NOTICE OF OPEN MEETING & VOTE TO CLOSE PART OF THE MEETING
A G E N D A
SPECIAL COUNCIL MEETING
City of Moberly
City Council Room – Moberly City Hall
101 West Reed Street
November 06, 2019
12:00 PM

Posted:

Pledge of Allegiance
Roll Call
Approval of Agenda
Recognition of Visitors
Communications, Requests, Informational Items & Consent Calendar
1 Presentation from Williams Spurgeon Kuhl & Freshnock on Fire Station 1 and 2
Public Hearing and Receipt of Bids
Ordinances & Resolutions
Official Reports
Anything Else to Come Before the Council
Adjournment

The public is invited to attend the Council meeting. Representatives of the news media may obtain copies of this notice by contacting the City Clerk. If a special accommodation is needed as addressed by the Americans with Disabilities Act, please contact the City Clerk twenty-four (24) hours in advance of the meeting.

City of Moberly
City Council Agenda Summary

Agenda Number: _____
Department: Fire Dept
Date: November 6, 2019

Agenda Item: Presentation from Williams Spurgeon Kuhl & Freshnock on Fire Station 1 and 2

Summary: See Attached documents

Recommended Action: Review attached documents

Fund Name: N/A

Account Number: N/A

Available Budget $: N/A

ATTACHMENTS:

____ Memo	____ Council Minutes
____ Staff Report	____ Proposed Ordinance
_x_ Correspondence	____ Proposed Resolution
____ Bid Tabulation	____ Attorney's Report
____ P/C Recommendation	____ Petition
____ P/C Minutes	____ Contract
____ Application	____ Budget Amendment
____ Citizen	____ Legal Notice
____ Consultant Report	____Other_____

Roll Call	Aye	Nay
Mayor		
M___ S___ **Jeffrey**	____	____
Council Member		
M___ S___ **Brubaker**	____	____
M___ S___ **Kimmons**	____	____
M___ S___ **Davis**	____	____
M___ S___ **Kyser**	____	____
	Passed	Failed

CITY OF MOBERLY
FIRE STATION 1 & 2

STUDY & CONDITIONS ASSESSMENT

WITH RECOMMENDATIONS

Williams Spurgeon Kuhl & Freshnock Architects, Inc.

www.wskfarch.com

CITY COUNCIL PRESENTATION

- STATION 1 CONDITIONS OVERVIEW
- STATION 2 CONDITIONS OVERVIEW
- STATIONS 1 & 2 RECOMMENDATIONS
  - HEALTH, SAFTEY & WELLNESS
  - CODE NON-COMPLIANCE
  - OPERATIONAL DEFICIENCIES
- STATEMENT OF PROBABLE COSTS

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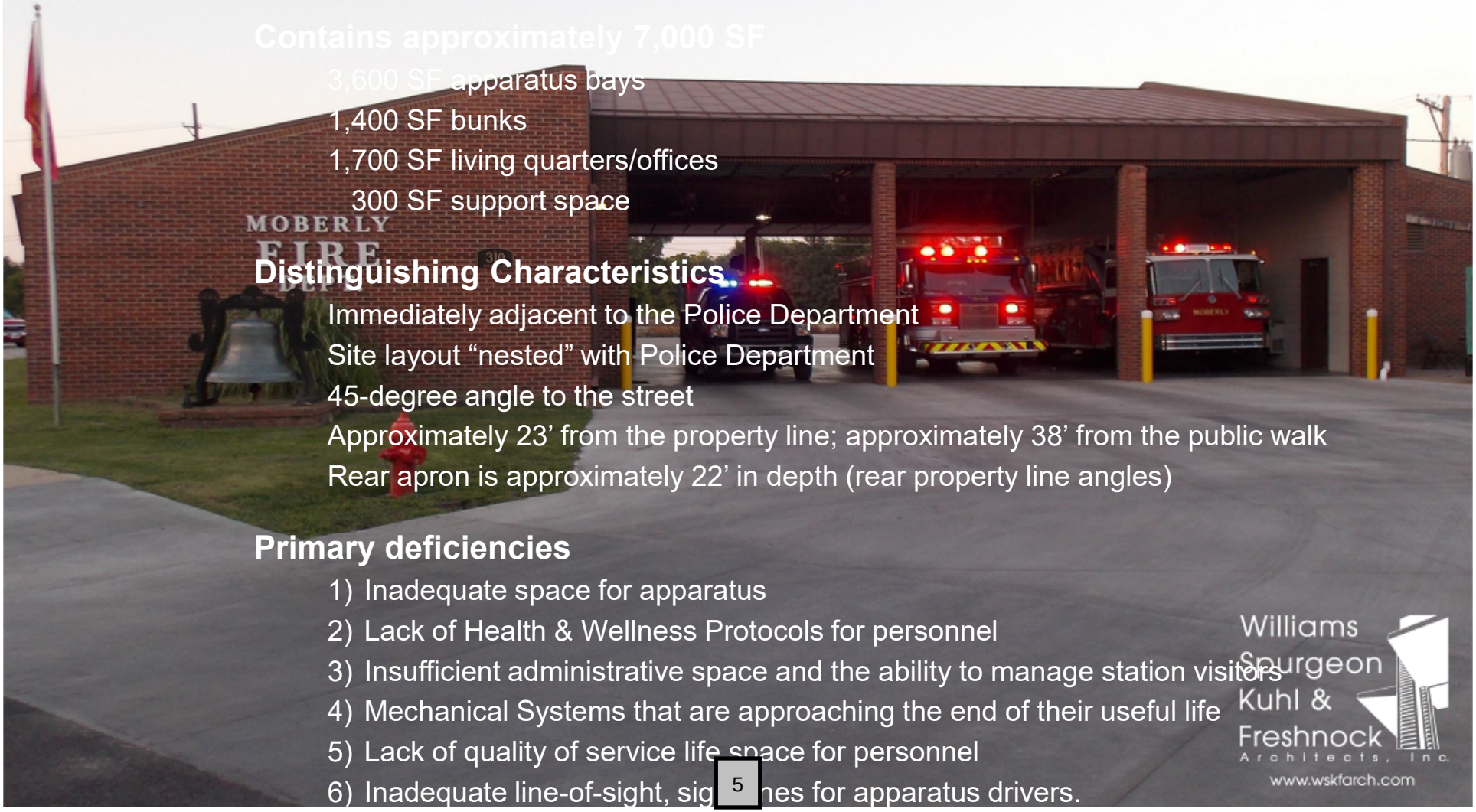
CITY COUNCIL PRESENTATION

- STATION 1 CONDITIONS OVERVIEW

Existing Station 1 Constructed 1974

Contains approximately 7,000 SF

- 3,600 SF apparatus bays
- 1,400 SF bunks
- 1,700 SF living quarters/offices
- 300 SF support space



Distinguishing Characteristics

- Immediately adjacent to the Police Department
- Site layout “nested” with Police Department
- 45-degree angle to the street
- Approximately 23’ from the property line; approximately 38’ from the public walk
- Rear apron is approximately 22’ in depth (rear property line angles)

Primary deficiencies

1) Inadequate space for apparatus
2) Lack of Health & Wellness Protocols for personnel
3) Insufficient administrative space and the ability to manage station visitors
4) Mechanical Systems that are approaching the end of their useful life
5) Lack of quality of service life space for personnel
6) Inadequate line-of-sight, signalines for apparatus drivers.

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CITY COUNCIL PRESENTATION

- STATION 2 CONDITIONS OVERVIEW

Existing Station 2 Constructed in 1974

Contains approximately 3,200 SF

- 1,600 SF apparatus bays
- 800 SF bunks
- 800 SF living quarters/offices

Distinguishing Characteristics

- Located on N. Moberly Street/Bus. Hwy. 63
- PEMB Structure
- Limited Site Depth

Primary Deficiencies

1) Inadequate space for apparatus
2) Lack of Health & Wellness Protocols for personnel
3) Mechanical Systems that are approaching the end of their useful life
4) Lack of quality of service life space for personnel
5) Back-in apparatus bays
6) Lack of traffic controls (7,500 vehicles per day (peak 500 to 600/hr.)

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CITY COUNCIL PRESENTATION

- STATION 1 RECOMMENDATIONS

Health, Safety & Wellness

a. **Lack of apparatus bay exhaust systems;** direct capture or filtration systems

b. **Lack of environmental separation between bunkrooms & apparatus bays;** openings with gasketing, positive air pressure on the bunkroom side (air should flow from the bunkrooms to the apparatus bays)

c. **Lack of environmental separation between living quarters/offices & apparatus bays;** Refer to item 'b' above.

d. **Lack of Exhaust Air & Floor Drains for gear Storage;** exhaust air and floor drains in the gear storage room

e. **Drinking Fountain Exposed to products of combustion;** relocate drinking fountain

f. **Lack of fresh air intake for mechanical systems;** provide fresh air for mechanical systems

g. **Inadequate line-of-sight distance for apparatus;** not financially feasible to resolve

h. **Lack of compliance with NFPA 1500, Standard on Fire Department Safety, Health, and Wellness Program;** provide adequate space for inspection, care and maintenance of protective gear, provide fitness space

CITY COUNCIL PRESENTATION

- STATION 1 RECOMMENDATIONS

Code Non-Compliance

a. **Limited compliance with NFPA 1851, Standard on Selection, Care and Use of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting;** Provide space for cleaning, care and repair of fire gear

b. **Non-compliance with NFPA 13, Standard for the Installation of Sprinkler Systems;** Provide fire protection (fire sprinkler) system

c. **Lack of compliance with the American Disabilities Act (ADA);** Provide accessible design

d. **Lack of compliance with National Electric Code;** Provide space at electrical service panels

e. **Lack of compliance with NFPA 30, Flammable & Combustible Liquids Code;** Provide fire-proof storage

f. **Non-compliant exit from the Training Room;** Provide level exit

g. **Lack of compliance with IBC 2012, Chapter 4, Section 402.2, Separation Walls;** Provide fire separation between bunkrooms and adjacent spaces

h. **Lack of compliance with International Plumbing Code (IPC) 2012;** Provide oil/sand separator

CITY COUNCIL PRESENTATION

- STATION 1 RECOMMENDATIONS

Operational Deficiencies

a. **Inadequate space for fire apparatus;** Infeasible to provide space

b. **Inadequate space for storage, equipment, records, supplies, etc.;** Provide additional storage space

c. **Inadequate space for living quarters;** Infeasible to provide space

d. **Inadequate security control (public/staff security);** Provide access control/video surveillance

e. **Evidence of moisture intrusion (CMU walls);** Provide moisture control

f. **Lack of sound control between Offices and Living Quarters;** Provide sound control

g. **Lack of gender-neutral space (toilets & showers);** Provide gender-neutral toilet/showers

h. **Deteriorating construction;** Replace rusting door openings, renovate toilets/showers

i. **Insufficient space for personnel personal storage;** Replace lockers

j. **Aging standby generator;** Replace existing generator

k. **Insufficient space for future needs;** Infeasible to provide space

CITY COUNCIL PRESENTATION

- STATION 2 RECOMMENDATIONS

Health, Safety & Wellness

a. **Lack of apparatus bay exhaust systems;** Provide exhaust system

b. **Lack of environmental separation between living quarters & apparatus bays;** Provide tight-fitting openings, provide positive air pressure

c. **Drinking fountain exposed to products of combustion;** Provide drinking fountain

d. **Lack of fresh air intake for mechanical systems;** Provide fresh air intake

e. **Inadequate apparatus maneuvering in right-of way and lack of traffic control for safe exiting onto highway;** Infeasible to provide

f. **Lack of compliance with NFPA 1500, Standard on Fire Department Safety, Health, and Wellness Program;** Provide space for inspection, care and maintenance of gear

CITY COUNCIL PRESENTATION

- STATION 2 RECOMMENDATIONS

Code Non-Compliance

a. **Limited compliance with NFPA 1851, Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting;** Provide space for cleaning, care and repair of gear

b. **Non-compliance with NFPA 13, Standard for the Installation of Sprinkler Systems;** Provide fire protection (fire sprinkler) system

c. **Lack of compliance with the American Disabilities Act (ADA);** Provide accessible design

d. **Lack of compliance with National Electric Code;** Provide space for adequate clearance at electrical service panels

e. **Lack of compliance with NFPA 30, Flammable & Combustible Liquids Code;** Provide fire-proof storage

f. **Non-compliant exit from the Bunk Rooms;** Provide second exit from bunkroom wing

g. **Lack of compliance with IBC 2012, Chapter 4, Section 402.2, Separation Walls;** Provide fire separation between bunks and adjacent spaces

h. **Lack of compliance with International Plumbing Code (IPC) 2012;** Provide oil/sand separator

i. **Lack of emergency power sou** Provide emergency generator

CITY COUNCIL PRESENTATION

- STATION 2 RECOMMENDATIONS

Operational Deficiencies

a. **Inadequate space for fire apparatus;** Infeasible to provide

b. **Inadequate overhead doors;** Infeasible to provide

c. Inadequate apparatus exhaust; Provide exhaust system

d. **Lack of separation between Apparatus Bays & Gear Storage;** Provide separate gear storage space

e. **Inadequate space for storage, equipment, records, supplies, etc.;** Provide storage space

f. **Inadequate space and security for office;** Provide office space

g. **Inadequate security control (public/staff security);** Provide access control/video surveillance

h. **Evidence of moisture control in bunkrooms;** Repair or replace mechanical systems

i. **Insufficient space for personnel personal storage;** Provide new lockers

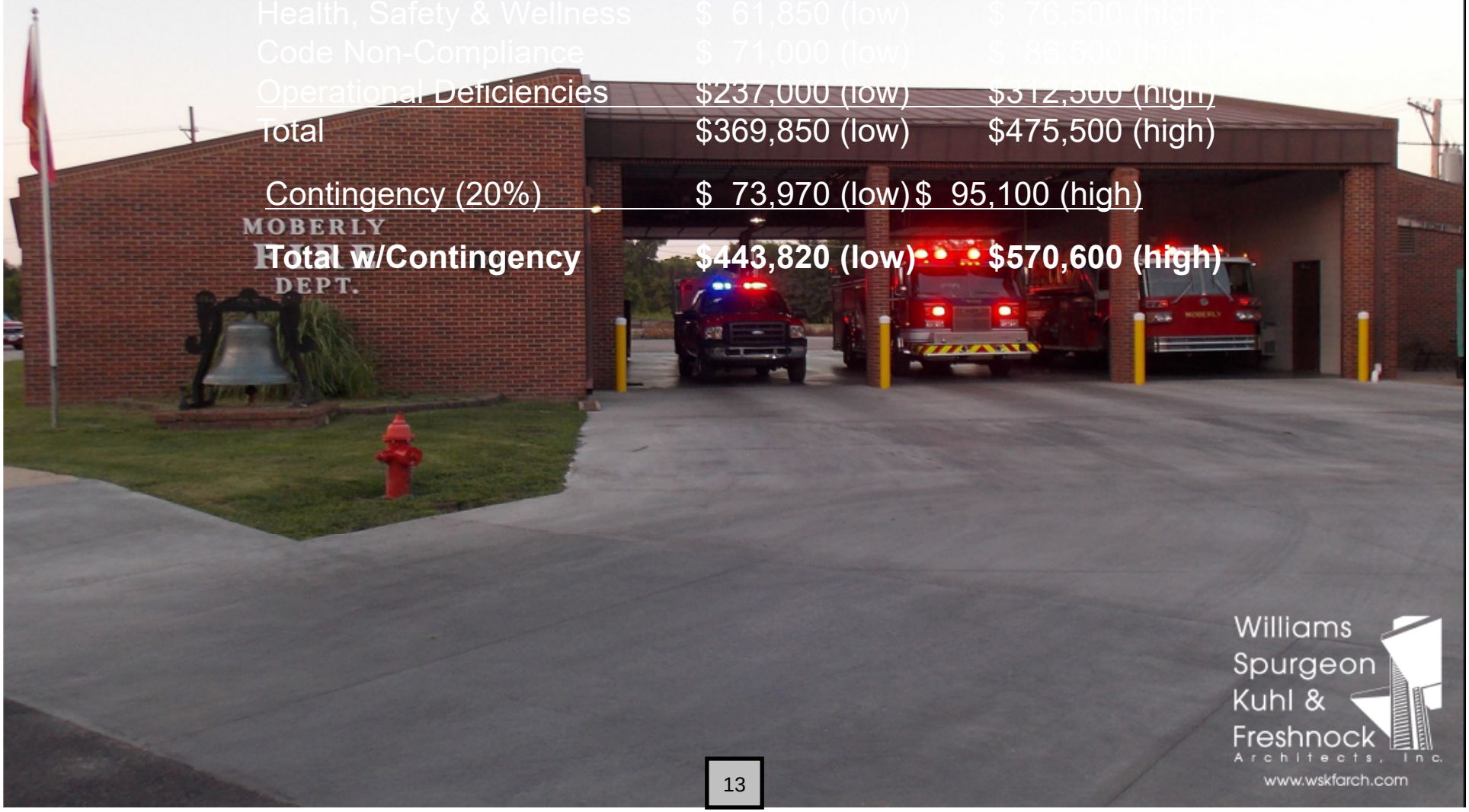
j. **Insufficient space for future needs;** Infeasible to provide

k. **High potential for water intrusion/insufficient storm water management;** Regrade north site area

CITY COUNCIL PRESENTATION

- STATION 1 PROBABLE COSTS

Health, Safety & Wellness	$ 61,850 (low)	$ 76,500 (high)
Code Non-Compliance	$ 71,000 (low)	$ 86,500 (high)
Operational Deficiencies	$237,000 (low)	$312,500 (high)
Total	$369,850 (low)	$475,500 (high)
Contingency (20%)	$ 73,970 (low)	$ 95,100 (high)
Total w/Contingency	**$443,820 (low)**	**$570,600 (high)**



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CITY COUNCIL PRESENTATION

- STATION 2 PROBABLE COSTS

Health, Safety & Wellness	$ 82,850 (low)	$102,500 (high)
Code Non-Compliance	$ 46,500 (low)	$ 62,750 (high)
Operational Deficiencies	$ 79,000 (low)	$100,000 (high)
Total	$208,350 (low)	$265,250 (high)
Contingency (20%)	$ 41,670 (low)	$ 53,050 (high)
Total w/Contingency	**$250,020 (low)**	**$318,300 (high)**

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CITY COUNCIL PRESENTATION

- STATION 1 & 2 SOFT COSTS

Construction Testing/Inspections	$ 500 to $ 1,000
Furniture/Fixtures/Equipment-Station 1	TBD
Furniture/Fixtures/Equipment-Station 2	TBD
Design Fees	$ 80,000 to $ 90,000
Total Soft Cost	**$ 80,500 to $ 91,000***

**Excludes FF&E*

Total Hard + Soft Cost **$ 774,340 (low)** **$ 979,900 (high)**

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CITY COUNCIL PRESENTATION

CITY OF MOBERLY
FIRE STATION 1 & 2

DISCUSSION

Williams Spurgeon Kuhl & Freshnock Architects, Inc.
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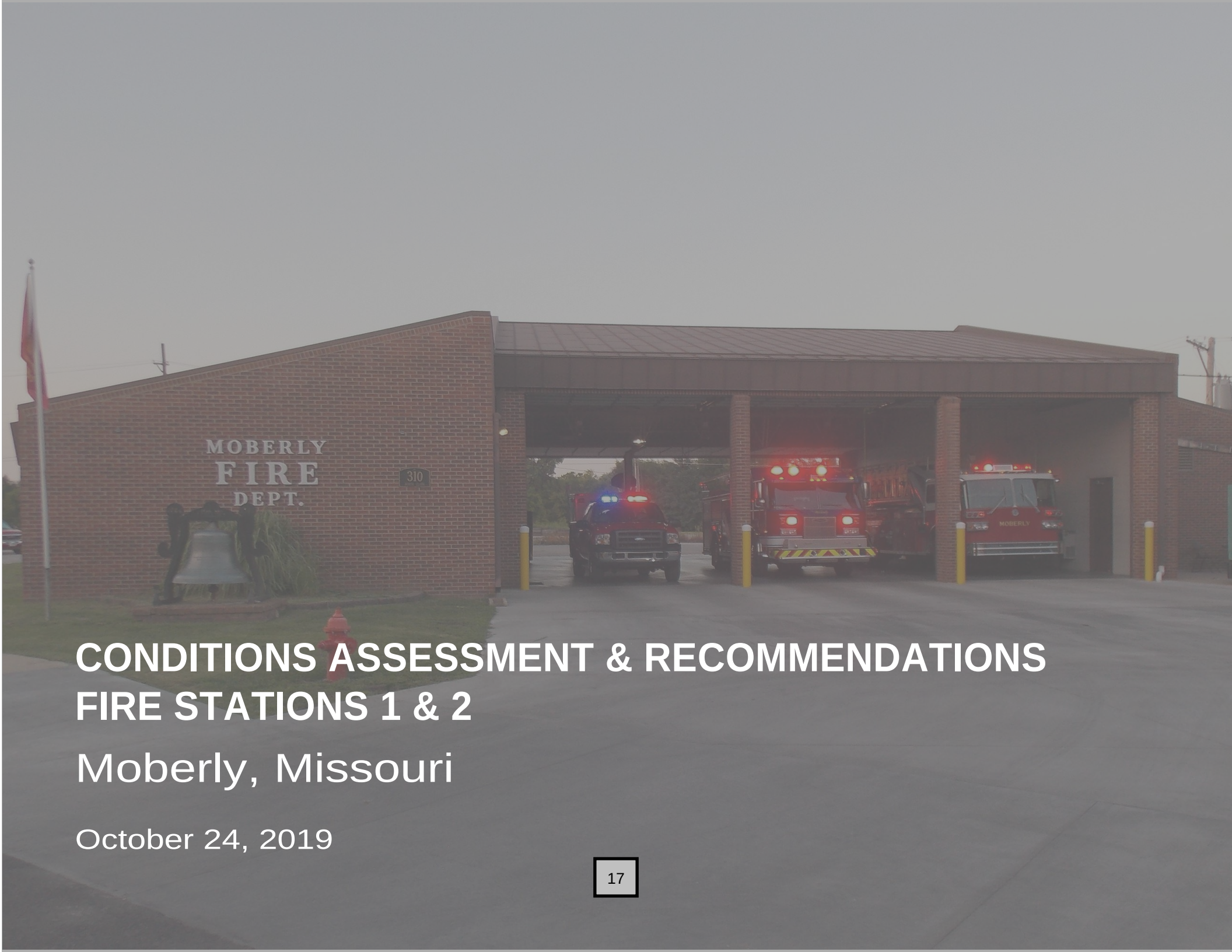


CONDITIONS ASSESSMENT & RECOMMENDATIONS
FIRE STATIONS 1 & 2

Moberly, Missouri

October 24, 2019

Contents

EXECUTIVE SUMMARY

Existing Station 1 contains approximately 7,000 SF of which 3,600 SF is apparatus bays, 1,400 SF is bunks, 1,700 SF is living quarters/offices and 300 SF is support space. All of the space of Station 1 is at grade. As Station 1 is immediately adjacent to the Police Department, the site layout of Station 1 is a "nested" design. As Police Department layout is at a forty-five (45) degree angle to the street, Station 1 is also at the same orientation. As such, the apparatus bays are oriented southwest/northeast.

The front apron of Station 1 is approximately 23' from the property line and approximately 38' from the public walk at Bay 1 (generally considered, first out bay). Bay 3 is approximately 55' from the bay to the property line and approximately 74' from the bay to the public walk. Bay 2 is within the limits of Bay 1 and Bay 3. The rear apron is approximately 28' in depth to 22' in depth (rear property line angles). In reality, the Fire Department utilizes the undeveloped space at the rear of the station as needed for circulation/access purposes.

The primary deficiencies associated with Station 1 include: 1) Inadequate space for apparatus, 2) Lack of Health & Wellness Protocols for personnel, 3) Insufficient administrative space and the ability to manage station visitors, 4) Mechanical Systems that are approaching the end of their useful life, 5) Lack of quality of service life space for personnel, and 6) Inadequate line-of-sight, sight lines for apparatus drivers.

Existing Station 2 contains approximately 3,200 SF of which 1,600 SF is apparatus bays, 800 SF is bunks, and 800 SF is living quarters/offices. All of the space of Station 2 is at grade. Station 2 is N. Moberly Street or Business Highway 63. The Average Daily Traffic count for Bus. 63 is approximately 7,500 per day with peak volume of 500 to 600 per hour during late afternoon traffic.[1] Access to the apparatus bays is from back-in maneuvering.

The anticipated cost to remedy the identified deficiencies are noted below. Additional information is provided later in the report under Cost Estimate:

Station 1

Health, Safety & Wellness Total Cost Estimate
$ 61,850 (low) $ 76,500 (high)

Code Non-Compliance Total Cost Estimate
$ 71,000 (low) $ 86,500 (high)

Operational Deficiencies Total Cost Estimate
$267,000 (low) $357,500 (high)

Total w/ 20% Contingency**: $479,820 (low) $624,300 (high)**

Station 2

Health, Safety & Wellness Total Cost Estimate
$82,850 (low) $102,500 (high)

Code Non-Compliance Total Cost Estimate
$46,500 (low) $ 62,750 (high)

Operational Deficiencies Total Cost Estimate
$ 79,000 (low) $100,000 (high)

Total w/20% Contingency**: $250,020 (low) $318,300 (high)**

[1] Missouri Department of Transportation, 2019

INTRODUCTION/OVERVIEW

Williams Spurgeon Kuhl & Freshnock Architects (WSKF) was requested to complete a Conditions Assessment of Fire Stations 1 and 2 for for the Moberly Fire Department. The "assessment" was completed through on-site survey of the existing facilities as well as drawing review for each of the facilities. The survey generally involved an "architectural" review and not an "engineering" review with the difference primarily being casual observation of mechanical, electrical and plumbing engineering systems and not an in-depth investigation of existing systems. Additionally, no structural engineering or civil engineering assessment was completed as well. Likewise, no environmental assessment (hazardous materials) was completed.

WSKF was retained by the City of Moberly to complete a "study" that assessed the existing facility conditions of each station and offered recommendations for options to address the conditions observed which were determined to be; 1) Safety, Health & Wellness, 2) Code Compliance and 3) Operationally Deficiencies (conditions that affect services performance; short-term and long-term). It should be noted, that the locations of stations were not part of the scope of the study. Fire stations are normally located based on geography; how to provide the best response time to an event. For stations that have been in service for an extended time (30 to 40 years), it is not uncommon for development to make the original station location unfit. The assessment of station location is a study recommended to be completed by the Fire Department.

As with any such "study" the conditions assessed, and the recommendations offered are greatly dependent upon the firm and individuals completing this work. WSKF Architects is a company that was founded in 1969 and just completed our 50th year of business operations. While our history of services includes a wide range of facilities, one of facility focuses over the last 15 years has been public safety; fire, police, EMS and dispatch. WSKF currently is working from Casper, WY to Tulsa OK to Sioux Falls, SD on fire projects. We recently reached a $100 million in project facility delivery and we are currently contracted for over $30 million in future facility services. The individuals completing the study for Moberly are Rick Kuhl and Dalyn Novak. Rick's resume includes work from California to New York with over 30 years of experience and Dalyn's resume includes over 10 fire and fire related projects.

Generally, the considerations for each Station were; 1) to assess current conditions, 2) catalog all conditions that are not to current standards and 3) recommend ways to address deficient conditions. What is incumbent upon the City, is a critical assessment of financial investment for each of the facilities. As we all know, there will be a time when the continued investment of funds to remedy deficiencies does not make sense. To this end, the City will need to determine if it makes sense to: 1) remain in the current location with the understanding that modifications of existing facilities would be implemented to address noted deficiencies or 2) relocate the facilities to new sites to meet geographic response requirements.

The Moberly Fire Department primarily provides Emergency Services for Fire and related services for EMS. Daily staffing is from 3 to 5 at Station 1 and 3 at Station 2 for a total of 6 to 8. Station 1 houses 10 individual pieces of apparatus and Station 2 houses 2 individual pieces of apparatus. Generally, the equipment housed at each station are:

Station 1

1. Pumper
2. Ladder
3. Brush Truck
4. Incident Command
5. Pickup
6. Rescue Trailer
7. Light Tower

8. Foam Trailer
9. Chief's Command Vehicle
10. Staff Command Vehicle

Station 2

1. Pumper
2. Reserve Pumper

Station 1 and 2 were constructed at approximately the same time; 1974. Station 1 was constructed to serve as the headquarters and Station 2 was constructed to serve as a satellite. Each station was constructed to serve a specific purpose; Station 1 for the serve as the primary location for fire and fire related services and Station 2 for support services. Generally, fire stations are constructed in specific locations; locations to strategically serve the geographic area of the station. As city's develop, the station location requirements can sometime change. When Stations 1 and 2 were constructed, the population of Moberly was approximately 13,000. The current population of Moberly is approximately 14,000. The number of housing units is Moberly is approximately 5,600 with 75% of the housing stock having an average value over $120,000.[2]

The Fire Department current occupies approximately 10,000 SF within two (2) buildings as follows:

Station 1	6,800 SF
Station 2	3,200 SF

A brief overview of each station is as follows:

Station 1:

Site Area – 28,400 SF

Building Area – 6,735 SF

Building Volume – 121,750 CF

Building Construction – Load-bearing masonry (CMU) with brick veneer, steel bar joist roof structure with bulb-tee deck and standing seam roofing; interior walls are wood-framed with drywall finish; interior ceilings are acoustical ceiling panels

General Design – 3, drive-thru apparatus bays, 5 bunks, dayroom, kitchen, dining room, 3 offices, waiting, training room and storage/support space

Station 2:

Site Area – 15,000 SF

Building Area – 3,450 SF

Building Volume – 31,660 CF

Building Construction – Pre-Engineered Metal Building structure with prefinished metal panel walls and roof; interior walls are wood-framed with drywall finish; interior ceilings are acoustical ceiling panels

General Design – 2-bay apparatus bays, 3 bunks, dayroom, kitchen, dining room, 1 office area, and storage/support space

The following contents of the study provides more detailed information relative to the deficiencies identified by the survey and assessment of each station.

[2] City-Data.com, 2016

STUDY PROCESS

The study was completed over a 3-month time period. The study "kickoff" began in July 2019 and was completed in October 2019. The "study" will be considered a "draft" until the City formally accepts the assessment and recommendations. During the study of Stations 1 and 2, WSKF completed both on-site survey work and collaboration with the Fire Department to both confirm survey extent and detail as well as confirmation of identified deficiencies.

The study process began with discussions with Fire Administration. Additionally, some discussions were completed with on-duty crew members as they were available.

The on-site survey work was completed with photographs of interior and exterior conditions, field measurements as well as Internet investigation. The purpose of the photographs was to document general conditions as well document specific conditions that were observed as deficient. The field measurements were valuable in confirming information that was provided by existing drawings as well as to document changes to the existing facilities that had been completed since the original construction of each facility.

As it is difficult to fully understand each facility's operations, there were subsequent meetings to discuss operations and potential areas of improvement. While operations do slightly vary from department to department, daily fire operations are generally the same. The number of pieces of apparatus and crew will vary, but the daily tasks to be completed by each department are generally the same. However, there are variables between departments that range from training to fitness depending on the department's facilities and resources.

It is important to benchmark facility requirements based on both experience and standards. For experience, facility requirement considerations would include such things as; 1) Apparatus Turning Radii, 2) Adequate space requirements for living quarters, and 3) Equipment needs. For standards, references to National Fire Protection Association (NFPA) and international Building Code (IBC) are used. There are also voluntary benchmarks for fire department performance that are available from Center for Public Safety Excellence (CPSE).

Additionally, there are emerging practices and protocols for fire departments that are, generally, in response to trends in the fire service industry regarding health and wellness. These practices and protocols are center on fire fighter health and wellness. National Institute of Occupational Safety and Health (NIOSH) recently completed two studies focused on firefighter cancer and concluded that firefighters face a 9 percent increase in cancer diagnoses, and a 14 percent increase in cancer-related deaths compared to the general population in the United States.[3] As a result of this Study, President Trump signed into legislation a requirement for the CDC to set up a registry for fire fighters that will track links between their workplace exposure and cancer.[4]

Given these emerging trends and the results from the studies, it seems only prudent that design in response to such should be considered for this study. Generally, the study incorporates current best practice recommendations that are aimed at reducing or mitigating risks to firefighter health and wellness. As the study of firefighter health and wellness continues to develop there will likely be other recommendations for addressing risks. The current efforts to reduce risks range from the design of firefighter gear to fire apparatus to fire stations. There is no one component to address all risks as all elements need to be considered as a collaborative effort to address risks.

[3] Findings from a Study of Cancer among U.S. Fire Fighter, CDC Workplace Safety & Health, NIOSH

[4] H.R. 931, Firefighter Cancer Registry Act of 2018

CONDITIONS ASSESSMENT & RECOMMENDATIONS

The following narrative will be a review of station deficiencies through survey conditions assessment and recommendations for both stations. While there are sometimes options to resolve deficiencies, the study attempts to make recommendations based on various factors such as space limitations, cost and overall ability to incorporate such recommendations. Additionally, there has been no attempt to prioritize deficiencies as we believe that should be the prerogative of the Fire Department and the City. The following is narrative and deficiencies that present the current recommendations for the respective facilities.

Station 1

As the Headquarters for the Fire Department, Station 1 inherently includes operations that are different and distinct from Station 2. Additionally, Station 1 is located in the core of the commercial district for the City of Moberly thus requiring staffing and apparatus to service this geographic area; alignment of sources with risks.

The study assessment and recommendations are organized around the following:

1) Health, Safety & Wellness
2) Code Non-Compliance
3) Operational Deficiencies

A more detailed review of each area of assessment is as follows:

1) Health, Safety & Wellness

a. **Lack of apparatus bay exhaust systems;** Apparatus exhaust has been identified as one of the leading contributors to firefighter illness. While the existing facility contains a "dilution system" (whole bay exhausting), there should be a direct capture or filtration system for the bays. *NOTE: Fire Department has included in their proposed budget the purchasing and installation of a direct capture system.*

b. **Lack of environmental separation between bunkrooms & apparatus bays;** All openings between the apparatus bays and adjacent bunkrooms should be tight-fitting openings with gasketing. Ideally, the mechanical system should provide for positive air pressure on the bunkroom side of the opening such that when the door is opened to access the apparatus bays, the air should flow from the bunkrooms to the apparatus bays

c. **Lack of environmental separation between living quarters/offices & apparatus bays;** Refer to item 'b' above.

d. **Lack of Exhaust Air & Floor Drains for gear Storage;** Best design practices include both exhaust air and floor drains in the gear storage room. The exhaust air removes emissions from fire gear stored in the room and floor drains are needed to capture water from gear. *NOTE: The current room also contains a vent that connects to the adjacent mechanical room; this will allow fumes from gear to migrate to the mechanical room.*

e. **Drinking Fountain Exposed to products of combustion;** The drinking fountain is located in the apparatus bays and exposed to apparatus products of combustion. The drinking fountain should be relocated outside the bays.

f. **Lack of fresh air intake for mechanical systems;** fresh air for mechanical systems is of

particular importance for fire stations to better assure of a health environment. The fresh air intake for the bunkroom wing is located adjacent to the emergency generator and the fresh air intake for the living quarters/offices is off the gear storage room.

g. **Inadequate line-of-sight distance for apparatus;** The apparatus driver needs an adequate line-of-sight in order to safely operate the equipment. As a result of the apparatus aprons being located adjacent Police Department building, there is insufficient space for adequate line-of-sight. This condition is a safety issue for the Department as well as the Public.

h. **Lack of compliance with NFPA 1500[5], Standard on Fire Department Safety, Health, and Wellness Program;** There is insufficient space for the Department to comply with requirements to inspect, care and maintain protective gear. The Department does have a gear washer, however, there is insufficient space within this area (or elsewhere in the Station) comply with this requirement. Additionally, firefighters are required to maintain a performance level of fitness which requires regular fitness routines. It is understood that the City provides for memberships to local fitness facilities, however, it is common for fire departments to have fitness facilities within the station.

2) Code Non-Compliance

a. **Limited compliance with NFPA 1851[6], Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting;** This standard is used, hand-in-hand, with NFPS 1500 (see proceeding) for the purchasing, cleaning, care and repair of fire gear. This limited space for such work and the existing space does not allow for the isolation of clean gear from soiled gear.

b. **Non-compliance with NFPA 13[7], Standard for the Installation of Sprinkler Systems;** The existing station does not have a fire protection (fire sprinkler) system. While the requirement for a fire protection system was not required at the time the original station was constructed, the current code (IBC 2012) would require fire protection. Additionally, it is difficult for the Fire Department to advocate and require fire protection for current buildings when this not provided for within their own place of business.

c. **Lack of compliance with the American Disabilities Act (ADA);** The original requirement for accessibility was mandated by the Federal Government. Today, many cities, including Moberly, now review and enforce requirements for accessibility. Chapter 11 of the 2012 IBC covers the requirements for accessibility.

d. **Lack of compliance with National Electric Code;** The City of Moberly enforces the use of the 2011 National Electric Code. The Code requires that adequate space be provided in front of the electrical panels within the building to both access and service devices. There is insufficient space in the electrical rooms for space to access and service the electrical panels.

e. **Lack of compliance with NFPA 30[8], Flammable & Combustible Liquids Code;** There is not fire-proof storage of flammable liquids storage

[5] Refer to Appendix, Partial Copy of NFPA 1500
[6] Refer to Appendix, Partial Copy of NFPA 1851
[7] Refer to Appendix, Partial Copy of NFPA 13
[8] Refer to Appendix, Partial Copy of NFPA 30

provided within the station.

f. **Non-compliant exit from the Training Room;** The exit door to the exterior of the building has a step immediately outside the door. The building codes requires a level surface landing; landing is to have a minimum width of the door and 44 inches in the direction of exit travel.

g. **Lack of compliance with IBC 2012, Chapter 4, Section 402.2, Separation Walls;** The bunkroom occupancy is classified as an R-2 Occupancy. Based on the R-2 Occupancy, the sleeping units are to be separated from one another and adjacent spaces with 1-HR. fire rated construction. The existing bunkrooms do not have fire-rated construction surrounding the rooms.

h. **Lack of compliance with International Plumbing Code (IPC) 2012;** Building uses that are subject to the discharge of oil, grease, sand and other substances harmful or hazardous to the public sewer are to be provided with grease, oil and sander traps or interceptors. The apparatus bay floor drains do not include the use of interceptors.

3) Operational Deficiencies

a. **Inadequate space for fire apparatus;** The existing apparatus bays width ranges in size 15 feet to 15.5 feet. Given that more modern-day apparatus is approximately 14 feet wide (with mirrors) this is insufficient space for safe apparatus maneuvering. Additionally, the noted width includes also space for personnel. Understanding that the side walls of the apparatus bays include both storage and out-swinging doors, the inadequate width is compounded. NOTE: The overhead door width is 14 feet which is ideal; there is just a lack of circulation space on each side of the bay.

b. **Inadequate space for storage, equipment, records, supplies, etc.**; The inadequacy of storage is evident throughout the Station including the use of the apparatus bays for storage, the gear storage room for storage and the workshop being used for storage. This deficiency results in available space being used for storage which hampers the intended use of the space.

c. **Inadequate space for living quarters;** The station is occupied daily by 3 - 5 personnel; 3 of those are firefighters. The existing dayroom is approximately 200 Square Feet which includes 70 Square Feet of circulation leaving a space of 130 Square Feet; this is inadequate. Additionally, the dining space is approximately 100 Square Feet; this is inadequate for 5 personnel.

d. **Inadequate security control (public/staff security);** As the front door of the Station is open during business hours, anyone can access the offices and living quarters without control. This condition places both the staff and the visitor at some risk. In order to conduct the business of the Fire Department, adequate security is required throughout the Station including both public and staff areas of use. *NOTE: Some amount of security system work is in progress but is not yet operational. However, from the explained scope of work, the current systems are not adequate.*

e. **Evidence of moisture intrusion (CMU walls);** Some offices have evidence of moisture intrusion through the wall (paint coatings are bubbled). Moisture is entering the building through the masonry or through roofing assemblies and allowing moisture through the walls. *NOTE: Some remediation of this condition is in progress but may not be completed resolved.*

f. **Lack of sound control between Offices and Living Quarters;** The is very little isolation between the business and living spaces within the Station. This condition impacts both the "business" and the "living" uses of the facility. Conversations are not private and disrupt both uses. Some means of sound control is needed to resolve this issue.

g. **Lack of gender-neutral space (toilets & showers);** The fire service industry is one that involves both male and female fire fighters. The uncertainty of the gender makeup of the department suggests that toilet and shower facilities should be single-use, single-occupant use to assure maximum access to qualified personnel. Given the challenges the fire industry faces with attracting qualified personnel, the department should implement facilities accommodation that ensures access to as many personnel as possible. Gender neutral facilities encourages personnel access.

h. **Deteriorating construction;** The existing station exhibits some deteriorating conditions such as rusting doors and frames. As the noted doors and frames are located between the apparatus bays and adjacent spaces, this condition could contribute to adjacent spaces experiencing apparatus fumes or products of combustion. Conditions such as these should be repaired through replacement.

   A similar deteriorating condition exist in the bunkroom toilets and showers. These types of space are notorious for high levels of moisture which contributes to the rapid deterioration of materials and products within these spaces. Ceiling finishes are deteriorated within these spaces and should be replaced. Additionally, as the moisture within these spaces does not seem to be addressed with exhaust systems, a dedicated exhaust system for high humidity space.

i. **Insufficient space for personnel personal storage;** The bunkroom is the one space with the station that allows for personal storage. As the bunkroom setup is a "hot bunk" use (use changes with each shift), personnel need space for the storage of bedding. As most personnel have sheets, blanket or bed covers, the storage of such items is bulky. As the existing lockers for the storage of personal items is 1 foot wide, the storage of bedding is nearly impossible. Most fire stations provide a minimum of 20-inch-wide lockers with an extended lower drawer that allows for the storage of bedding. This locker options should be considered if enough space is available.

j. **Aging standby generator;** The existing generator is approximately 20 to 30 years of age. This generator supplies power for the Fire Department, Police Department and the Dispatch. Given the essential use of the generator, consideration for replacement of the generator is warranted. While the generator is not likely used on a regular basis, it is essential to the operations of all the agencies and users.

k. **Insufficient space for future needs;** While the station provides for the current space needs, this does not address the future needs. For example, if the Department were to add additional personnel, either firefighters or administration, there would not be sufficient space for such expansion. Additionally, fire apparatus continues to increase in size to provide the desired space for the various uses and functions. The existing apparatus bays are insufficient to accommodate

apparatus that is much larger than the current equipment.

Station 2

Station 2 includes operations that are different and distinct from Station 1/Headquarters as Station 2 is a standalone fire station. Station 2 is located in the north central area of town along the business route of Hwy 63 in the City of Moberly thus requiring staffing and apparatus to service this geographic area; alignment of sources with risks.

The study assessment and recommendations are organized around the following:

1) Health, Safety & Wellness
2) Code Non-Compliance
3) Operational Deficiencies

A more detailed review of each area of assessment is as follows:

1) Health, Safety & Wellness

a. **Lack of apparatus bay exhaust systems;** Apparatus exhaust has been identified as one of the leading contributors to firefighter illness. Station 2 has no exhaust or filtration systems. It is recommended that some type of exhaust system in place. Whole bay exhaust or direct capture as well as a filtration system should be provided.

b. **Lack of environmental separation between living quarters & apparatus bays;** All openings between the apparatus bays and adjacent bunkrooms and other living spaces should be tight-fitting openings with gasketing. Ideally, the mechanical system should provide for positive air pressure on the bunkroom side of the opening such that when the door is opened to access the apparatus bays, the air should flow from the bunkrooms into the apparatus bays effectively keeping contaminants in the apparatus bay and out of the living quarters.

c. **Drinking fountain exposed to products of combustion;** The drinking fountain is located in the apparatus bays and exposed to apparatus products of combustion. The drinking fountain should be relocated outside the bays.

d. **Lack of fresh air intake for mechanical systems;** fresh air for mechanical systems is of particular importance for fire stations to better assure of a health environment. The fresh air intake for the kitchen/dining/dayroom wing is located adjacent to the station's trash containers.

e. **Inadequate apparatus maneuvering in right-of way and lack of traffic control for safe exiting onto highway;** Although there is drive-thru access for one bay the access to this door is on private property owned by the neighboring church, so access is not always guaranteed. Without this drive-thru access apparatus are required to back into the bays effectively stopping traffic on Business Route Hwy 63. This condition is a safety issue for the Department as well as the Public. A traffic signal controlled by the Fire Department could greatly reduce the risk to both the public and the department. A siren is located at Station 2 but is currently not functioning.

f. **Lack of compliance with NFPA 1500[9], Standard on Fire Department Safety, Health, and Wellness Program;** There is insufficient space for the Department to comply with requirements to

[9] Refer to Appendix, Partial Copy of NFPA 1500

inspect, care and maintain protective gear. The Department does have a gear washer at Station 1, however, there is insufficient space within this area (or elsewhere in Station 1 or 2) to comply with this requirement. Additionally, firefighters are required to maintain a performance level of fitness which requires regular fitness routines. It is understood that the City provides for memberships to local fitness facilities, however, it is common for fire departments to have fitness facilities within the station.

2) Code Non-Compliance

a. **Limited compliance with NFPA 1851[10], Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting;** This standard is used, hand-in-hand, with NFPS 1500 (see proceeding) for the purchasing, cleaning, care and repair of fire gear. This limited space for such work and the existing space does not allow for the isolation of clean gear from soiled gear.

b. **Non-compliance with NFPA 13[11], Standard for the Installation of Sprinkler Systems;** The existing station does not have a fire protection (fire sprinkler) system. While the requirement for a fire protection system was not required at the time the original station was constructed, the current code (IBC 2012) would require fire protection. Additionally, it is difficult for the Fire Department to advocate and require fire protection for current buildings when this not provided for within their own place of business.

c. **Lack of compliance with the American Disabilities Act (ADA);** The original requirement for accessibility was mandated by the Federal Government. Today, many cities, including Moberly, now review and enforce requirements for accessibility. Chapter 11 of the 2012 IBC covers the requirements for accessibility.

d. **Lack of compliance with National Electric Code;** The City of Moberly enforces the use of the 2011 National Electric Code. The Code requires that adequate space be provided in front of the electrical panel within the building to both access and service devices. There is insufficient space in the electrical room for space to access and service the electrical panel.

e. **Lack of compliance with NFPA 30[12], Flammable & Combustible Liquids Code;** There is not fire-proof storage of flammable liquids storage provided within the station.

f. **Non-compliant exit from the Bunk Rooms;** The egress path out of the bunk rooms, by code, should exit directly out of the building and not through an intervening space (apparatus bay).

g. **Lack of compliance with IBC 2012, Chapter 4, Section 402.2, Separation Walls;** The bunkroom occupancy is classified as an R-2 Occupancy. Based on the R-2 Occupancy, the sleeping units are to be separated from one another and adjacent spaces with a 1-HR. fire rated construction. The existing bunkrooms do not have fire-rated construction surrounding the rooms.

h. **Lack of compliance with International Plumbing Code (IPC) 2012;** Building uses that are subject to the discharge of oil, grease, sand and other substances harmful or hazardous to the

[10] Refer to Appendix, Partial Copy of NFPA 1851
[11] Refer to Appendix, Partial Copy of NFPA 13
[12] Refer to Appendix, Partial Copy of NFPA 30

public sewer are to be provided with grease, oil and sander traps or interceptors. The apparatus bay floor drains do not include the use of interceptors.

i. **Lack of emergency power source;** As an "essential facility" or a facility that provides essential/emergency services to the community, fire stations and similar facilities should be equipped with a standby generator for temporary power service.

3) Operational Deficiencies

a. **Inadequate space for fire apparatus;** The apparatus bays at Station 2 are approximately 40 feet by 40 feet. In width, 40 feet is adequate for two bays but 40 feet in length is rather short. Each truck should have no less than 4 feet at the front and rear for adequate maneuvering of fire personnel. The bay length could become a hinderance when purchasing future fire apparatus.

b. **Inadequate overhead doors;** The overhead doors on the front of the station are approximately 11'-2" wide by 10'-11" tall while the rear door is approximately 10'-6" wide by 10'-6" tall. Industry standard overhead doors are 14'-0" wide by 14'-0" tall. The combination of the lack of traffic signaling on the highway, apparatus backing into the bays, and these overhead doors creates maneuvering challenges for the apparatus engineer.

c. **Lack of separation between Apparatus Bays & Gear Storage;** Emissions/particles of combustion break down the fire retardancy of firefighting gear over time. Best design practices include locating personnel gear in a room separate from the Apparatus Bay. Exhaust air within this room removes emissions from stored fire gear. Floor drains are needed to capture water from gear as well.

d. **Inadequate space for storage, equipment, records, supplies, etc.**; The inadequacy of storage is evident throughout the Station including the use of the apparatus bays and utility/mechanical rooms for storage. This deficiency results in available space being used for storage which hampers the intended use of the space.

e. **Inadequate space and security for office;** The station is occupied daily by 3 personnel. The existing living space includes a desk in the corner of the dining room. Work should be kept separate from the living quarters in a secure office. NOTE: The original station design included an office that has since been removed to provide more living space.

f. **Inadequate security control (public/staff security);** As the front door of the Station is open during business hours, anyone can access the living quarters without control. This condition places both the staff and the visitor at some risk. In order to conduct the business of the Fire Department, adequate security is required throughout the Station including both public and staff areas of use. *NOTE: Some amount of security system work is in progress but is not yet operational. However, from the explained scope of work, the current systems are not adequate.*

g. **Evidence of moisture control in bunkrooms;** The level of humidity in the bunk rooms suggests that the existing mechanical system is not able to handle the high humidity and needs to be repaired or replaced.

h. **Insufficient space for personnel personal storage;** The bunkroom is the one space with the station that allows for personal storage. As the bunkroom setup is a “hot bunk” use (use changes with each shift), personnel need space for the storage of bedding. As most personnel have sheets, blanket or bed covers, the storage of such items is bulky. As the existing lockers for the storage of personal items is 1 foot wide, the storage of bedding is nearly impossible. Most fire stations provide a minimum of 20-inch-wide lockers with an extended lower drawer that allows for the storage of bedding. This locker options should be considered if enough space is available.

i. **Insufficient space for future needs;** While the station provides for the current space needs, this does not address the future needs. For example, if the Department were to add additional personnel there would not be sufficient space for such expansion. Additionally, fire apparatus continues to increase in size to provide the desired space for the various uses and functions. The existing apparatus bays are insufficient to accommodate apparatus that is much larger than the current equipment.

j. **High potential for water intrusion/insufficient storm water management;** Pre-engineered metal building construction is inherently less watertight in comparison to other construction methods making it easy for water to enter the building. With the site’s flat nature this is a concern.

COST ESTIMATE

It is difficult to determine more precise costs without more detailed design. With more detailed design comes the ability to complete material quantity takeoffs that become the foundation of the cost estimate. The cost estimate contained below, is based on some preliminary assessment of unit costs as well as historical experience with fire station design and construction. Some of the recommended work is based on envisioned work to be completed. Additionally, some of the cost for various items has benefited from input from consulting engineers with whom we regularly work. The consulting engineer's input is quite valuable to this work and the City.

The cost estimate is presented with a "range" of cost from 'low' to 'high' costs. Given this approach, we believe the further defined design cost will likely fall within this range or cost; not the low but hopefully, not the high. In addition to the cost estimates for each of the 3 major categories (Health, Safety & Wellness, Code Non-Compliance and Operational Deficiencies) there is a "Contingency" of 20 percent to cover the gaps in the cost estimate. Again, understanding that the cost estimate for preliminary design assessment is a high-level estimate (estimate without the benefit of more detailed design), there is a need for some contingency to cover both undefined and under-estimated costs.

It should be noted that the cost estimates are based on costs for 2019. If the is recommended work to be completed in 2020 and beyond, we would need to reassess the estimates to assure that they are valid for future work. Generally, we are seeing inflation of cost in the range 4 to 6 percent per year. As this is a factor for cost estimates, we recommend updating the cost on a regular (yearly) basis.

The anticipated cost to remedy the identified deficiencies are:

Station 1

Health, Safety & Wellness

Exhaust System	$40,000 (low)	$45,000 (high)
Environmental Separation	$ 350 (low)	$ 500 (high)
Exhaust Air/Floor Drains	$ 2,500 (low)	$ 3,500 (high)
Drinking Fountain Relocation	$ 5,000 (low)	$ 7,500 (high)
Mechanical Fresh Air	$10,000 (low)	$15,000 (high)
Line-of-Sight Issue	(not feasible to solve)	
Gear Repair/Maintenance	$ 4,000 (low)	$ 5,000 (high)
Total	**$61,850 (low)**	**$76,500 (high)**

Code Non-Compliance

Gear Repair	(see above)	
Fire Protection	$42,000 (low)	$46,000 (high)
ADA Compliance (limited)	$ 5,000 (low)	$ 6,000 (high)
NEC Compliance	$ 5,000 (low)	$ 7,500 (high)
Flammable Liquids Compliance	$ 1,000 (low)	$ 1,250 (high)
Training Room Exit	$ 500 (low)	$ 750 (high)
Fire Separation	$ 7,500 (low)	$10,000 (high)
Oil/Sand Separator	$10,000 (low)	$15,000 (high)
Total	**$71,000 (low)**	**$86,500 (high)**

Operational Deficiencies

Apparatus Space	(not feasible to solve)	
Storage	$75,000 (low)	$100,000 (high)
Living Space	(not feasible to solve)	
Security Systems	(currently in progress)	
Moisture Intrusion	$ 10,000 (low)	$ 15,000 (high)
Sound Control	$ 7,000 (low)	$ 10,000 (high)
Gender Neutral Toilet/Shower	$ 25,000 (low)	$ 40,000 (high)
Construction Deterioration	$ 35,000 (low)	$ 50,000 (high)
Personnel Lockers	$ 15,000 (low)	$ 17,500 (high)
Generator Replacement	$ 70,000 (low)	$ 80,000 (high)
Insufficient Personnel Space	(not feasible to solve)	
Total	**$237,000 (low)**	**$312,500 (high)**

Total (from above)	$369,850 (low)	$475,500 (high)
Contingency (20%)	$ 73,970 (low)	$ 95,100 (high)
Total w/Contingency	**$443,820 (low)**	**$570,600 (high)**

Station 2

Health, Safety & Wellness

Exhaust System	$30,000 (low)	$36,000 (high)
Environmental Separation	$ 350 (low)	$ 500 (high)
Drinking Fountain Relocation	$ 5,000 (low)	$ 7,500 (high)
Mechanical Fresh Air	$ 2,500 (low)	$ 3,500 (high)
ROW/Traffic Control	$45,000 (low)	$55,000 (high)
Gear Repair/Maintenance	(no cost, space provided at Station 1)	
Total	**$82,850 (low)**	**$102,500 (high)**

Code Non-Compliance

Gear Repair	(see above)	
Fire Protection	$17,500 (low)	$21,000 (high)
ADA Compliance (limited)	$ 5,000 (low)	$ 6,000 (high)
NEC Compliance	$ 5,000 (low)	$ 7,500 (high)
Flammable Liquids Compliance	$ 1,000 (low)	$ 1,250 (high)
Fire Separation	$ 5,000 (low)	$ 7,500 (high)
Bunk Room Exiting	$ 3,000 (low)	$ 4,500 (high)
Oil/Sand Separator	$10,000 (low)	$15,000 (high)
Total	**$46,500 (low)**	**$62,750 (high)**

Operational Deficiencies

Apparatus Space	(not feasible to solve)	
Overhead Doors	(not feasible to solve)	
Gear Storage	(not feasible to solve)	
Storage	(not feasible to solve)	
Office Space/Security	(not feasible to solve)	
Security Systems	(currently in progress)	
Humidity Control	$ 10,000 (low)	$ 15,000 (high)
Personnel Lockers	$ 9,000 (low)	$ 10,000 (high)
Insufficient Personnel Space	(not feasible to solve)	
Water Intrusion	(not feasible to solve)	
Generator	$ 60,000 (low)	$ 75,000 (high)
Total	**$ 79,000 (low)**	**$100,000 (high)**

Total (from above)	$208,350 (low)	$265,250 (high)
Contingency (20%)	$ 41,670 (low)	$ 53,050 (high)
Total w/Contingency	**$250,020 (low)**	**$318,300 (high)**

The above cost summary represents the “hard cost” (construction cost) for Station 1 and 2. There will be “soft cost” associated with the completion of the work as well. The following are some of the anticipated soft costs to be accounted:

Construction Testing/Inspections	$ 500 to $ 1,000
Furniture/Fixtures/Equipment-Station 1	TBD
Furniture/Fixtures/Equipment-Station 2	TBD
Design Fees	$ 80,000 to $ 90,000
Total Soft Cost	**$ 80,500 to $ 91,000***

**Excludes FF&E*

Total Hard+Soft Cost	**$ 774,340 (low)**	**$ 979,900 (high)**

CONCLUSIONS

While it is possible to repair and update the existing facilities, there is the question; is it prudent? In order to answer this question, it is appropriate to consider this question for each station independently.

Station 1

Station 1 has been in service for approximately 45 years. For a station constructed of masonry with a steep pitched roof, this age of use and service is considered on the verge of needing major systems replacement or updating. Fire Stations, like other facilities that are in use 24/7/365 do become worn and fatigued. As anyone can image, over the life of such facilities, not only to facilities become worn, but they are also not current with today's industry standards.

The code non-compliance and operational deficiencies are well-documented in the preceding narratives and statements of probable cost. As noted above, the question of prudent investment in facility renovations is an overarching consideration; should the City continue to invest in Station 1?

While Station 1 has some inherent deficiencies that are not resolvable (lack of line-of-sight conditions for safety), there are items that can be resolved (apparatus bay exhausting systems) with appropriate funding. While the repair cost for Station 1 will likely cost in the range of $750,000, it is our recommendation to continue to invest in Station 1 to extend the useful life another 20 years or so.

Station 2

Station 2 is of the same general age and service life as Station 1. However, Station 2 construction, Pre-Engineered Metal Building, with light weight interior framing and finishes is not as durable as Station 1. The exterior and interior conditions of Station 2 are readily apparent to anyone who surveys the facility. Station 2 is quite worn and in need of some significant investment to add service life to the facility.

While the repair investment in Station 2, is less than Station 1 (estimated value of repair is approximately $500,000), the question of prudency should be considered. Is it prudent to make this investment in Station 2?

When considering the question of continued investment, we believe such consideration should be made with respect to many considerations. One fundamental consideration is the current value of Station 2?

At approximately 3,200 GSF, we believe the current value of Station 2 is $600,000 to $750,000 (excluding land value). We believe that when the renovation of a facility exceeds the 50% current value of the facility, careful investment consideration is warranted.

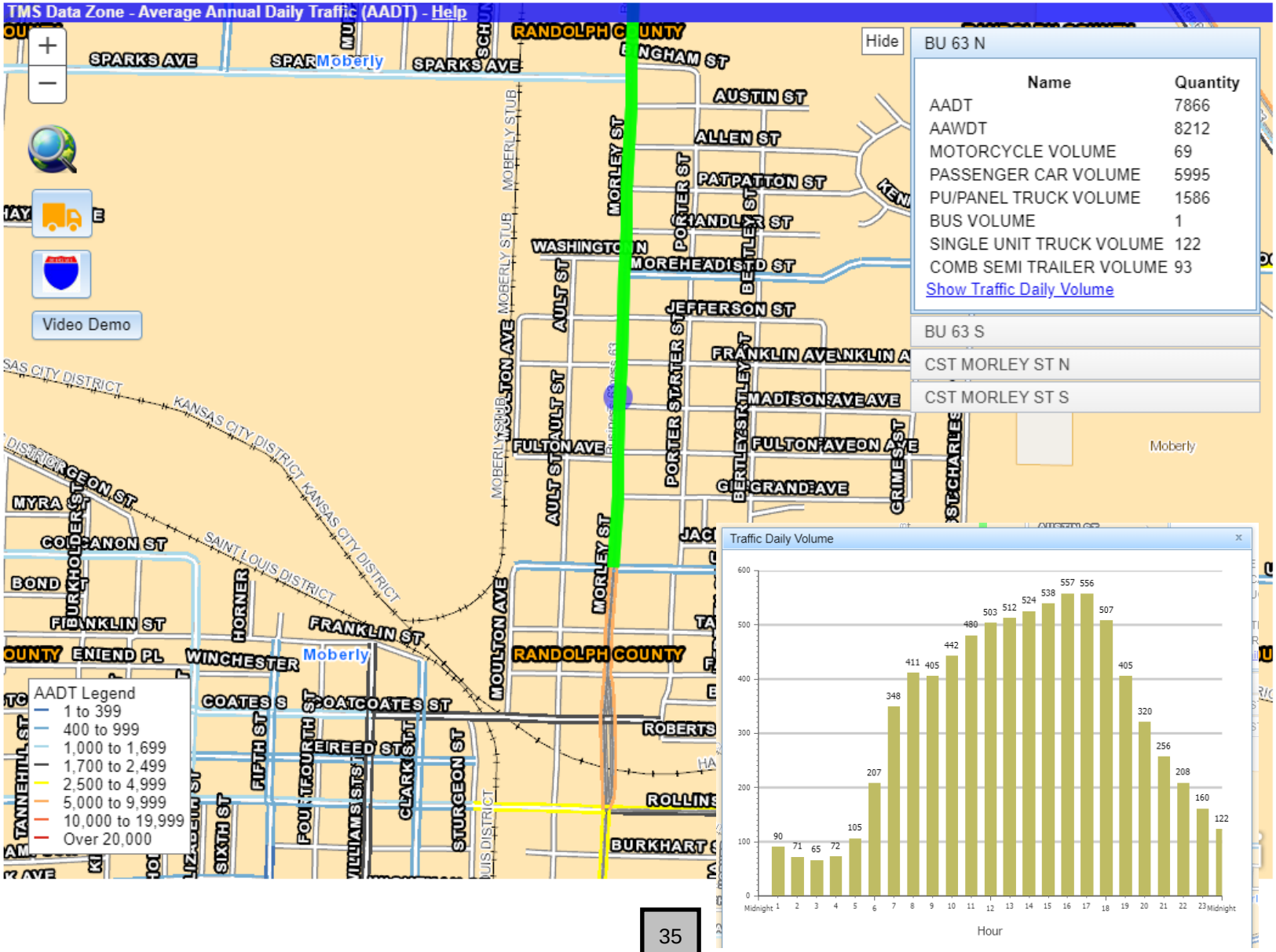
Additionally, there are some inherent operation conditions that cannot be resolved; in particular; the inability to make the apparatus bays drive thru. While the existing station has overhead doors on both sides of the bays, driving through the bays requires access the adjacent private property. Additionally, as the adjacent private property is a church property, there are times of use for the adjacent property that will likely prohibit drive-thru operations. This is one of many operational conditions present some difficult challenges with resolution.

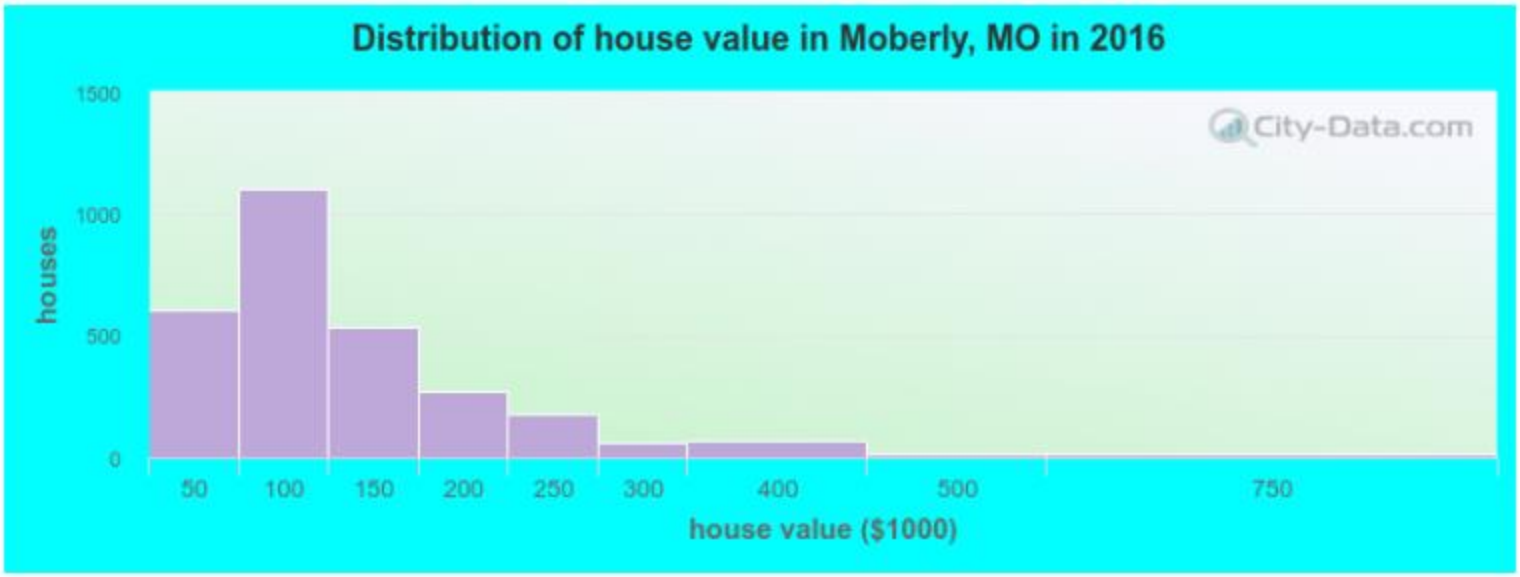
Given the above discussion and other discussions throughout this Study, we do not believe it is prudent to renovate and repair Station 2.

APPENDIX

Traffic Volume Maps

Interactive Average Annual Daily Traffic Map





Population in 2017: 13,783 (99% urban, 1% rural).
Population change since 2000: +15.4%

Males: 7,340 (53.3%)
Females: 6,443 (46.7%)

Median resident age: 35.8 years
Missouri median age: 38.4 years

Mean prices in 2016: all housing units: $118,052; detached houses: $120,715;

Promoting productive workplaces through safety and health research NIOSH

FIRE FIGHTER RESOURCES

Cancer and Other Illnesses

Cancer

Highlight

National Fire Fighter Registry: On Monday, July 9th 2018 President Donald Trump signed legislation requiring the CDC to set up a registry of fire fighters that will track links between their workplace exposures and cancer. NIOSH will take the lead in establishing the registry. In FY19, Congress appropriated $1 million to NIOSH towards implementation activities related to the Firefighter Cancer Registry. The language can be found in the Joint Explanatory Statement of the Committee of Conference-Division B-Labor, HHS accompanying H.R. 6157. If you have questions, email FFRegistry@cdc.gov.

NFPA® 1500

Standard on

Fire Department Occupational Safety, Health, and Wellness Program

2018 Edition

This edition of NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, was prepared by the Technical Committee on Fire Service Occupational Safety and Health. It was issued by the Standards Council on August 1, 2017, with an effective date of August 21, 2017, and supersedes all previous editions.

This edition of NFPA 1500 was approved as an American National Standard on August 21, 2017.

Origin and Development of NFPA 1500

The first edition of NFPA 1500 was published in 1987 as there was no consensus standard for an occupational safety and health program for the fire service. Fire service organizations were being increasingly subject to regulations that were developed for general industry and that did not provide for many of the specific needs and concerns of an organization involved in the delivery of emergency services. The direct line-of-duty deaths were being documented and reported, but there was also a growing concern with the number of fire fighters who were suffering disabling injuries or developing occupational diseases that often had debilitating or fatal consequences. Following the first edition, revised editions were published in 1992, 1997, and 2002.

For the 2007 edition, the technical committee, working from data provided from NFPA's Data Analysis and Research Division and NIOSH Fire Fighter Investigation reports, carefully reviewed the entire document including the associated annex material and updated many areas to reflect current best practices. Requirements were reorganized in some areas to make the document more user friendly.

Among the changes made were revising the section on risk management and adding additional explanation in the annex. A new section on appointment of a health and safety officer was added, and sections that duplicated the responsibilities of the health and safety officer in NFPA 1521 were removed.

Chapter 5 was reorganized and revised to reflect not only the need of members to have skill and knowledge in performing their day-to-day tasks but also the need for ongoing professional development.

In Chapter 6, requirements and annex material were added to support improved vehicle response operations with an emphasis on safe arrival at the scene.

Requirements for providing and using protective ensembles appropriate for technical rescue operations and chemical and biological terrorism incidents that went into the 2002 edition as a TIA were updated and incorporated, as were other requirements for personal protective ensembles.

New sections on traffic incidents, establishing control zones, and fitness for duty evaluations were added.

For the 2013 edition, the committee updated many of the references and referenced materials within this document to ensure consistency between this document and other projects. Some of those other projects are PPE, fire department apparatus, and respiratory protection. The committee included new requirements for the training, use, and limitations of PPE. The committee also developed new requirements to include not only the ensemble but also ensemble elements, which would include anything that has been added to the ensemble as part of the requirements. The cleaning and care of PPE as well as station/work uniforms was also addressed with new or updated requirements. For fire department apparatus, the committee brought the related requirements within this document in line with those requirements contained within the respective projects. Some issues that were addressed were the inclusion of a vehicle data recorder (VDR) and a driver training

Contents

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NFPA® 1851

Standard on

Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting

2014 Edition

This edition of NFPA 1851, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, was prepared by the Technical Committee on Structural and Proximity Fire Fighting Protective Clothing and Equipment, released by the Technical Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment, and acted on by NFPA at its June Association Technical Meeting held June 10–13, 2013, in Chicago, IL. It was issued by the Standards Council on July 26, 2013, with an effective date of August 15, 2013, and supersedes all previous editions.

This edition of NFPA 1851 was approved as an American National Standard on August 15, 2013.

Origin and Development of NFPA 1851

The first edition of NFPA 1851, in 2001, was titled *Standard on the Selection, Care, and Maintenance of Structural Fire Fighting Protective Ensembles*, and was developed to be a companion document for NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting*. NFPA 1971, which has been in effect since 1975, specifies product design, performance, testing, and certification. NFPA 1971 is written for use by manufacturers to design and produce their products and by certification organizations to evaluate and test those products to determine compliance with the standard as well as to provide checks on production to ensure continuing compliance. While NFPA 1971 is primarily written for those groups, the standard is also used by fire departments and other organizations in developing purchase specifications for structural fire fighting protective ensembles and ensemble elements to ensure that the products they purchase are certified as being compliant with the standard.

NFPA 1851 is written for the organizations that evaluate the risks their emergency responders face and their particular needs for the protective clothing, that develop purchase specifications, and that purchase structural fire fighting protective ensembles and ensemble elements. It is also written for end users of structural fire fighting protective ensembles and ensemble elements to be able to inspect, maintain, and care for the protective ensembles and elements they use during structural fire fighting operations.

The overall protection and safety of fire fighting personnel depend not only on adequate protective clothing but equally on the organization's policies, training, and administration of the correct use of the proper protective ensembles in fire fighting situations. To satisfy the portion of the organization's overall protective clothing and equipment program that addresses structural fire fighting protective ensembles, this document provides criteria for the selection, care, and maintenance of the protective ensemble and ensemble elements.

In this standard, the requirements for several areas are written to begin with the person who actually uses the protective ensemble being constantly aware of the protective ensemble's condition and need for cleaning, repair, or more in-depth inspection. Users can perform the simple actions to improve the condition of the protective ensemble. The more involved actions of advanced inspection, evaluation, cleaning, decontamination, and repair are handled by the organization's designated staff who are trained and authorized to perform more advanced duties. In other areas, the requirements are written for the organization to perform the administrative functions of the program and periodic actions to evaluate the structural fire fighting protective ensemble program to ensure that the program is achieving its goals and that the quality of the protective ensembles and ensemble elements provides optimum safety to fire fighters.

The second edition of NFPA 1851 was a complete revision of the first edition. Because NFPA 1976, *Standard on Protective Ensemble for Proximity Fire Fighting*, was incorporated into the

2007 edition of NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, under the Technical Committee on Structural and Proximity Fire Fighting Protective Clothing and Equipment, NFPA 1851 was expanded to include both structural fire fighting ensembles and proximity fire fighting ensembles.

The complete revision followed the new standards format according to the *Manual of Style for NFPA Technical Committee Documents*, which has Chapter 1 covering scope, purpose, and application; Chapter 2 covering referenced publications; and Chapter 3 covering definitions. Chapter 4 covered the organization's program; Chapter 5, selection; Chapter 6, inspections; Chapter 7, cleaning and decontamination; Chapter 8, repairs; Chapter 9, storage; Chapter 10, retirement, disposition, and special incident procedures; Chapter 11, new requirements for independent service providers (ISPs); and Chapter 12, testing procedures.

New requirements in Chapter 11 for organizations and ISPs and for verification of the ISPs by independent, third-party certification organizations set the criteria for organizations and ISPs to perform the tasks of inspection, cleaning, and repairing of protective ensembles and ensemble elements. New requirements for testing methods for trained personnel in the organization as well as the ISPs set the criteria to determine the functionality and protection afforded by the ensembles and ensemble elements.

Requirements were revised in Chapter 10 for retiring structural fire fighting ensembles and ensemble elements and proximity fire fighting ensembles and ensemble elements to require retirement not later than 10 years from the date the ensembles or ensemble elements were manufactured. The radiant reflective outer shell of proximity fire fighting ensembles and ensemble elements must be replaced a maximum of 5 years from the date the ensembles or ensemble elements were manufactured. More frequent replacement of fire fighting ensembles and ensemble elements was now required to better ensure that fire fighters have state-of-the-art protection from fire fighting environments. The significant changes that the technology undergoes within two editions of this standard (approximately 10 years), in addition to the normal "wear and tear" of fire fighting, other emergency incident responses, training, and other factors, dictate that protective ensembles and ensemble elements be replaced. Fire departments that respond to a higher-than-average number of emergency incidents or that have frequent or extensive "working fire" operations might want to plan for replacement of ensembles or ensemble elements on a more frequent cycle.

This third edition of NFPA 1851 is a complete revision and features many editorial changes as well as new definitions for *manufacturer trained organization, verified organization,* and *verified independent service provider (ISP).* A new table has been added to Chapter 4 that specifies the responsibilities for garment inspection, cleaning, and repair. Chapter 6, Inspection, now includes inspection for delamination and label integrity and legibility. Chapter 7 has changes to the cleaning and decontamination procedure, and Chapter 8 has revised requirements for the repair of ensemble and ensemble elements. There are also several changes to Chapter 11, Verification, that affect how an organization or ISP is to be verified, and two new tables have been added that address advanced inspection and advanced cleaning evaluations.

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NFPA® 13

Standard for the

Installation of Sprinkler Systems

2016 Edition

This edition of NFPA 13, *Standard for the Installation of Sprinkler Systems*, was prepared by the Technical Committees on Private Water Supply Piping Systems, Residential Sprinkler Systems, Sprinkler System Discharge Criteria, and Sprinkler System Installation Criteria, released by the Correlating Committee on Automatic Sprinkler Systems, and acted on by NFPA at its June Association Technical Meeting held June 22–25, 2015, in Chicago, IL. It was issued by the Standards Council on August 18, 2015, with an effective date of September 7, 2015, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See "Codes & Standards" at www.nfpa.org for more information.

This edition of NFPA 13 was approved as an American National Standard on September 7, 2015.

Origin and Development of NFPA 13

NFPA 13 represents the first standard published under the auspices of the NFPA Committee on Automatic Sprinklers. Originally titled *Rules and Regulations of the National Board of Fire Underwriters for Sprinkler Equipments, Automatic and Open Systems*, the standard has been continuously updated to keep in step with change.

Full information about the NFPA actions on various changes will be found in the NFPA Proceedings. The dates of successive editions are as follows: 1896, 1899, 1902, 1905, 1907, 1908, 1912, 1913, 1915, 1916, 1917, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929. In 1930, a separate standard was published on Class B systems. This was integrated into the 1931 edition. Further revisions were adopted in 1934, 1935, and 1936. A two-step revision was presented in the form of a progress report in 1939 and finally adopted in 1940. Further amendments were made in 1947, 1950, 1953, 1956, 1958, 1960, 1961, 1963, 1964, 1965, 1966, 1968, 1969, 1971, 1972, 1973, 1974, 1975, 1976, 1978, 1980, 1982, 1984, 1986, and 1989.

The 1991 edition incorporated an entire rewrite of the standard to make the overall format user friendly. Substantive changes were made to numerous terms, definitions, and descriptions, with additional refinements made in 1994.

The centennial (1996) edition included a significant rework of the requirements pertaining to the application, placement, location, spacing, and use of various types of sprinklers. Other changes provided information on extended coverage sprinklers and recognized the benefits of fast-response sprinkler technology.

The 1999 edition encompassed a major reorganization of NFPA's Sprinkler Project that included the establishment of a Technical Correlating Committee on Automatic Sprinkler Systems and four new sprinkler systems technical committees, the consolidation of NFPA's sprinkler system design and installation requirements, and the implementation of numerous technical changes.

The scope of NFPA 13 was expanded to address all sprinkler system applications. The 1999 edition contained information on the installation of underground pipe from NFPA 24 and sprinkler system discharge criteria for on-floor and rack storage of Class I, II, III, IV, and plastic commodities, rubber tires, baled cotton, and roll paper that were previously located in NFPA 231, 231C, 231D, 231E, and 231F. Additionally, sprinkler system information for specialized hazards from over 40 NFPA documents was either brought into NFPA 13 using NFPA's extract policy or specifically referenced. A new chapter was also added to address the structural aspects of exposed and buried system piping. A table of cross-references to previous editions and material that was located in other NFPA documents was included at the end of the 1999 edition.

More specific changes included a new sprinkler identification marking system and the designation of sprinkler sizes by nominal K-factors. New criteria for the use of steel pipe in underground applications was added, as well as a new provision to guard against microbiologically influenced corrosion. Obstruction rules for specific sprinkler types and rules for locating sprinklers in concealed spaces were revised. New limitations were placed on the sprinkler sizes in storage applications, and criteria for the K-25 sprinkler was added. Additionally, the requirements for protecting sprinklers against seismic events also underwent significant revision.

The 2002 edition of NFPA 13 underwent style formatting and technical revisions. The style formatting was completed to comply with the *Manual of Style for NFPA Technical Committee Documents* and to reorganize many of the requirements in NFPA 13 into unique chapters. Editorially, NFPA 13 eliminated all of the exceptions and reworded them as requirements where applicable, moved the mandatory references to Chapter 2, and relocated all of the definitions to Chapter 3. In reorganizing NFPA 13, several new chapters were created to consolidate requirements including the following: Chapter 10 contained all of the applicable requirements for underground piping including materials, installation, and acceptance testing; Chapter 11 contained design approaches including pipe schedule, density/area method, room design method, special design areas, residential sprinklers, exposure protection, and water curtains; Chapter 12 contained the design approaches for the protection of storage, including idle pallets, miscellaneous storage, storage less than 12 ft, palletized, solid pile, bin box, and shelf storage, rack storage less than 25 ft, rack storage greater than 25 ft, rubber tire, baled cotton, rolled paper, and special storage designs; and Chapter 13 contained all of the design and installation requirements from all of the various documents that have been extracted into NFPA 13.

The 2002 edition made specific technical changes to address several key issues. Three major areas of irregular ceiling were addressed, including skylights, stepped ceilings, and ceiling pockets. The design requirements for ESFR sprinklers were expanded to allow the user to choose the storage height and then the building height for any allowable arrangement. Design requirements for the protection of storage on solid shelves were added. Requirements for the installation of residential sprinklers were added that parallel the requirements for other types of sprinklers.

For the 2007 edition, definitions were reorganized to locate all of the storage definitions in one area, and several new definitions addressing private water supply terms were added. The definitions and requirements of Ordinary Hazard Group 1 and 2 Occupancies were clarified where storage is present. The requirements for trapeze hangers were clarified and made consistent for all components, and the seismic bracing criteria were updated to ensure that NFPA 13 contains all of the appropriate requirements for installation and design of seismic bracing of fire sprinkler systems. The requirements for storage were further reorganized and divided into separate chapters addressing general requirements for storage; miscellaneous storage; protection of Class I to Class IV commodities that are stored palletized, solid piled, bin boxes, or self storage; protection of plastic and rubber commodities that are stored palletized, solid piled, bin boxes, or shelf storage; protection of Class I through Class IV commodities that are stored on racks; protection of plastic and rubber commodities that are stored on racks; protection of rubber tire storage; protection of roll paper; and special designs of storage protection.

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For the 2010 edition many of the major changes related to the requirements for storage protection. First was the combination of large drop sprinkler and the specific application control mode sprinkler requirements and the revision of the terminology to identify them as Control Mode Specific Application sprinklers (CMSA). Next, new criteria for use of smoke vents were added to Chapter 12. The density/area curves in the storage chapters were reduced to a maximum 3000 ft^2 operating area; this was a significant reduction of some curves that had extended up to 6000 ft^2. Changes to rack storage in the 2010 edition included a new method to calculate the rack shelf area. Finally, the provisions for back to back shelf storage were added to the storage chapters.

Criteria for the protection of three new special storage arrangements were added to Chapter 20. These included protection of carton records storage with catwalk access; compact shelving of commodities consisting of paper files, magazines, books, and similar documents in folders and miscellaneous supplies with no more than 5 percent plastics up to 8 ft high; and protection of high bay record storage.

In Chapter 9, a number of changes occurred regarding sway bracing of sprinkler systems including the introduction of new zone of influence tables for Schedule 5 steel pipe, CPVC, and Type M copper tube. Also the means for calculating the loads in the zone of influence were modified to correlate with SEI/ASCE-7 and a new Annex E was added that described this calculation.

Other areas of change included requirements for listed expansion chambers; clarification of ceiling pocket rules; and clarification of the formulas used in calculating large antifreeze systems.

The 2013 edition of NFPA 13 included changes to many technical requirements as well as the reorganization of multiple chapters. One significant change that was made to the administrative chapter of NFPA 13 was to clarify that watermist systems were not covered within NFPA 13 and that NFPA 750 should be used when looking for guidance on the design and installation of those systems. A series of new requirements addressed the need for a compatibility review where nonmetallic piping and fittings are installed in systems also using petroleum-based products such as cutting oils and corrosion inhibitors. Several modifications were made to the standard pertaining to freeze protection. The use of antifreeze in new NFPA 13 sprinkler systems was prohibited unless the solution use was listed and the listing indicated illustrated the inability for the solution to ignite. Other freeze protection modifications to the standard included clarification on the use of heat tracing, required barrel length for dry sprinklers, and the allowance for engineering

analyses to be submitted to support an alternate freeze protection scheme. New sprinkler omission requirements were added for elevator machine rooms and other elevator associated spaces where certain criteria were met. Chapter 9 included updated information on shared support structures as well as a revised seismic bracing calculation form. Chapters 16 and 17 were reorganized to make the chapters easier to follow, to create more consistency between the various storage chapters. A new chapter on alternative approaches for storage applications was added to provide guidance on performance-based approaches dealing with storage arrangements.

One of the largest changes to the 2016 edition of NFPA 13 is the review of all metric conversions. Historically the document has used an "exact" conversion process, but in the 2016 edition an approximate conversion process is used. The intent of this change is to make the document more usable outside the United States. Another major change is the inclusion of a pipe venting requirement to eliminate as much air as possible from wet pipe systems. This requirement contemplates only a single vent in each wet system.

There are a significant number of changes to the storage chapters of NFPA 13. New design criteria are included for the protection of exposed, expanded Group A plastics stored in racks. Also, a ceiling and in-rack design approach, called an "alternative protection scheme," has been added to Chapters 16 and 17. A similar concept has existed for sprinkler protection in NFPA 30 for several revision cycles.

A new section on sprinkler design where cloud ceilings are installed has been added. This design scheme allows sprinklers to be omitted above cloud ceilings when the gap between clouds (or clouds and walls) meets a maximum allowable dimension based on the floor-to-cloud ceiling height. This new language was created based on a project conducted by the fire protection research foundation. Chapter 10, which is extracted from NFPA 24, has been significantly revised based on the rewrite of NFPA 24. Most of the technical content remains the same, although the organization and structure have been modified.

Prior editions of this document have been translated into languages other than English, including French and Spanish.

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NFPA® 30

Flammable and Combustible Liquids Code

2018 Edition

This edition of NFPA 30, *Flammable and Combustible Liquids Code*, was prepared by the Technical Committees on Fundamentals, Operations, Storage and Warehousing of Containers and Portable Tanks, and Tank Storage and Piping Systems, released by the Correlating Committee on Flammable and Combustible Liquids, and acted on by NFPA at its June Association Technical Meeting held June 4–7, 2017, in Boston, MA. It was issued by the Standards Council on August 17, 2017, with an effective date of September 6, 2017, and supersedes all previous editions.

This edition of NFPA 30 was approved as an American National Standard on September 6, 2017.

Origin and Development of NFPA 30

From 1913 to 1957, this document was written as a model municipal ordinance known as the *Suggested Ordinance for the Storage, Handling, and Use of Flammable Liquids.* In 1957, the format was changed to a code, although the technical requirements and provisions remained the same. Since its inception, numerous revised editions have been published as dictated by experience and advances in technology.

A brief review of the major changes adopted since 1981 follows. In 1984, the chapter on automotive and marine service stations was removed from NFPA 30 and was replaced with a new document, NFPA 30A, *Automotive and Marine Service Station Code*, now titled *Code for Motor Fuel Dispensing Facilities and Repair Garages.* In 1987, Chapter 5 (Industrial Plants), Chapter 6 (Bulk Plants and Terminals), Chapter 7 (Process Plants), and Chapter 8 (Refineries, Chemical Plants, and Distilleries) were combined into a single chapter on operations. In 1990, a new section was added to address hazardous materials storage lockers, and more detailed guidance was added to address ventilation of enclosed process areas and for estimation of fugitive emissions. In 1993, the chapter on tank storage was amended to allow combined remote impounding and diking systems and to provide relief from the spill control requirements for certain secondary containment–type tanks. Also, the chapter on container and portable tank storage was completely rewritten so that its requirements were presented more clearly, especially for mercantile occupancies.

In 1996, the following major changes were incorporated: requirements for temporary and permanent closure of underground storage tanks; requirements for tightness testing of tanks of specific design; recognition of intermediate bulk containers; and mandatory fire protection design criteria for inside storage of liquids in storage rooms and liquid warehouses.

In 2000, the following major changes were incorporated: complete editorial rewrites of Chapter 2, Tank Storage, and Chapter 3, Piping Systems; requirements for vaults for aboveground tanks and for protected aboveground tanks; recognition of certain nonmetallic intermediate bulk containers for storage of Class II and Class III liquids, along with fire protection system design criteria for them; simplified spill containment and drainage requirements; new fire protection design criteria for a number of flammable and combustible liquid commodities; expansion of the requirements for construction and separation of process buildings; a new section addressing recirculating heat transfer fluid heating systems; a new section addressing solvent recovery distillation units; and consolidation of all requirements for hazardous location electrical area classification into a single chapter.

The 2003 edition of NFPA 30 incorporated the following changes:

(1) Numerous occupancy definitions were either added or corrected to correlate with NFPA 1, *Uniform Fire Code™*; NFPA *101®*, *Life Safety Code®*; and *NFPA 5000®*, *Building Construction and Safety Code®*.
(2) Separation distance requirements for protected aboveground tanks were reduced, and separation distance requirements for tanks in vaults were eliminated.

(3) Special operating requirements were added for shop-fabricated aboveground tanks with abnormally long vertical piping for fill and/or vent lines.
(4) New criteria were added to Chapter 6, Container and Portable Tank Storage, for maximum allowable capacities of acceptable container sizes.
(5) Fire protection design criteria for unsaturated polyester resins were added.
(6) Section D.5, Recommended Fire Protection Design Criteria for High-Expansion Foam Fire Protection for Nonmiscible Liquids, was added.
(7) Revisions were made to the spacing requirements and construction requirements for process buildings.
(8) Special requirements were added for insulated piping for recirculating heat transfer systems.
(9) Permanent interconnections between fire water systems and process water systems were prohibited.

The 2008 edition of NFPA 30 incorporated a complete editorial revision of the prior edition to implement NFPA's hazardous materials template, a formatting scheme intended to integrate a common organization and common outline for all NFPA codes and standards that address the various types of hazardous materials. As a result of the implementation of the template, the eight chapters that the 2003 edition of NFPA 30 comprised were subdivided and rearranged into 29 shorter, more narrowly focused chapters. Requirements that are generally applicable to all facilities that store, handle, and use flammable and combustible liquids were relocated to the beginning of the code. Chapters dealing with bulk storage and bulk handling of liquids were moved to the end of the code, based on the reasoning that not all codes and standards dealing with hazardous materials include provisions for bulk storage.

In addition to the editorial revision, the 2008 edition of NFPA 30 incorporated the following technical changes:

(1) Several new definitions were added to assist the user in applying the requirements of the code. Some existing definitions in Chapter 3 were changed to read the same as the preferred definitions in the NFPA *Glossary of Terms*. Where possible, secondary definitions were moved to appropriate chapters.
(2) Chapter 6, Container and Portable Tank Storage, was replaced by Chapters 9 through 16 of the 2008 edition. These new chapters regulated storage of containers, portable tanks, and intermediate bulk containers in a manner that is consistent with model building codes, such as *NFPA 5000®, Building Construction and Safety Code®*, and model fire prevention codes, such as NFPA 1, *Uniform Fire Code™*, and incorporated the concepts of maximum allowable quantities (MAQs), control areas, and protection levels.
(3) Fire protection design criteria for inside storage areas were expanded to include requirements for small plastic containers of Class IB, IC, II, and III liquids in corrugated cartons and for Class IIIB liquids in corrugated cardboard intermediate bulk containers with plastic inner liners. The flowcharts and tables that contain these design criteria were reformatted to present the information more consistently.
(4) New corrosion protection requirements were added for nonmetallic tanks.
(5) New requirements for periodic testing, maintenance, inspection, and repair of aboveground storage tanks were added.
(6) Overfill prevention requirements were revised so that they apply to all tanks larger than 1320 gal (5000 L) capacity.
(7) Additional requirements for fire-resistant tanks were added.
(8) The maximum capacity for secondary containment–type tanks storing Class II and Class IIIA liquids was increased from 12,000 gal (45,000 L) to 20,000 gal (76,000 L).
(9) The requirements for construction of storage tank vaults were improved for clarity.
(10) Special requirements for marine piping systems were added.

The 2012 edition of NFPA 30 incorporated the following technical changes:

(1) Use and installation of alcohol-based hand rub dispensers were exempted from the code.
(2) NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, was added to Section 1.5 as one of the NFPA codes and standards deemed equivalent to the code for purposes of installation of fuel tanks for diesel-driven fire pumps.
(3) Definitions for the various building occupancies were amended to correlate with the preferred definitions as found in NFPA *101®, Life Safety Code®*.
(4) The definitions of *fire-resistant tank* and *protected aboveground tank* were relocated to Chapter 22, Storage of Liquids in Tanks — Aboveground Storage Tanks.
(5) New provisions were added to require that Class II and Class III liquids that are stored, handled, processed, or used at temperatures at or above their flash points follow all applicable requirements in the code for Class I liquids, unless an engineering evaluation deems otherwise. Supplementary information was included in Annex A. In addition, direct reference to this provision was added at appropriate locations in subsequent chapters.
(6) An annex item was added to 6.5.1 to explain that use of spark-resistant tools must be evaluated on a case-by-case basis.

(7) New Section 6.10 and the accompanying Annex G were added to address management of facility security by means of a mandatory security and vulnerability assessment. Annex G provides an outline of a suggested assessment process.
(8) Annex guidance was added to 9.5.4.2 for selecting a safe location to which a flammable liquids storage cabinet can be vented.
(9) The provisions for flammable liquids storage cabinets were amended to incorporate more extensive marking requirements.
(10) A footnote was added to Table 9.9.1, Fire Resistance Ratings for Liquid Storage Areas, to indicate that no fire resistance rating is required for separation walls for accessory use areas of small floor area.
(11) Section 13.3 was revised to more clearly establish the required separation between detached unprotected liquids storage buildings and both protected and unprotected exposed properties.
(12) Numerous minor amendments were made to clarify application of the provisions of Chapter 16.
(13) A new subsection, 17.3.7, was added to address process vessels used to heat liquids to temperatures at or above their flash points, as suggested by the U.S. Chemical Safety and Hazard Investigation Board.
(14) An Annex A item was added to 18.6.3 to provide guidance for selecting a safe location to which a flammable liquids dispensing area can be vented.
(15) Subsection 21.4.3, Normal Venting for Storage Tanks, was amended to clarify its application. An Annex A item was included to clarify that the interstitial space of a secondary containment tank does not require normal venting.
(16) A new 21.5.2.1 was added to clarify that tightness testing is not required for an interstitial space of a secondary containment tank that maintains factory-applied vacuum.
(17) A note and Annex A item were added to Table 22.4.2.1, Minimum Shell-to-Shell Spacing of Aboveground Storage Tanks, to explain the term *sum of adjacent diameters* and its determination.
(18) Subsection 22.17.4 was amended to provide additional guidance on handling floating roof pontoons that have been breached by liquids or vapors.
(19) Section 23.14 was amended so that it no longer allows the use of water ballast to secure underground tanks in areas subject to flooding.

The 2015 edition of NFPA 30 incorporated the following major amendments:

(1) The definition of "safety can" was amended to incorporate a screen/strainer in each fill and pour opening. This recognizes the actual construction of safety cans as currently manufactured and listed.
(2) A 12 ft (3.6 m) storage height restriction was imposed on unprotected storage in mercantile occupancies, to be consistent with the storage height restriction already in place for mercantile occupancies protected in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems,* for ordinary hazard Group 2.
(3) Numerous amendments were made to Chapter 16 to clarify intent, to eliminate certain inconsistencies between NFPA 30 and NFPA 13, and to correlate with terminology used in and specific requirements of NFPA 13.
(4) Subsection 17.4.3 and Table 17.4.3 were amended to increase the required separation distances between process vessels and adjacent important buildings, adjacent property lines, and the near and far sides of public ways. The amendments address recommendations submitted by the U.S. Chemical Safety and Hazard Investigation Board.
(5) A new subsection, 18.4.4, was added to address hand-operated pumps to dispense liquids that function using compressed air.
(6) A new Section 19.7 was added to address the installation of cooking oil storage and dispensing systems for use in commercial kitchens, such as restaurants and prepared food production facilities.
(7) Section 22.7 was amended to eliminate the use of a weak roof-to-shell seam as an allowed means of emergency venting for ANSI/UL 142 steel aboveground storage tanks.
(8) Subsection 22.11.4 was amended to set a 50,000 gal maximum capacity for all secondary containment–type storage tanks for all Class I, Class II, and Class IIIA liquids.
(9) Subsection 27.4.4 was amended to strengthen the provisions regarding the use of low-melting-point piping materials. The amendments address recommendations submitted by the U.S. Chemical Safety and Hazard Investigation Board.
(10) Section 28.11 was amended by adding certain operating requirements for the person responsible for loading or unloading tank vehicles. These correlate with the provisions of NFPA 385, *Standard for Tank Vehicles for Flammable and Combustible Liquids.*
(11) A new Annex A item, A.21.7.2.2, was added to address security of storage tanks in remote unattended locations. This addresses recommendations submitted by the U.S. Chemical Safety and Hazard Investigation Board.

The 2018 edition of NFPA 30 incorporates the following major amendments:

(1) Definitions for the terms *rack, rack bay,* and *rack section* have been added to Section 3.3.
(2) Definitions for the terms *protected* and *unprotected,* as they relate to storage of containers, have been added to Sections 9.2, 12.2, and 16.2. Related text that appeared in Subsections 9.3.4 and 12.3.4 has been deleted.
(3) Subsection 9.4.1, which sets forth the types of containers considered acceptable under the code, has been amended by the addition of item (8), which recognizes nonmetallic intermediate bulk containers that can satisfy the fire exposure test protocols of Paragraph 9.4.1.1.

(4) Paragraph 9.4.1.1 has been amended to specifically reference UL 2368, *Standard for Fire Exposure Testing of Intermediate Bulk Containers for Flammable and Combustible Liquids,* and FM Class 6020, *Approval Standard for Intermediate Bulk Containers.* In addition, the references to these two standards have been deleted from Table 9.4.3, but have been added to Subsection 16.3.7.

(5) Paragraph 9.4.3(4) has been amended by specifically referencing UL 1275, *Standard for Flammable Liquid Storage Cabinets,* and FM Class 6050, *Approval Standard for Storage Cabinets (Flammable and Combustible Liquids),* or equivalent standards.

(6) Section 12.8, General Purpose Warehouses, has been replaced with provisions that only allow specific liquid/container combinations to be stored in such facilities. These combinations are allowed in unlimited quantities, but must be protected in accordance with the fire protection design criteria in Chapter 16. For consistency, Subsection 12.3.1 has been appropriately amended and (former) Subsection 12.3.2 has been deleted.

(7) Paragraph 16.5.1.6 has been amended by deleting the requirement that foam-water sprinkler systems be designed in accordance with NFPA 16. This eliminates potential conflict between NFPA 16 and Chapter 16 of this code.

(8) Paragraph 16.6.1.4(3) has been amended by providing alternative means to calculate the water demand for the most hydraulically remote in-rack sprinklers in the Scheme "A" design.

(9) Paragraphs 16.6.2.4(3) and 16.6.2.4(4) have been amended by deleting the reference to the single horizontal barrier, thus removing a redundancy in the Scheme "B" in-rack sprinkler design criteria, and by providing alternative means to calculate the water demand for the most hydraulically remote in-rack sprinklers in the Scheme "B" design.

(10) Paragraph 16.6.3.4(3) has been amended by providing alternative means to calculate the water demand for the most hydraulically remote in-rack sprinklers in the Scheme "C" design.

(11) Subsection 18.4.7 has been amended by deleting the text relating to listed flexible connectors, thus removing a duplication of Subsection 27.5.2.

(12) Subsection 18.5.4 has been completely revised by deleting the previous allowable quantities and replacing them with allowable quantities that more closely correlate with the maximum allowable quantities (MAQs) in Section 9.6.

(13) Paragraph 19.7.2.2.2 has been added, which adds a requirement that nonmetallic cooking oil tanks be listed in accordance with UL 2152, *Outline of Investigation for Special Purpose Nonmetallic Containers and Tanks for Specific Combustible or Noncombustible Liquids.*

(14) Paragraph 19.7.3.2.1 has been amended to clarify the permitted means of securing cooking oil tanks.

(15) Paragraph 21.4.3.4 has been amended to eliminate a potential conflict with 21.4.2.1.2.

(16) Paragraph 21.7.4.3.1 has been amended by moving the reference to API 1604, *Closure of Underground Petroleum Storage Tanks,* to Annex A.21.7.4.3.1.

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(17) Paragraph 22.4.2.4.2 has been amended to match the required separation distance between liquid storage tanks and LP-Gas containers with that specified in NFPA 58, *Liquefied Petroleum Gas Code.*

(18) Subsection 27.5.2 has been amended to require that flexible connectors be listed in accordance with UL 2039, *Standard for Flexible Connector Piping for Fuels.*

(19) Paragraph 29.3.28.4 has been amended by replacing the extinguisher's weight with its rating as the appropriate criteria. Existing extinguishers provided on a weight basis are allowed to remain in service.

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