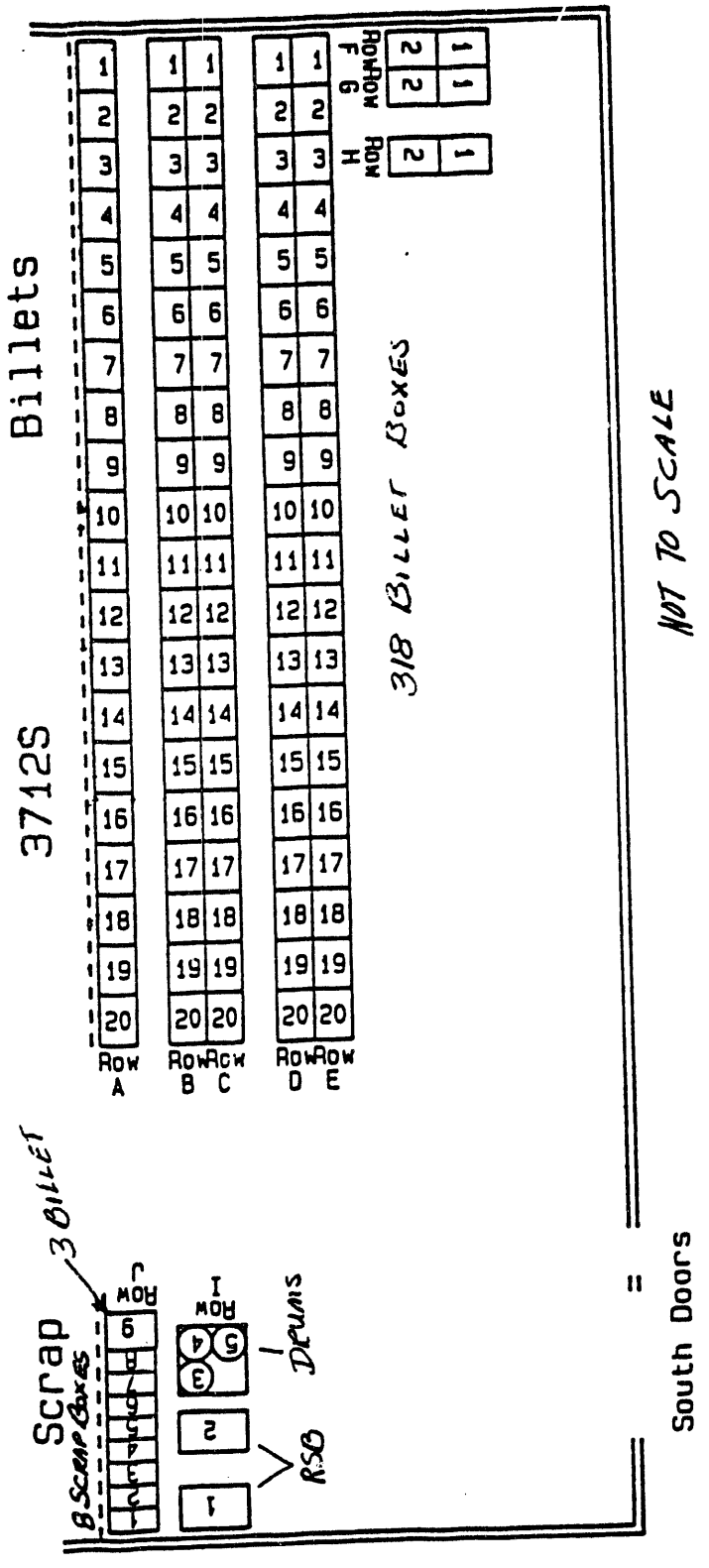
Billets
3712S
318 Biller Boxes
NOT TO SCALE
Scrap
3 Billet
B Scrap Boxes
Row J
Row I
Drums
RSB
=
South Doors
Row A
Row B
Row C
Row D
Row E
Row F & Row H

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# BUILDING CONSTRUCTION

Building Name/Number: Fuels Manufacturing Storage/3712
Area: 300

Construction:

| | |
|---|---|
| Roof: | Metal deck on steel beams |
| Roof Covering: | Metal deck |
| Exterior Walls: | Uninsulated corrugated metal |
| Interior Walls: | Corrugated metal |
| Floors: | Reinforced concrete slab |
| Fire Areas: | One |
| Building Area: | 9,720 $ft^2$ (H-3-17517 & 17419) |
| Storage Floor Area: | 9,492 $ft^2$ |

Description:

One-story steel frame structure with metal panel siding and roof. Concrete floor and foundation. lighting is incandescent. The steam to the heating system and the water to the evaporator cooler have been disconnected; therefore, the building is unheated and uncooled. The building is equipped with a dry pipe sprinkler system.

# SURVEY DATA

Sheet 1 of 1

Date: October 1993

LOCATION: 300 AREA

BUILDING: 3712

| BOX TYPE & OTHER MATERIALS | NUMBER OF | BTU'S EACH | TOTAL BTU'S |
|---|---|---|---|
| RED SHIPPING | 893 | 1,756,800 | 1,568,822,400 |
| G4255 BILLET | 321 | 856,000 | 274,776,000 |
| G4214 SCFAP | 8 | 560,000 | 4,480,000 |
| RSB CARDBOARD | 893 | 12,000 | 10,716,000 |
| SHIPPING PLASTIC | 893 | 10,000 | 8,930,000 |
| MISCELLANEOUS | | Attached Sheets | 3,842,952 |
| GRAND TOTAL | | | 1,871,567,352 |

# CALCULATIONS FOR 3712 BUILDING



STORAGE AREA = 9,492 $ft^2$

FIRE LOAD DENSITY

Grand Total/Area of Storage = 197,173.13 $Btu/ft^2$
(Obtained from Survey Data Table)

EQUIVALENT FIRE

135,518.56 $Btu/ft^2$ ÷ 8,000 Btu/lb = 24.65 $lb/ft^2$

**SUMMARY**

| APPROX AREA ($ft^2$) | FIRE LOAD (Btu) | FIRE LOAD DENSITY ($Btu/ft^2$) | EQUIVALENT FIRE ($lb/ft^2$) | FIRE DURATION | TEMPERATURE (°F) |
|---|---|---|---|---|---|
| 9,492 | 1,871,567,352 | 197,173 | 25 | 2 1/2 hrs | 1,888 |

# MISCELLANEOUS STANDARDS



WOODEN CABINET

24" wide x 92 1/2" long x 77" high -- 1/2" plywood
The base is 1" plywood.

Using: 8,000 Btu/lb and
40 lb/ft$^3$

Calculation:

Base: (24 1/2" x 92 1/2" x 1")/1,728 in$^3$ = 1.31 ft$^3$ x 1 = 1.31 ft$^3$

Top & 3 Shelves: (23 1/2" x 91 1/2" x 1/2")/1,728 in$^3$
= 0.62 ft$^3$ x 4 = 2.49 ft$^3$

Ends: (24" x 77" x 1/2")/1,728 in$^3$ = 0.53 ft$^3$ x 2 = 1.07 ft$^3$

Dividers: (23 1/2" x 63 3/4" x 1/2")/1,728 in$^3$
= 0.43 ft$^3$ x 4 = 1.73 ft$^3$

Back: (92 1/2" x 77" x 1/2")/1,728 in$^3$ = 2.06 ft$^3$ x 1 = 2.06 ft$^3$

Front Boards: (21 1/2" x 91 1/2" x 1/2")/1,728 in$^3$
= 0.57 ft$^3$ x 1 = 0.57 ft$^3$

Total 9.23 ft$^3$

9.23 ft$^3$ x 40 lb/ft$^3$ = 369.17 lb

369.17 lb x 8,000 Btu/lb = **2,953,352 Btu**

# MISCELLANEOUS STANDARDS



WOODEN SCALE WEIGHT BOX

37" X 43" X 12" high
Top & Bottom 3/4" plywood
Sides 1 1/2" plywood

Calculations:

Top & Bottom: (37" x 43" x 3/4")/1,728 $in^3$ = 0.69 $ft^3$ x 2 = 1.38 $ft^3$

Sides: (37" x 10 1/2" x 1 1/2")/1,728 $in^3$ = 0.34 $ft^3$ x 2 = 0.67 $ft^3$

(40" x 10 1/2" x 1 1/2")/1,728 $in^3$ = 0.36 $ft^3$ x 2 = 0.73 $ft^3$

TOTAL 2.78 $ft^3$

2.78 $ft^3$ x 40 lb/$ft^3$ = 111.20 lb

111.20 lb x 8,000 Btu/lb = 889,600 Btu

**TOTAL MISCELLANEOUS 3,842,952 Btu**

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**ATTACHMENT "C"**

**3716 BUILDING**
**CALCULATIONS**

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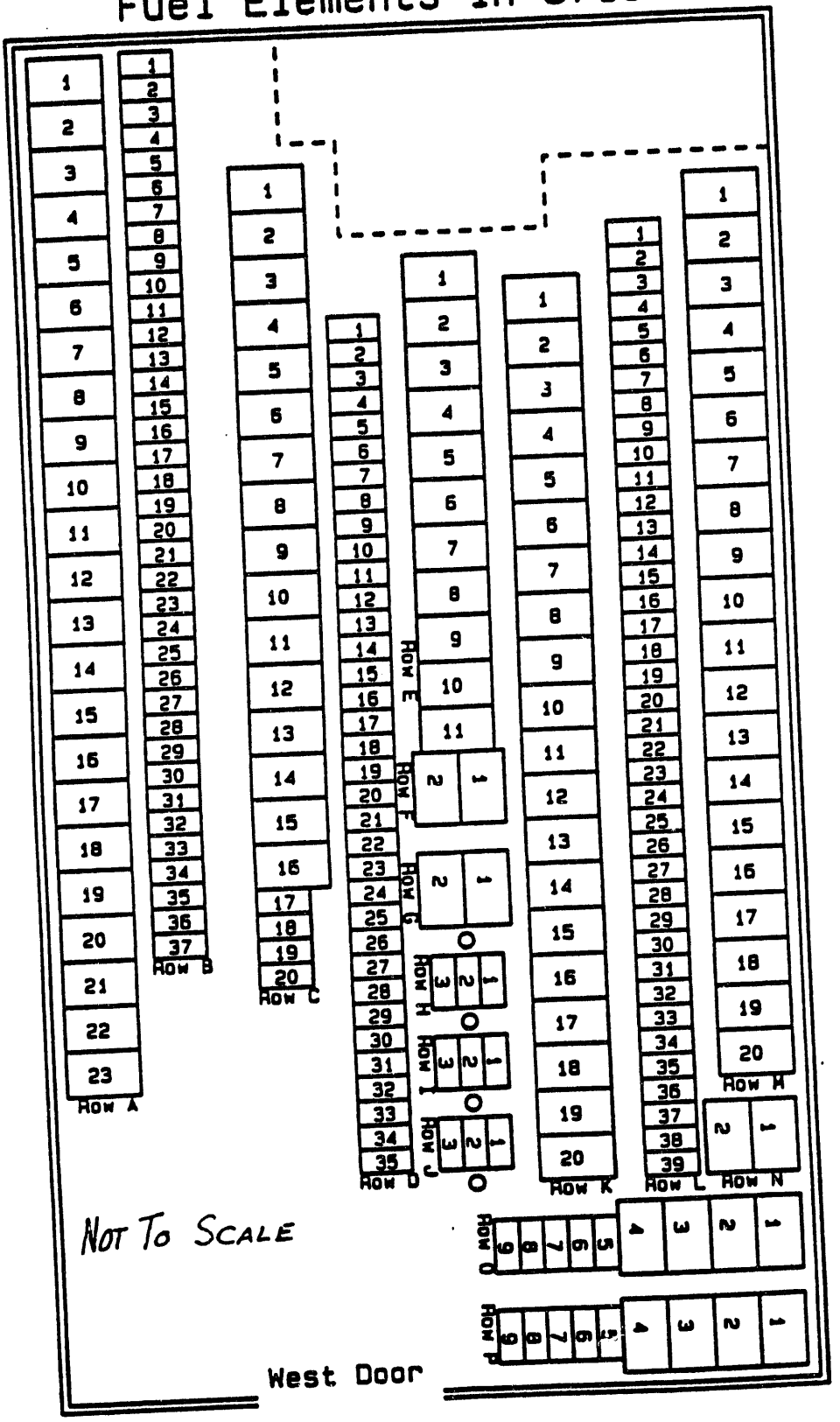
# Fuel Elements in 3716



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# BUILDING CONSTRUCTION

Building Name/Number: Fuels Manufacturing Storage/3716
Area: 300

Construction:

| | |
|---|---|
| Roof: | Metal deck on steel beams |
| Roof Covering: | Metal deck |
| Exterior Walls: | Insulated steel panels |
| Interior Walls: | Gypsum board on wood stud |
| Floors: | Reinforced concrete slab |
| Fire Areas: | One |
| Building Area: | 3,200 $ft^2$ (H-3-7943) |
| Storage Floor Area: | 3,081 $ft^2$ |

Description:

One story metal frame structure with insulated aluminum siding and roof. Structure mounted 4 feet above grade on concrete wall with concrete floor stab on grade. The floor and approximately 4 feet of the supporting wall is reinforced concrete on grade. Inside partitions are gypsum board on wood studs. The steam to the heating system and the water to the evaporator cooler have been disconnected; therefore, the building is unheated and uncooled. The structure is protected by a dry pipe sprinkler system.

# SURVEY DATA

Sheet 1 of 1

Date: 6 / 3 / 93

LOCATION: 300 AREA

BUILDING: 3716

| BOX TYPE | NUMBER OF | BTU'S EACH | TOTAL BTU'S |
|---|---|---|---|
| RED SHIPPING | 206 | 1,756,800 | 361,900,800 |
| G4255 BILLET | | 856,000 | |
| G4214 SCRAP | 134 | 560,000 | 75,040,000 |
| RSB CARDBOARD | 206 | 12,000 | 2,472,000 |
| WRAPPING PLASTIC | 206 | 10,000 | 2,060,000 |
| BUILDING MATERIALS | | | 8,720,755 |
| MISCELLANEOUS | | | 16,741,230 |
| GRAND TOTAL | | | 466,934,785 |

# CALCULATIONS FOR 3716 BUILDING

STORAGE AREA = 3,081 $ft^2$

Calculations:

Grand Total/Area of Storage = 151,553 $Btu/ft^2$
(Obtained from Survey Data Sheet)

EQUIVALENT FIRE

151,553 $Btu/ft^2$ ÷ 8,000 Btu/lb = 18.94 $lb/ft^2$

**SUMMARY**

| APPROX AREA ($ft^2$) | FIRE LOAD (Btu) | FIRE LOAD DENSITY ($Btu/ft^2$) | EQUIVALENT FIRE $lb/ft^2$ | FIRE DURATION | TEMPERATURE (°F) |
|---|---|---|---|---|---|
| 3,081 | 466,934,785 | 151,553 | 19 | 2 hrs | 1,850 |

# MISCELLANEOUS
# FOR 3716 BUILDING


Using:

8,000 Btu/lb -- miscellaneous wood

10,000 Btu/lb -- mixed miscellaneous (wood, cardboard, cloth)

20,000 Btu/lb -- miscellaneous plastic (polyethylene)

Calculations:

- Insulation (8 sheets) 2' x 10' x 0.08' x 8 = 13.36 $ft^3$

  13.36 $ft^3$ x 10.4 lb/$ft^3$ x 3,380 Btu/lb = 469,630 Btu

- Rolled foam (30 pounds) - Polyvinyl chloride

  30 lb x 7,720 Btu/lb = 231,600 Btu

- Plastic Box (6 pounds)

  6 lb x 20,000 Btu/lb = 120,000 Btu

- Mixes miscellaneous (10 pounds)

  10 lb x 10,000 Btu/lb = 100,000 Btu

- Cardboard (600 pounds)

  600 lb x 10,000 Btu/lb = 6,000,000 Btu

- Box of Rags (9 at 30 pounds each)

  270 lb x 10,000 Btu/lb = 2,700,000 Btu

- 2 large chairs at 100,000 Btu each = 200,000 Btu

- Miscellaneous Wood (865 pounds)

  865 lb x 8,000 Btu/lb = 6,920,000 Btu

TOTAL MISCELLANEOUS **16,741,230 Btu**

# BUILDING MATERIALS FOR 3716 BUILDING



INSULATION

1" fiberglass - 2400 $ft^2$

Using: 3 $lb/ft^3$ and 3,040 Btu/lb

Calculation:
2400 $ft^2$ x 0.08 ft x 3 $lb/ft^3$ x 3,040 Btu/lb = 1,751,040 Btu

1" roof board - 800 $ft^2$

Using: 10.4 $lb/ft^3$ and 3,380 Btu/lb

Calculation:
800 $ft^2$ x 0.08 ft x 10.4 $lb/ft^3$ x 3,380 Btu/lb = 2,249,728 Btu

TOTAL INSULATION 4,000,768 Btu

LIGHT DOMES

4' x 4' x 1/4" -- 4 of them

Using: 86 $lb/ft^3$ and 9,290 Btu/lb

Calculation:
4' x 4' x 0.02' x 86 $lb/ft^3$ x 9,290 Btu/lb x 4 = 1,022,643 Btu

PAINTED AREA

The paint and gypsum board it covered was considered as a whole. The value for the gypsum board plus paint was taken from NFPA 220, Appendix C.

8.7 $ft^3$ + 20.6 $ft^3$ + 13.9 $ft^3$ = 43.2 $ft^3$

Using: 3/8" Gypsum board "A" + alkyd gloss paint
46.7 $lb/ft^3$ and 880 Btu/lb

Calculation:
43.2 $ft^3$ x 46.7 $lb/ft^3$ x 880 Btu/lb = 1,775,347 Btu

TILE AREA

36 $ft^2$ + 168 $ft^2$ + 84 $ft^2$ = 288 $ft^2$

Using: 1/8" linoleum
86 $lb/ft^3$ and 7,760 Btu/lb

Calculation:
288 $ft^2$ x 0.01 ft x 86 $lb/ft^3$ x 7,760 Btu/lb = 1,921,997 Btu

TOTAL BUILDING MATERIALS **8,720,755 Btu**

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# ATTACHMENT "D"

## 303-A BUILDING CALCULATIONS

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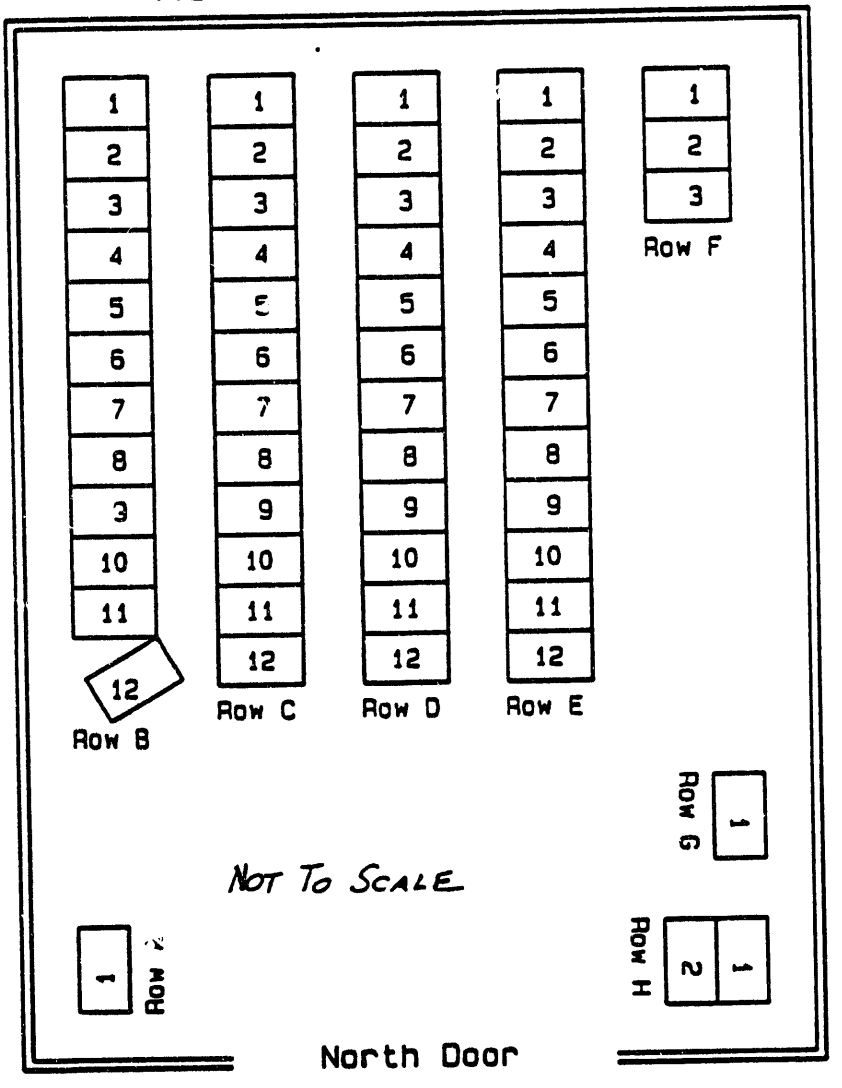
# Assemblies- 303-A



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# BUILDING CONSTRUCTION

Building Name/Number: Magazine - Product Storage/303-A
Area: 300

Construction:

| | |
|---|---|
| Roof: | Reinforced concrete |
| Roof Covering: | Tar and gravel |
| Exterior Walls: | Concrete block |
| Interior Walls: | Concrete |
| Floors: | Reinforced concrete slab |
| Fire Areas: | One |
| Building Area: | 1,296 $ft^2$ (HW-69534) |
| Storage Floor Area: | 1,150 $ft^2$ |

Description:

One story concrete block structure with concrete foundation and floor. The roof is precast concrete slab with tar and gravel surface. The structure is protected by a dry pipe sprinkler system.

# SURVEY DATA

Sheet 1 of 1

Date: 6 / 3 / 93

LOCATION: 300 Area

BUILDING: 303-A

| BOX TYPE | NUMBER OF | BTU'S EACH | TOTAL BTU'S |
|---|---|---|---|
| RED SHIPPING | 155 | 1,756,800 | 272,304,000 |
| G4255 BILLET | | 856,000 | |
| G4214 SCRAP | | 560,000 | |
| RSB CARDBOARD | 155 | 12,000 | 1,860,000 |
| WRAPPING PLASTIC | 155 | 10,000 | 1,550,000 |
| MISCELLANEOUS | | | |
| GRAND TOTAL | | | 275,714,000 |

# AREA CALCULATIONS FOR 303-A BUILDING



STORAGE AREA = 1,150 ft²

Calculations:

Grand Total/Area of Storage = 239,751.30 Btu/ft²
(Obtained from Survey Data Sheet)

EQUIVALENT FIRE

Calculations:

239,751.30 Btu/ft² ÷ 8,000 Btu/lb = 29.97 lb/ft²

**SUMMARY**

| APPROX AREA (ft²) | FIRE LOAD (Btu) | FIRE LOAD DENSITY (Btu/ft²) | EQUIVALENT FIRE lb/ft² | FIRE DURATION | TEMPERATURE (°F) |
|---|---|---|---|---|---|
| 1,150 | 275,714,000 | 239,751 | 30 | 3 hrs | 1,925 |

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**ATTACHMENT "E"**

**303-B BUILDING**
**CALCULATIONS**

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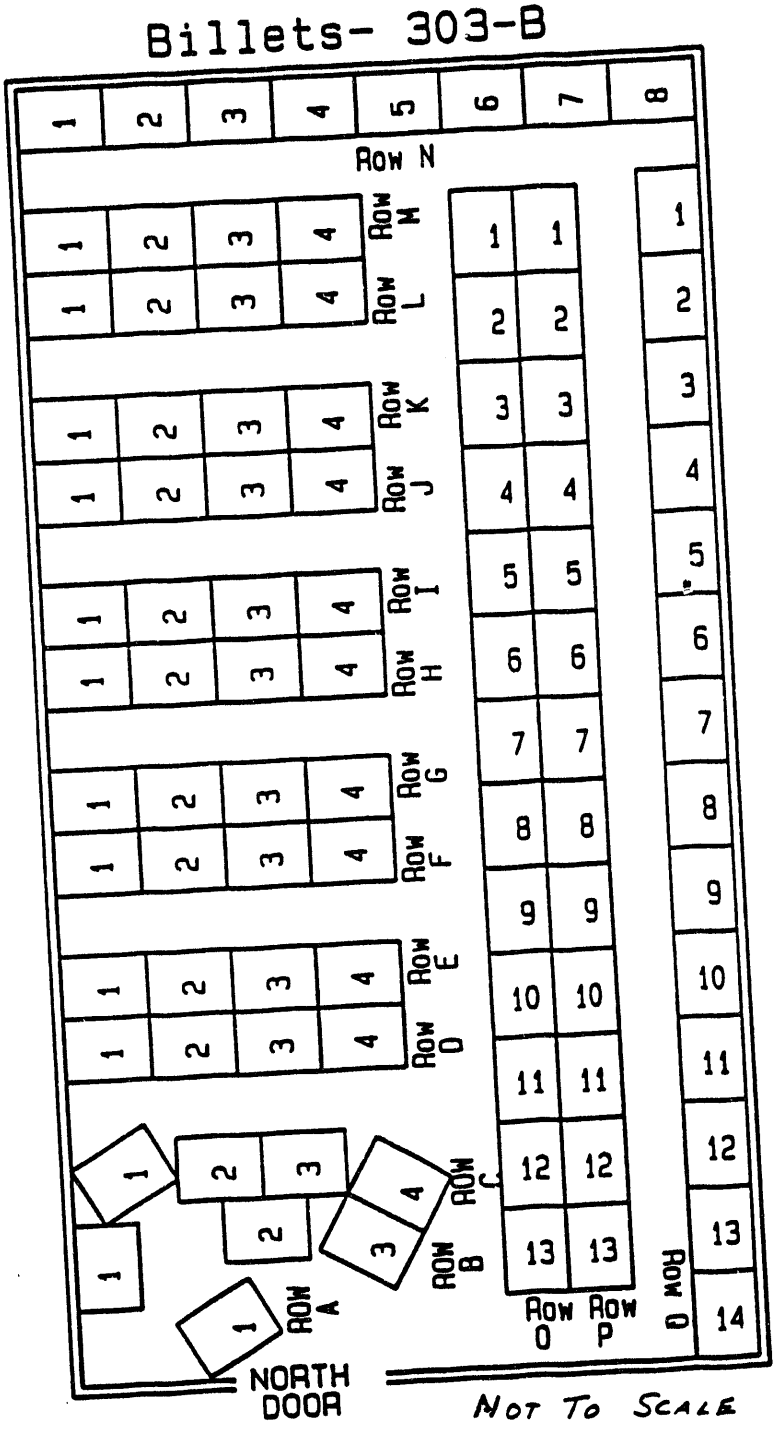
Billets- 303-B
1 2 3 4 5 6 7 8
ROW N
ROW M
ROW L
ROW K
ROW J
ROW I
ROW H
ROW G
ROW F
ROW E
ROW D
ROW C
ROW B
ROW A
ROW O
ROW P
ROW Q
NORTH DOOR
NOT TO SCALE

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# BUILDING CONSTRUCTION

Building Name/Number: Magazine - Product Storage/303-B
Area: 300

Construction:

| | |
|---|---|
| Roof: | Reinforced concrete |
| Roof Covering: | Tar and gravel |
| Exterior Walls: | Concrete block |
| Interior Walls: | Concrete |
| Floors: | Reinforced concrete slab |
| Fire Areas: | One |
| Building Area: | 1,296 $ft^2$ (HW-69534) |
| Storage Floor Area: | 1,150 $ft^2$ |

Description:

One story concrete block structure with concrete foundation and floor. The roof is precast concrete slab with tar and gravel surface. The structure is protected by a dry pipe sprinkler system.

# SURVEY DATA

Sheet 1 of 1

Date: 6 / 3 / 93

LOCATION: 300 Area

BUILDING: 303-B

| BOX TYPE | NUMBER OF | BTU'S EACH | TOTAL BTU'S |
|---|---|---|---|
| RED SHIPPING | | 1,756,800 | |
| G4255 BILLET | 480 | 856,000 | 410,880,000 |
| G4214 SCRAP | | 560,000 | |
| RSB CARDBOARD | | 12,000 | |
| WRAPPING PLASTIC | | 10,000 | |
| MISCELLANEOUS | | | |
| GRAND TOTAL | | | 410,880,000 |

# AREA CALCULATIONS FOR 303-B BUILDING



STORAGE AREA = 1,150 $ft^2$

Calculations:

Grand Total/Area of Storage = 357,286.96 $Btu/ft^2$
(Obtained from Survey Data Sheet)

EQUIVALENT FIRE

Calculations:

357,286.96 $Btu/ft^2$ ÷ 8,000 Btu/lb = 44.66 $lb/ft^2$

SUMMARY

| APPROX AREA ($ft^2$) | FIRE LOAD (Btu) | FIRE LOAD DENSITY ($Btu/ft^2$) | EQUIVALENT FIRE $lb/ft^2$ | FIRE DURATION | TEMPERATURE (°F) |
|---|---|---|---|---|---|
| 1,150 | 410,880,000 | 357,287 | 45 | 5 3/4 hrs | 2,131 |

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**ATTACHMENT "F"**

**303-E BUILDING**
**CALCULATIONS**

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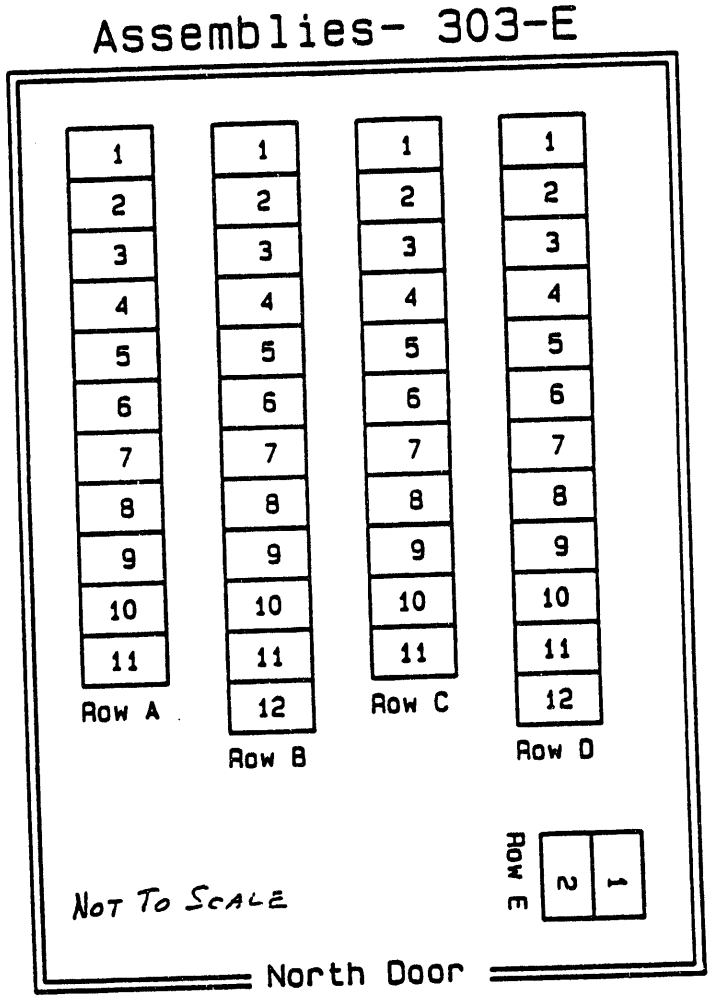
Assemblies- 303-E
1
2
3
4
5
6
7
8
9
10
11
Row A
1
2
3
4
5
6
7
8
9
10
11
12
Row B
1
2
3
4
5
6
7
8
9
10
11
Row C
1
2
3
4
5
6
7
8
9
10
11
12
Row D
Row E
2
1
Not To Scale
North Door

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# BUILDING CONSTRUCTION

Building Name/Number: Magazine - Product Storage/303-E
Area: 300

Construction:

| | |
|---|---|
| Roof: | Reinforced concrete |
| Roof Covering: | Tar and gravel |
| Exterior Walls: | Concrete block |
| Interior Walls: | Concrete |
| Floors: | Reinforced concrete slab |
| Fire Areas: | One |
| Building Area: | 1,296 $ft^2$ (HW-69534) |
| Storage Floor Area: | 1,150 $ft^2$ |

Description:

One story concrete block structure with concrete foundation and floor. The roof is precast concrete slab with tar and gravel surface. The structure is protected by a dry pipe sprinkler system.

# SURVEY DATA

Sheet 1 of 1

Date: 9 / 3 / 92

LOCATION: 300 Area

BUILDING: 303-E

| BOX TYPE | NUMBER OF | BTU'S EACH | TOTAL BTU'S |
|---|---|---|---|
| RED SHIPPING | 96 | 1,756,800 | 168,652,800 |
| G4255 BILLET | | 856,000 | |
| G4214 SCRAP | | 560,000 | |
| RSB CARDBOARD | 96 | 12,000 | 1,152,000 |
| WRAPPING PLASTIC | 96 | 10,000 | 960,000 |
| MISCELLANEOUS | | | |
| GRAND TOTAL | | | 170,764,800 |

# AREA CALCULATIONS FOR 303-E BUILDING



STORAGE AREA = 1,150 $ft^2$

Calculations:

Grand Total/Area of Storage = 148,491.13 $Btu/ft^2$
(Obtained from Survey Data Sheet)

EQUIVALENT FIRE

Calculations:

148,491.13 $Btu/ft^2$ ÷ 8,000 Btu/lb = 18.56 $lb/ft^2$

**SUMMARY**

| APPROX AREA ($ft^2$) | FIRE LOAD (Btu) | FIRE LOAD DENSITY ($Btu/ft^2$) | EQUIVALENT FIRE $lb/ft^2$ | FIRE DURATION | TEMPERATURE (°F) |
|---|---|---|---|---|---|
| 1,150 | 170,764,800 | 148,491 | 19 | 2 hrs | 1,850 |

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**ATTACHMENT "G"**

**303-G BUILDING**
**CALCULATIONS**

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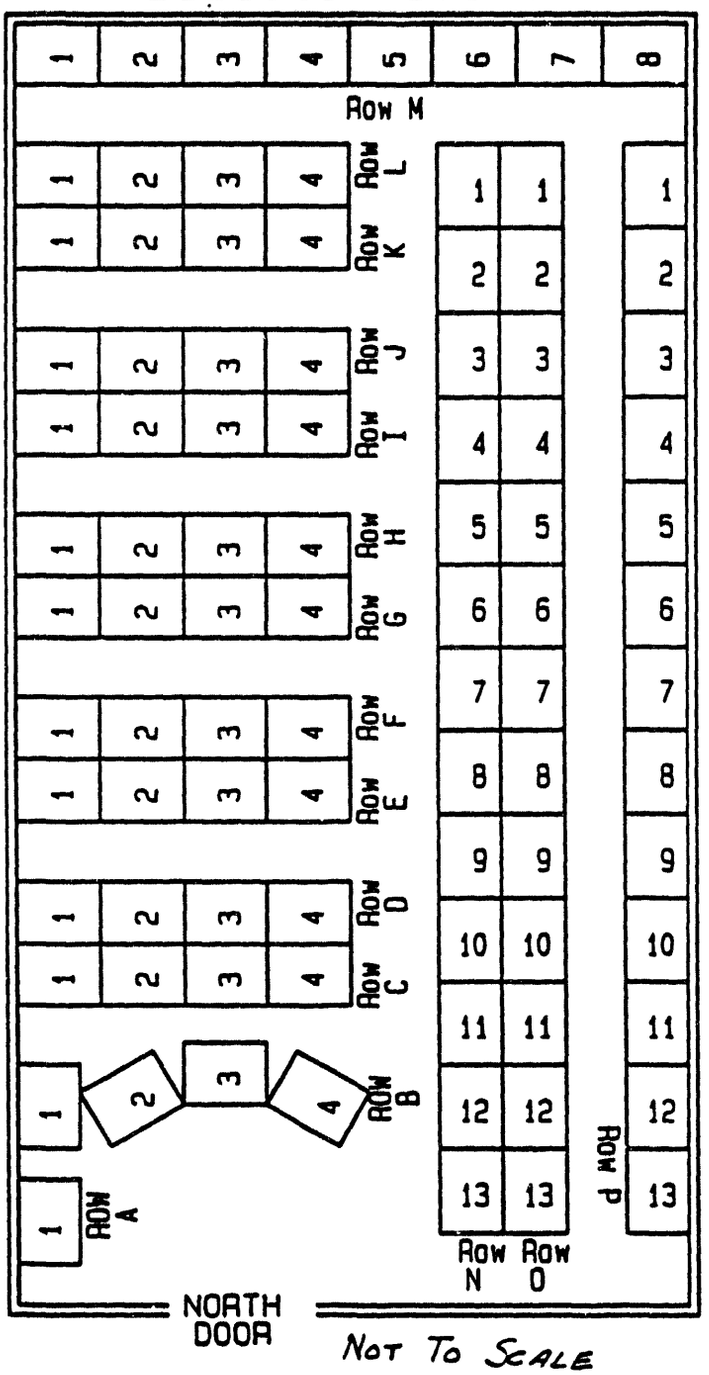
# Billets- 303-G



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# BUILDING CONSTRUCTION

Building Name/Number: Magazine - Product Storage/303-G
Area: 300

Construction:

| | |
|---|---|
| Roof: | Reinforced concrete |
| Roof Covering: | Tar and gravel |
| Exterior Walls: | Concrete block |
| Interior Walls: | Concrete |
| Floors: | Reinforced concrete slab |
| Fire Areas: | One |
| Building Area: | 1,296 $ft^2$ (HW-69534) |
| Storage Floor Area: | 1,150 $ft^2$ |

Description:

One story concrete block structure with concrete foundation and floor. The roof is precast concrete slab with tar and gravel surface. The structure is protected by a dry pipe sprinkler system.

# SURVEY DATA

Sheet 1 of 1

Date: 9 / 3 / 92

LOCATION: 300 Area

BUILDING: 303-G ROOM: N/A

| BOX TYPE | NUMBER OF | BTU'S EACH | TOTAL BTU'S |
|---|---|---|---|
| RED SHIPPING | | 1,756,800 | |
| G4255 BILLET | 460 | 856,000 | 393,760,000 |
| G4214 SCRAP | | 560,000 | |
| RSB CARDBOARD | | 12,000 | |
| WRAPPING PLASTIC | | 10,000 | |
| MISCELLANEOUS | | | |
| GRAND TOTAL | | | 393,760,000 |

# AREA CALCULATIONS FOR 303-G BUILDING



STORAGE AREA = 1,150 $ft^2$

Calculations:

Grand Total/Area of Storage = 342,400 $Btu/ft^2$
(Obtained from Survey Data Sheet)

EQUIVALENT FIRE

Calculations:

342,400 $Btu/ft^2$ ÷ 8,000 Btu/lb = 42.80 $lb/ft^2$

**SUMMARY**

| APPROX AREA ($ft^2$) | FIRE LOAD (Btu) | FIRE LOAD DENSITY ($Btu/ft^2$) | EQUIVALENT FIRE $lb/ft^2$ | FIRE DURATION | TEMPERATURE (°F) |
|---|---|---|---|---|---|
| 1,150 | 393,760,000 | 342,400 | 43 | 5 1/2 hrs | 2,113 |

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**ATTACHMENT "H"**

**303-K BUILDING**
**CALCULATIONS**

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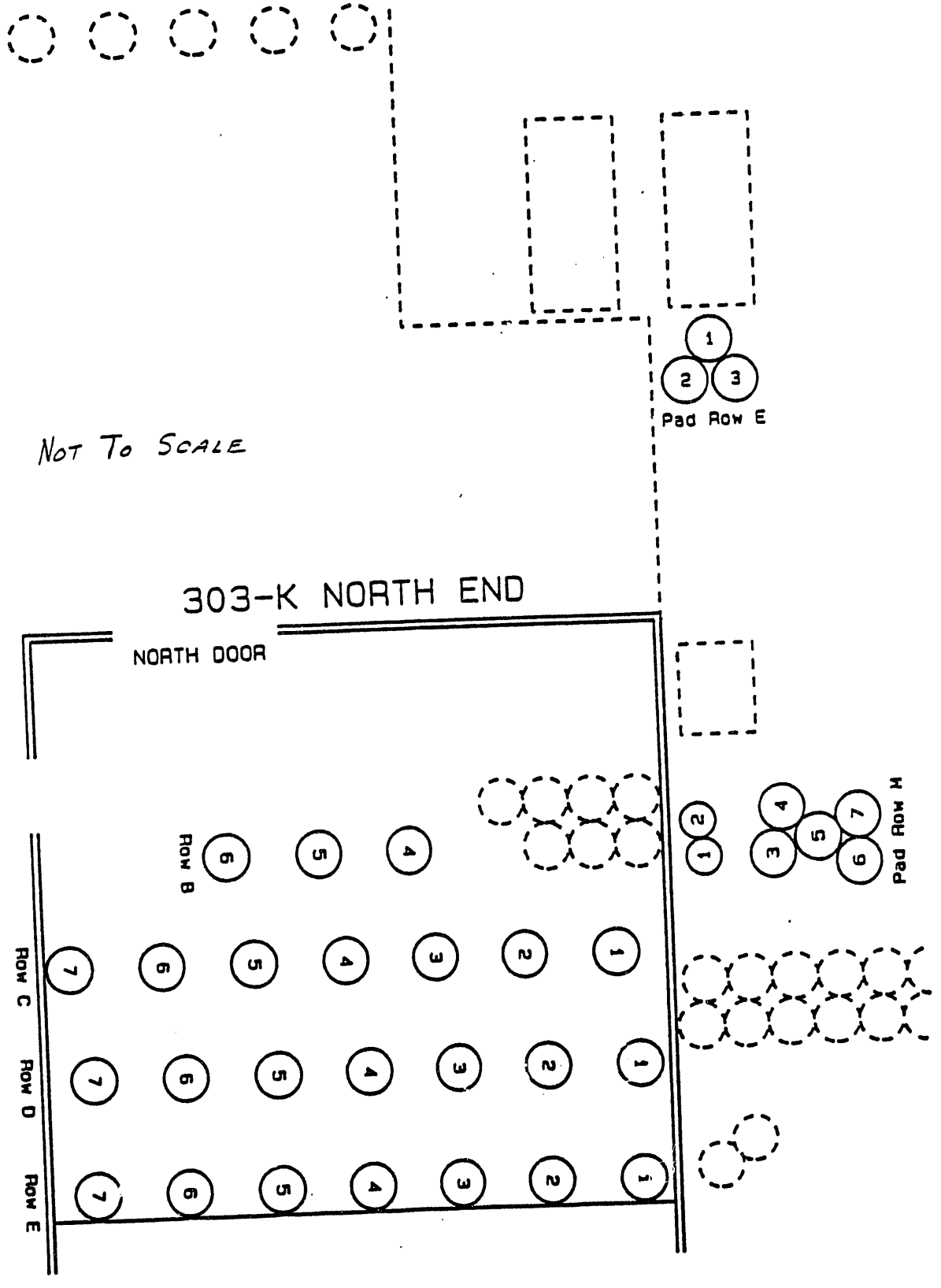
1
2
3
Pad Row E
NOT TO SCALE
303-K NORTH END
NORTH DOOR
Row B
Row C
Row D
Row E
Pad Row H

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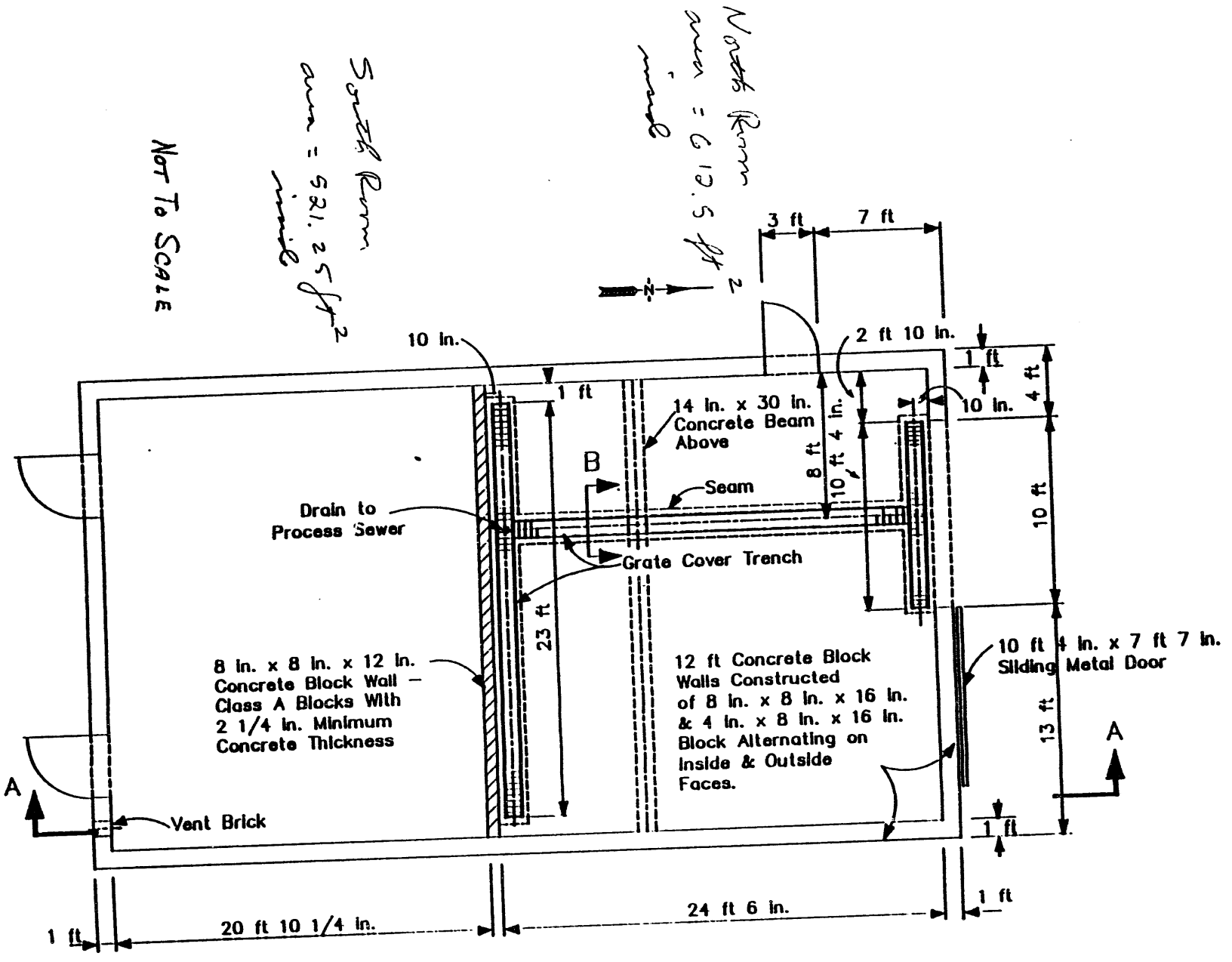


A Plan View of the 303-K Facility.

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# BUILDING CONSTRUCTION

Building Name/Number: Magazine - Product Storage/303-K
Area: 300

Construction:

| | |
|---|---|
| Roof: | Reinforced concrete |
| Roof Covering: | Tar and gravel |
| Exterior Walls: | Concrete block |
| Interior Walls: | Concrete |
| Floors: | Reinforced concrete slab |
| Fire Areas: | One/Two * |
| Building Area: | 1,296 $ft^2$ (HW-69534 & H-3-10040) |
| Storage Floor Area: | 612 $ft^2$ (North) |
| | 522 $ft^2$ (South) |

Description:

One story concrete block structure with concrete foundation and floor. The roof is precast concrete slab with tar and gravel surface. The building is divided by a concrete fire wall. There is no steam or water service in the building. All drain lines are plugged.

* The fire wall in the 303-K Building has unsealed penetrations. This technically makes the whole building one fire zone unless the penetrations are repaired.

# SURVEY DATA

Sheet 1 of 1

Date: 9 / 3 / 92

LOCATION: 300 Area

BUILDING: 303-K

| BOX TYPE | NUMBER OF | BTU'S EACH | TOTAL BTU'S |
|---|---|---|---|
| RED SHIPPING | | 1,756,800 | |
| G4255 BILLET | | 856,000 | |
| G4214 SCRAP | | 560,000 | |
| RSB CARDBOARD | | 12,000 | |
| WRAPPING PLASTIC | | 10,000 | |
| MISCELLANEOUS | | SEPARATE SHEET | 4,707,004 |
| TOTAL "COMBUSTIBLES" | | | 4,707,004 |
| CHIPS AND FINES | | SEPARATE SHEET | 697,035 |
| GRAND TOTAL | | | 5,404,039 |

# AREA CALCULATIONS FOR 303-K BUILDING



TOTAL AREA = 1,134 ft²

Calculations:

Total "Combustibles"/Area of Storage = 4,150.80 Btu/ft²
(Obtained from Survey Data Sheet)

Grand Total/Area of Storage = 4,765.47 Btu/ft²
(Obtained from Survey Data Sheet)

EQUIVALENT FIRE

Calculations:

4,150.80 Btu/ft² ÷ 8,000 Btu/lb = 0.52 lb/ft²

4,765.47 Btu/ft² ÷ 8,000 Btu/lb = 0.60 lb/ft²

**SUMMARY**

| APPROX AREA (ft²) | FIRE LOAD (Btu) | FIRE LOAD DENSITY (Btu/ft²) | EQUIVALENT FIRE lb/ft² | FIRE DURATION | TEMPERATURE (°F) |
|---|---|---|---|---|---|
| 1,134 | 4,707,004 | 4,151 | 0.5 | less than 30 min | less than 1550 |
| 1,134 | 5,404,039 | 4,766 | 0.6 | less than 30 min | less than 1550 |

The chips and fines stored in the building do not significantly effect the results of "combustibles" alone. The predicted fire is still under 30 minutes.

# MISCELLANEOUS "COMBUSTIBLES" FOR 303-K BUILDING
(North Room)



Using:

10,000 Btu/lb -- cotton absorbent pads
20,000 Btu/lb -- 10 mill plastic sheeting

Calculations:

- Plastic sheeting (40 pounds)

  40 lb x 20,000 Btu/lb = 800,000 Btu

- Cotton absorbent pads (160 pounds)

  160 lb x 10,000 Btu/lb = 1,600,000 Btu

**TOTAL FOR NORTH ROOM 2,400,000 Btu**

# MISCELLANEOUS "COMBUSTIBLES" FOR 303-K BUILDING
(South Room)



Using:

8,000 Btu/lb & 40 lb/ft³ -- Wood/Paper Products
3,040 Btu/lb & 3 lb/ft³ -- Fiberglass
7,720 Btu/lb -- Polyvinyl Chloride/Foam

Calculation:

- 2 wood boxes 16" wide x 18" high x 12' long
  3/4 " thick

Ends: (16" x 18" x 3/4")/1,728 in³ = 0.13 ft³ x 2 = 0.25 ft³

Top & Bottom: (16" x 144" x 3/4")/1,728 in³
= 1.00 ft³ x 2 = 2.00 ft³

Front & Back: (18" x 144" x 3/4")/1,728 in³
= 1.13 ft³ x 2 = 2.25 ft³

Total 4.50 ft³

4.50 ft³ x 40 lb/ft³ = 180 lb
180 lb x 8,000 Btu/lb = 1,440,000 Btu

- 4 - 4" wide x 4" high x 3' long - wood

(4" x 4" x 36")/1,728 in³ = 0.33 ft³ x 4 = 1.33 ft³

1.33 ft³ x 40 lb/ft³ = 53.20 lb
53.20 lb x 8,000 Btu/lb = 425,600 Btu

- 6 - 6" wide x 2" high x 2' long - wood

(6" x 2" x 24")/1,728 in³ = 0.17 ft³ x 6 = 1.00 ft³

1.00 ft³ x 40 lb/ft³ = 40 lb
40 lb x 8,000 Btu/lb = 320,000 Btu

- 5 lb misc wood/paper combustibles

5 lb x 8,000 Btu/lb = 40,000 Btu

# MISCELLANEOUS "COMBUSTIBLES" FOR 303-K BUILDING
(South Room)



- 5 fiberglass cases 20" wide x 3" high x 8' long 3/8" thick

Ends: (20" x 3" x 3/8")/1,728 $in^3$ = 0.01 $ft^3$ x 2 = 0.03 $ft^3$

Top & Bottom: (20" x 96" x 3/8")/1,728 $in^3$
= 0.42 $ft^3$ x 2 = 0.83 $ft^3$

Front & Back: (3" x 96" x 3/8")/1,728 $in^3$
= 0.06 $ft^3$ x 2 = 0.13 $ft^3$

Total 0.99 $ft^3$

0.99 $ft^3$ x 3 lb/$ft^3$ = 2.97 lb
2.97 lb x 3,040 Btu/lb = 9,029 Btu

- 10 - 3 oz foam spacers in each fiberglass case

3 oz/ 16 oz/lb x 50 x 7,720 Btu/lb = 72,375 Btu

**TOTAL FOR SOUTH ROOM 2,307,004 Btu**

**TOTAL MISCELLANEOUS COMBUSTIBLES FOR 303-K**
**4,707,004**

# CHIPS AND FINES
# 303-K BUILDING
(North Room)



There is 86.47 kg (190.64 lb) of uranium and 41.19 kg (90.8 lb) of zirconium distributed in 24 drums located in the north end of the 303-K Building.

Using information obtained from Reference 5, Btu content for the uranium and zirconium were calculated.

Given:

$U_3O_8$

$\Delta Hf$ = -854.4 kcal/mol ($\Delta Hf$, enthalpy of formation at 25°C)
1 mol = 842.08 g

$ZrO_2$

$\Delta Hf$ = -263.04 kcal/mol
1 mol = 123.22 g

Calculations:

$U_3O_8$

-854.4 kcal/mol x 1 mol/842.08 g x 86.47 kg x 1000 g/1 kg
x 3.968 Btu/kcal

= -348,132.85 Btu

$ZrO_2$

-263.04 kcal/mol x 1 mol/123.22 g x 41.19 kg x 1000 g/1 kg
x 3.968 Btu/kcal

= -348,902.47 Btu

TOTAL U & Zr LOADING: -697,035.32 Btu

The 303-K Building combustible loading "Grand Total" is 5,404,039 Btu (see Data Sheet, Page H-8); therefore, the chips and fines only make up approximately 13% of all the combustibles found in the 303-K Building.

$$\frac{697,035}{5,404,039} = 13\%$$

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**ATTACHMENT "I"**

**REFERENCE TABLES**
**AND GRAPHS**

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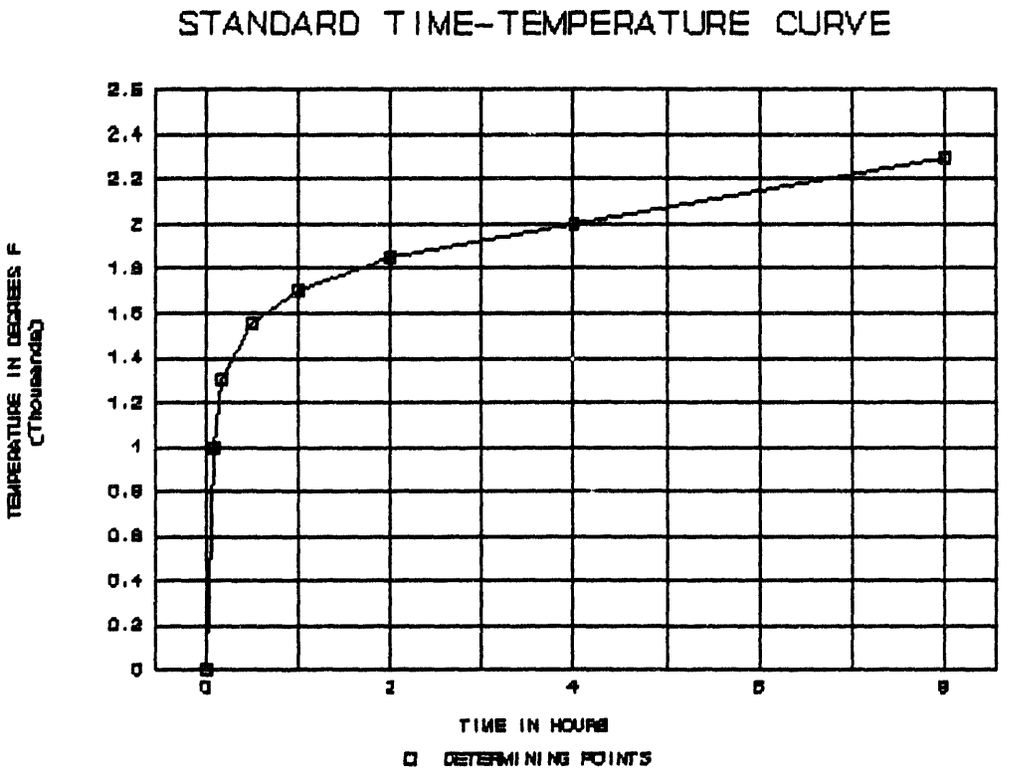
**FIGURE I1**




Reference 2, Figure 5-9A, Page 5-89

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**FIGURE I2**

# FIRE ENDURANCE OF CONCRETE

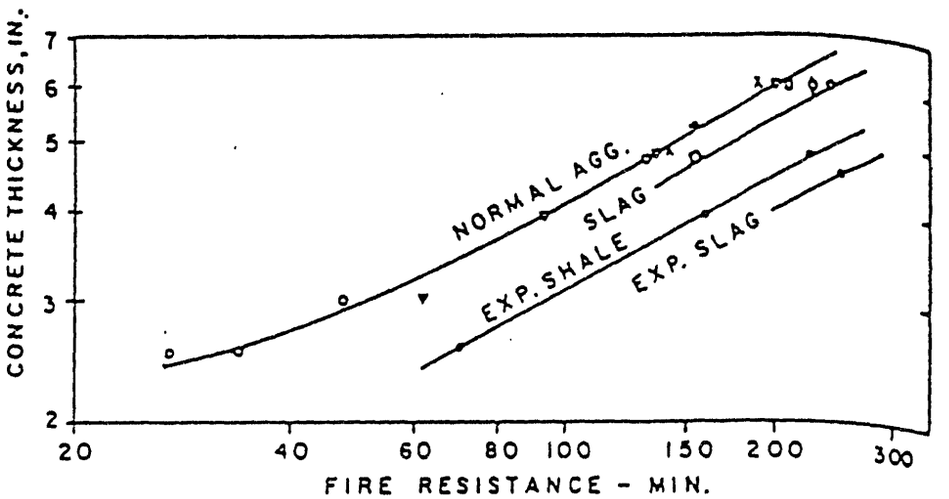


*Fig. 5-8R. Relationship of slab thickness and type of aggregate fire endurance.*

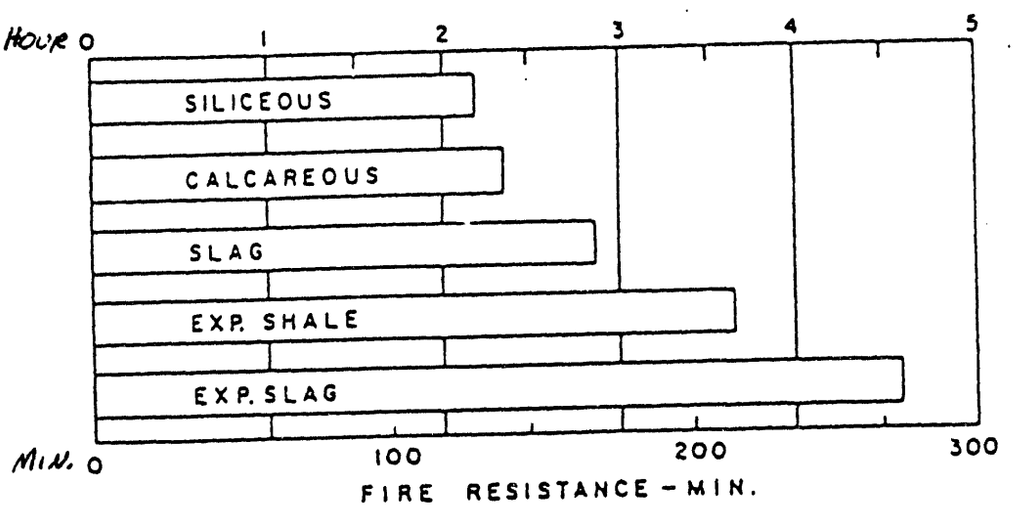


*Fig. 5-8Q. Effect of various types of aggregate on the fire endurance of 4¼-in. slabs.*

**Reference 2, Page 5-86**

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FIGURE I3

# SHIPPING BOX INFORMATION

Dimensions and Weights

| Model | External dimension | | | | Internal dimension | | | Empty weight (lb) | Authorized gross weight (lb) |
|---|---|---|---|---|---|---|---|---|---|
| | Width (in.) | Length (in.) | Height (in.) | Skid (in.) | Width (in.) | Length (in.) | Height (in.) | | |
| G-4214 | 16.38 | 34.50 | 10.0 | 4.00 | 14.13 | 30.00 | 8.38 | 70.0 | 1,260 |
| G-4245 | 12.25 | 18.50 | 10.0 | 3.13 | 10.00 | 14.00 | 8.50 | 25.0 | 225 |
| G-4255 | 25.63 | 35.00 | 10.0 | 3.50 | 24.13 | 30.75 | 8.00 | 107.0 | 1,470 |
| G-4273-5 | 27.00 | 41.25 | 13.0 | 3.38 | 25.50 | 37.00 | 12.00 | 132.0 | 3,035 |
| G-4273-6 | 27.00 | 41.25 | 16.0 | 3.38 | 25.50 | 37.00 | 14.00 | 146.0 | 3,540 |
| G-4292 | 16.38 | 34.50 | 17.0 | 3.38 | 14.13 | 30.00 | 16.13 | 85.0 | 1,330 |

Materials/Method of Construction

| | |
|---|---|
| Drawing No. G-4292<br>00F-5500-X-00491, Rev. 9 | |
| Drawing No. G-4214<br>00F-5500-X-00431, Rev. 19<br>00F-5500-X-01490, Rev. 3 | |
| Sides and ends | 1.125-in. thick white pine |
| Bottom | 1-in. hardwood |
| Lids | 2, 0.5-in. plywood |
| Banding | See drawing - 1.25-in. steel |
| Skids | 3 wooden, 3.625 in. or 4 in. |
| Drawing No. G-4245<br>00F-5500-X-00460, Rev. 3 | |
| Lid | 1, 0.5-in. plywood |
| Banding | 2 vertical and 2 horizontal |
| Skids | 3.25 in. |
| Drawing No. G-4255<br>00F-5500-X-00468, Rev. 5<br>00F-5500-X-00470, Rev. 0 | |
| Drawing No. G-4273<br>00F-5500-X-00471, Rev. 14<br>00F-5500-X-00472, Rev. 7<br>00F-5500-X-00473, Rev. 4 | |
| All construction | 0.75-in. exterior grade plywood |
| Skids | 3 wooden, 3.625 in. or 4 in. |

Reference 2, Page 5-93, Figure 5-9E

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**ATTACHMENT "J"**

**3712 BUILDING INVENTORY**
**ON FIRST WALK THROUGH**

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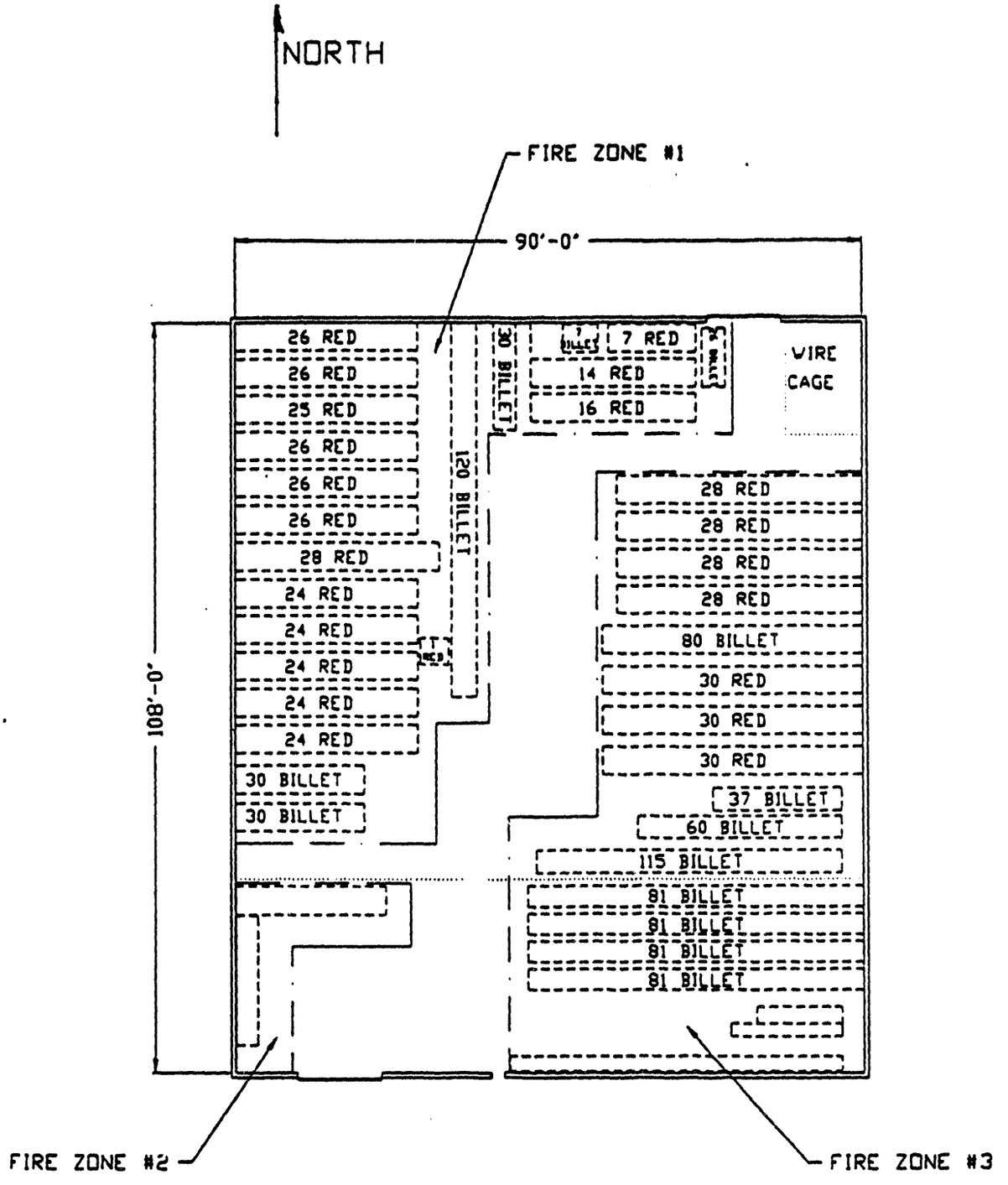


BUILDING 3712

NTS

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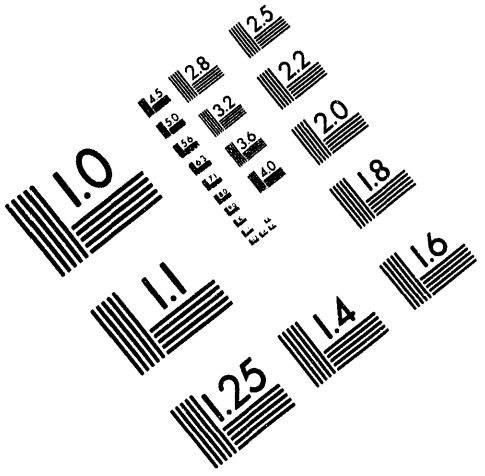
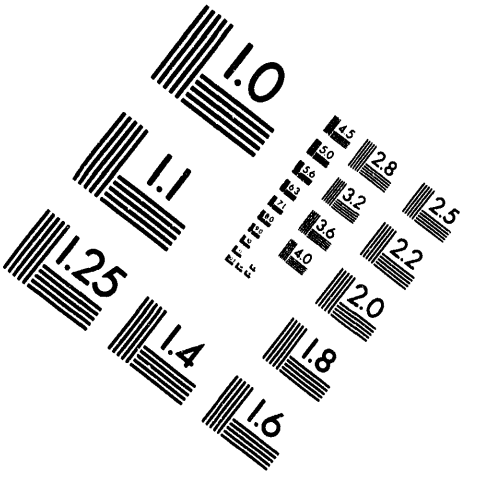
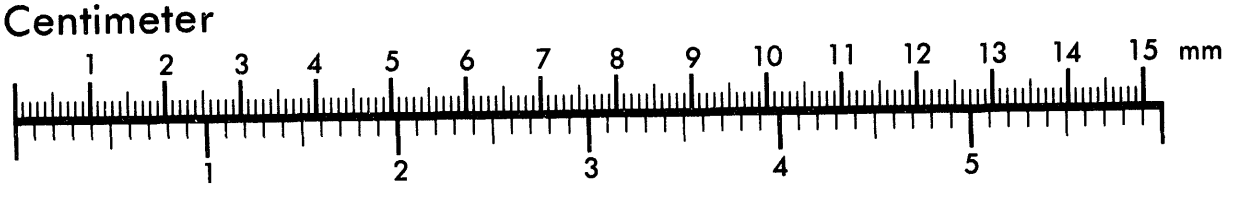
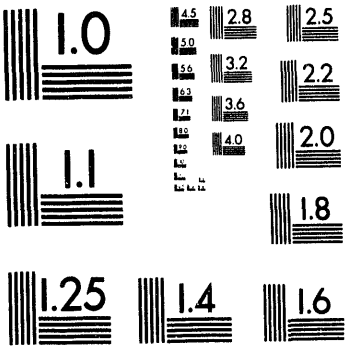
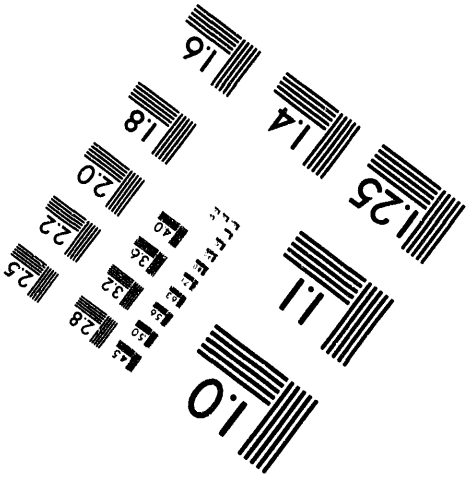


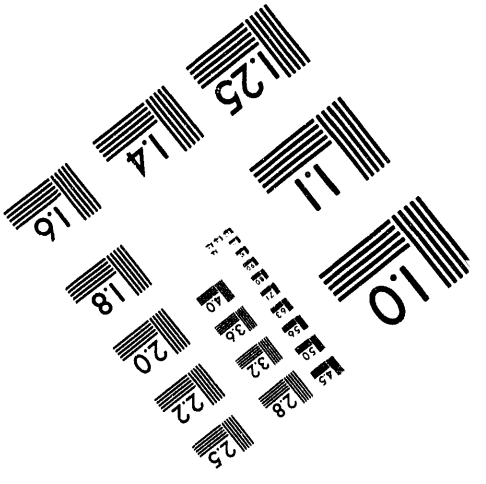
**Association for Information and Image Management**
1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202









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2 of 2

# BUILDING CONSTRUCTION

Building Name/Number: Fuels Manufacturing Storage/3712
Area: 300

Construction:

| | |
|---|---|
| Roof: | Metal deck on steel beams |
| Roof Covering: | Metal deck |
| Exterior Walls: | Uninsulated corrugated metal |
| Interior Walls: | N/A |
| Floors: | Reinforced concrete slab |
| Fire Areas: | Three - This is based on distance separation of the combustibles. |
| Building Area: | 9,720 $ft^2$ |

Description:

One-story steel frame structure with metal panel siding and roof. Concrete floor and foundation. lighting is incandescent. Heat furnished by steam-heated forced-air and cool by forced-air evaporative type unit. Building is equipped with automatic fire alarm sprinkler system.

)TE: Three fire areas were called out in this survey because of the distance separations between the groupings of boxes. The second survey (Attachment "B") had one because the storage had been rearranged and the separations went away.

# SURVEY DATA

Sheet 1 of 3

Date: 8 / 31 / 92

LOCATION:

BUILDING: 3712 ROOM: AREA 1

| BOX TYPE | NUMBER OF | BTU'S EACH | TOTAL BTU'S |
|---|---|---|---|
| RED SHIPPING | 341 | 2,032,000 | 692,912,000 |
| G4255 BILLET | 248 | 960,000 | 238,080,000 |
| G4214 SCRAP | | 440,000 | |
| CARDBOARD -- 7 OZ (LARGE) | | 4,400 | |
| CARDBOARD -- 5 OZ (MEDIUM) | | 3,100 | |
| CARDBOARD -- 4 OZ (SMALL) | | 2,500 | |
| CARDBOARD -- 3 OZ (TINY) | | 1,900 | |
| WOOD BOX TYPE "A" | | 102,400 | |
| WOOD BOX TYPE "B" | | 38,400 | |
| WOOD BOX TYPE "C" | | 16,000 | |
| WOOD BOX TYPE "D" | | 51,200 | |
| | | | |
| SHIPPING PLASTIC | 589 | 10,000 | 5,890,000 |
| | | | |
| MISCELLANEOUS | | | 1,920,000 |
| GRAND TOTAL | | | 938,802,000 |

MEASURED STORAGE AREA: 3,138 ft²

# SURVEY DATA

Sheet 2 of 3

Date: 8 / 31 / 92

LOCATION:

BUILDING: 3712 ROOM: AREA 2

| BOX TYPE | NUMBER OF | BTU'S EACH | TOTAL BTU'S |
|---|---|---|---|
| RED SHIPPING | | 2,032,000 | |
| G4255 BILLET | | 960,000 | |
| G4214 SCRAP | | 440,000 | |
| CARDBOARD -- 7 OZ (LARGE) | 11 | 4,400 | 48,400 |
| CARDBOARD -- 5 OZ (MEDIUM) | 43 | 3,100 | 133,300 |
| CARDBOARD -- 4 OZ (SMALL) | 231 | ?,500 | 577,500 |
| CARDBOARD -- 3 OZ (TINY) | 69 | 1,900 | 131,100 |
| WOOD BOX TYPE "A" | | 102,400 | |
| WOOD BOX TYPE "B" | | 38,400 | |
| WOOD BOX TYPE "C" | 5 | 16,000 | 80,000 |
| WOOD BOX TYPE "D" | 4 | 51,200 | 204,800 |
| | | | |
| PLASTIC BOXES | 9 lb | 20,000 Btu/lb | 180,000 |
| | | | |
| MISCELLANEOUS | | | 500,000 |
| **GRAND TOTAL** | | | **1,855,100** |

MEASURED STORAGE AREA: 260 ft²

# SURVEY DATA

Sheet 3 of 3

Date: 8 / 31 / 92

LOCATION:

BUILDING: 3712 ROOM: AREA 3

| BOX TYPE | NUMBER OF | BTU'S EACH | TOTAL BTU'S |
|---|---|---|---|
| RED SHIPPING | 202 | 2,032,000 | 410,464,000 |
| G4255 BILLET | 616 | 960,000 | 591,360,000 |
| G4214 SCRAP | | 440,000 | |
| CARDBOARD -- 7 OZ (LARGE) | 58 | 4,400 | 255,200 |
| CARDBOARD -- 5 OZ (MEDIUM) | | 3,100 | |
| CARDBOARD -- 4 OZ (SMALL) | 133 | 2,500 | 332,500 |
| CARDBOARD -- 3 OZ (TINY) | | 1,900 | |
| WOOD BOX TYPE "A" | 703 | 102,400 | 71,987,200 |
| WOOD BOX TYPE "B" | 385 | 38,400 | 14,784,000 |
| WOOD BOX TYPE "C" | 193 | 16,000 | 3,088,000 |
| WOOD BOX TYPE "D" | | 51,200 | |
| | | | |
| PLASTIC ON SHELVES | 8-1/2 lb | 20,000/lb | 170,000 |
| SHIPPING PLASTIC | 818 | 10,000 | 8,180,000 |
| MISCELLANEOUS | | SEE SEPARATE PAGE | 11,980,000 |
| GRAND TOTAL | | | 1,112,600,900 |

MEASURED STORAGE AREA: 4,138 ft²

# AREA CALCULATIONS FOR 3712 BUILDING



MEASURED STORAGE AREA 1 = 3,138 ft²

Calculations:

Grand Total/Area of Storage = 299,172 Btu/ft²
(Obtained from Area 1 Survey Data Sheet)

MEASURED STORAGE AREA 2 = 260 ft²

Calculations:

Grand Total/Area of Storage = 7,135 Btu/ft²
(Obtained from Area 2 Survey Data Sheet)

MEASURED STORAGE AREA 3 = 4,138 ft²

Calculations:

Grand Total/Area of Storage - 268,874 Btu/ft²
(Obtained from Area 3 Survey Data Sheet)

**SUMMARY**

| FIRE AREA | APPROX AREA (ft²) | FIRE LOAD (Btu) | FIRE LOAD DENSITY (Btu/ft²) | EQUIVALENT FIRE (lb/ft²) | FIRE DURATION | TEMPERATURE (°F) |
|---|---|---|---|---|---|---|
| 1 | 3,138 | 938,802,000 | 299,172 | 37 | 4 hrs | 2000 |
| 2 | 260 | 1,855,100 | 7,135 | 0.9 | 5 mins | 1000 |
| 3 | 4,138 | 1,112,600,900 | 268,874 | 34 | 3 1/2 hrs | 1963 |
| TOTAL FIRE LOAD | | 2,053,258,000 | | | | |
| | | ENTIRE BUILDING SPREAD | | | | |
| | 9,720 | 2,053,258,000 | 211,241 | 26 | 2.5 hrs | 1888 |

# AREA MISCELLANEOUS FOR 3712 BUILDING



Using:

8,000 Btu/lb -- miscellaneous wood

10,000 Btu/lb -- mixed miscellaneous (wood, cardboard, cloth)

20,000 Btu/lb -- miscellaneous plastic (polyethylene)

Calculations:

| | | | |
|---|---|---|---|
| Area 1 | 80 lb x 20,000 Btu/lb | = | 1,600,000 Btu |
| | 40 lb x 8,000 Btu/lb | = | 320,000 Btu |
| | Total | | **1,920,000 Btu** |
| Area 2 | 25 lb x 20,000 Btu/lb | = | 500,000 Btu |
| | Total | | **500,000 Btu** |
| Area 3 | 100 lb x 20,000 Btu/lb | = | 2,000,000 Btu |
| | 610 lb x 8,000 Btu/lb | = | 4,880,000 Btu |
| | 200 lb x 10,000 Btu/lb | = | 2,000,000 Btu |
| | One Large Chair | = | 100,000 Btu |
| | Wooden Case | = | 3,000,000 Btu |
| | Total | | **11,980,000 Btu** |

DATE
FILMED
8/25/94

END