



PDHonline Course G136 (3 PDH)

**NFPA Liquefied Petroleum Gas Code 58
Fire Safety Analysis Plan and O&M
Instructions for Propane Storage
Systems**

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National Fire Protection Association
Liquefied Petroleum Gas Code 58
Fire Safety Analysis Plan and Written Operations & Maintenance Instructions
For Propane Storage Systems

Tim Laughlin, P.E.

Course Outline

1. Learning objectives
2. Introduction
3. Course content
4. Course summary

This course includes a multiple-choice quiz at the end.

Learning Objective

At the conclusion of this course, the student will:

- Be familiar with NFPA 58 Liquefied Petroleum Gas Code latest Edition, and
- Have a better understanding of the requirements and other regulatory provisions for preparing a Fire Safety Analysis (FSA) for the storage of propane gas (LP-Gas) and
- Be able to institute a written Operations & Maintenance for a bulk propane storage facility in accordance with NFPA 58-2020 Chapter 15 requirements.

Course Introduction

The latest edition of the National Fire Protection Associations (NFPA) Pamphlet 58, Liquefied Petroleum Gas Code requires a written Fire Safety Analysis (FSA) and written Operations & Maintenance Instructions. These requirements originated at the US Environmental Protection Agency (EPA) under the Risk Management Program (RMP). The NFPA 58 requirements are much less restrictive than what the EPA originally proposed.

The requirement for a written (FSA) for all tank installations over 4,000 gallons aggregate capacity becomes effective when your State adopts the latest edition NFPA 58, Fire Protection (or later editions). New propane bulk plants and tank installations and for ASME tank installations on roofs, must complete an FSA before completion of the new facility. Also, a written FSA is required for all-existing bulk plants, tanks, and roof installations by three years after the effective date of the code.

In North Carolina, a professional engineer registered in North Carolina must prepare the FSA. Other guidelines for an alternative FSA come under the NC Department of Agriculture.

The other RMP-like requirements are found in the new Chapter 15 of NFPA 58, Operations and Maintenance. This requires written procedures for safely conducting LP-Gas activities at bulk and industrial plants. Also, these procedures must be kept up to date. Similarly, maintenance procedures must be prepared and implemented. These must be made available to contractors coming on site to do maintenance. Be sure to look at NFPA 58, for guidance for what is expected in these procedures and what you may use to help you prepare them.

For more information and guidelines on how to conduct an FSA, please visit the following web sites. National Propane Gas Association at <http://www.npga.org/> or <http://www.propanesafety.com/>. The NC Department of Agriculture's at <http://www.ncagr.gov/standard/LP/>
The National Fire Protection Association at <https://www.nfpa.org/>

Course Content

Fire Safety Analysis Manual for LP-Gas Storage Facilities

Based on the 2020 Edition of NFPA 58 Liquefied Petroleum Gas Code

From The National Propane Gas Association & Propane Education & Research Council (PERC) full manual download at:

<https://propane.com/resource-catalog/resources/fire-safety-analysis-manual-2020-edition-downloadable-version/>

Fire Safety Analysis (FSA) is a self-conducted audit of the safety features of a propane installation and an assessment of the means to minimize the potential for inadvertent propane releases from storage containers and during transfer operations. The assessment also includes an evaluation of the capabilities of local emergency response agencies as well as an analysis of potentially hazardous exposures from the installation to the neighborhood and from the surroundings to the LP-Gas facility. Since 1976, NFPA 58, *Liquefied Petroleum Gas Code* (hereinafter referred to as the "Code" or "NFPA 58") has required that a facility operator or owner conduct an FSA for propane facilities having ASME containers of aggregate storage greater than 4,000 gallons water capacity. The FSA requirement was changed in the 2001 edition to require a written FSA. The requirements for fire protection are indicated in the 2020 edition of NFPA 58 in Section **6.29 Fire Protection of ASME Containers**. Specifically, **6.29.2** ("Planning") and 6.29.3("Protection of ASME Containers") require the following: **6.29.2.1** The planning for the response to incidents including the inadvertent release of LP-Gas, fire, or security breach shall be coordinated with local emergency response agencies. **6.29.2.2** Planning shall include consideration of the safety of emergency personnel, workers, and the public. **6.29.3.1** Fire protection shall be provided for installations with an aggregate water capacity of more than 4000 gal (15.1 m³) and for ASME containers on roofs. **6.29.3.2** The modes of fire protection shall be specified in a written fire safety analysis for new installations and for existing installations that have an aggregate water capacity of more than 4000 gallons and for ASME containers on roofs. Existing installations shall comply with this requirement within 2 years of the effective date of this code. **6.29.3.3**

The fire safety analysis shall be submitted by the owner, operator, or their designee to the authority having jurisdiction and local emergency responders. The FSA and required assessment of the installation provides several important benefits: 1) A structured assessment by which each facility can be evaluated for conformity of installed equipment with Code requirements. 2) A means to evaluate the capability of systems and equipment installed to control and contain potential LP-Gas releases during day-to-day operations. 3) An approach to evaluate the informational needs of the facility, based on factors such as the type and frequency of transfer operations, size of the storage containers, location of 1 - 1 the facility with respect to other buildings and the existing procedures and systems in place. 4) A means to describe product control and fire protection features which exceed the comprehensive requirements of NFPA 58. 5) A tool for facilitating a cooperative and effective dialogue with local emergency response agencies and authorities having jurisdiction.

1.2 Scope of the Manual The manual addresses a number of subjects, including: (1) A review of the product control measures required in the NFPA 58, "Liquefied Petroleum Gas Code" (2) Local conditions of hazards within the facility site (3) Exposures to and from other properties (4) Effectiveness of local fire departments (5) Effective control of leakage, fire and exposure (6) Illustrative examples using four different sizes of typical LP-Gas facilities This FSA manual is intended for use by propane plant owners or operators, consultants, authorities having jurisdiction (AHJs) and emergency response personnel. The manual addresses the process by which an FSA can be conducted for an LP-Gas facility containing one or more stationary ASME containers. The FSA manual is designed to provide a guide for identifying the requirements in NFPA 58 and determining compliance with them. NFPA 58 provides, in part, that: The fire safety analysis shall be an evaluation of the total product control system, such as the emergency shutoff and internal valves equipped for remote closure and automatic shutoff using thermal (fire) actuation, pull away protection where installed, and the optional requirements of Section 6.30. The philosophy of NFPA 58 is to minimize fires by minimizing the accidental release of propane if an incident should occur. Or put in simple terms, "no fuel, and no fire."

The manual **does not** address the following: 1. Marine terminals, refrigerated LP-Gas storage and the transportation of LP-gas by either rail tank cars or by cargo tank trucks. Marine terminals are governed by the OSHA Process Safety Management regulations and the US EPA Risk Management Plan regulations; refrigerated storage of LP-gas is a high-volume operation requiring special 1 All reference, henceforth, to the pamphlet or the "code" in this document should be construed as referring to NFPA 58. 1 - 2 considerations; and, the transportation of LP-gas is addressed by Title 49 of the Code of Federal Regulations, *Transportation*. 2. Storage of LP-Gas in salt domes and caverns. 3. Installations ASME LP-gas containers on roofs of buildings. This type of installation, for which a fire safety analysis is required, is excluded from the scope of this manual primarily because of the rarity of such installations in the United States. 4. Cylinder filling operations at a dispensing facility, unless the storage threshold for LP Gas has

been exceeded, requiring an FSA to be prepared. 5. The use of facility employees performing as a “fire brigade.” The above facilities may be required to comply with other safety analysis requirements.

1.3 Need for an FSA Manual Neither NFPA 58 nor the “Liquefied Petroleum Gas Code Handbook” provides detailed guidance on how to prepare or develop a written FSA. Since each facility or bulk storage plant presents unique physical and operational characteristics, the fire safety analysis is a tool used to assess the level of fire safety performance that a specific facility or bulk plant can be expected to provide. This FSA will also provide essential information on the facility and its operation to the local authority having jurisdiction (AHJ) and local emergency response agency. An informal survey was taken of AHJ’s on the fire safety analyses used for existing and new plants in their jurisdictions (conducted by the author) at the time the first edition of this manual was being prepared. It indicated that there was no uniformity either in content, the details of information, or final assessment of the facility in the FSAs submitted. They ranged from a single page submission for medium size bulk plant to very detailed assessment including risk assessment and management plan for a 30,000-gallon bulk storage facility. Without a guidance manual, potential confusion would almost certainly occur as each AHJ would be required to establish an individual set of criteria that would meet the FSA in their area. Thus, the need in the LP-Gas industry for assistance with the following tasks was clearly established. 1) Providing a FSA template that allows for consideration of different size installations 2) Establishing a uniform approach and defining common elements 3) Developing simplified checklists and an example-based methodology for completing the analysis 4) Utilizing technically-based guidance and support The intent of this FSA manual is to provide an easy-to-use procedure for LP-gas facility owners or operators who are most familiar with the equipment technology and system operations and therefore qualified to complete the document. Knowledge of fire science and engineering principles is not required for this document to be useable by an owner, operator or an AHJ, because those principles have already been factored into the assessment criteria contained within the FSA. By utilizing the expertise of industry, engineering, and fire service representatives in the development of the material to follow, this manual provides a comprehensive, uniform, objective 1 - 3 approach that was designed to provide for the uniform and objective application of FSA requirements by the AHJs. Further, the joint input of the Propane Education & Research Council (PERC), National Propane Gas Association (NPGA), and the National Fire Protection Association (NFPA) provides additional assurance of the manual’s depth, credibility and broad-based consensus. This FSA manual has been developed based on the requirements of NFPA 58. Using this manual to perform an FSA at a facility constructed to meet the requirements of prior editions of NFPA 58 or other State specific Codes may produce conflicts between actual facility construction and the checklists in this manual. The code or standard in effect at the time of construction of the facility should be used as the source of requirements to perform the FSA. Checklist items contained within this manual can be revised to indicate the appropriate code items required at the time of facility construction.

1.4 LP-Gas Safety Record and Risks The LP-Gas industry has a long history of safe operations. With the requirement in the 1976 edition of NFPA 58 to retrofit LP-Gas plants with emergency shut-off valves (ESVs) in transfer lines, the safety of LP-Gas facilities was further improved. The FSA provided in this manual, in addition to other safety programs currently enacted at any workplace, is intended to reduce, or eliminate the risk of fatality or injury to both the plant employees and the public. In an effort to identify the level of risk a propane installation poses to the general public, as well as employees and emergency responders, the U.S. Department of Energy (DOE) instituted a study in 1981. Accident data from a variety of sources was analyzed, including: the US Department of Transportation hazardous material incident report database, reports of the National Transportation Safety Board, National Fire Protection Association, technical journals, and other sources. Data analyzed for the period 1971 through 1979 addressed LP-Gas transportation and product releases from stationary storage facilities. The special focus of the study was the fatalities suffered by employees and the general public. The study concluded that a fatality to the general public as a direct result of an LPG transportation or storage incident involving the loss of product is very small and the risk (expressed in expected number of fatalities per year) is smaller than that from natural phenomena (lightning, tornadoes, objects falling from the sky, etc). An analysis conducted by the National Fire Protection Association of LP-Gas fire damage and casualty data during the period between 1980 and 1999 also indicates that the LP-Gas storage facility operations in the US are very safe. The number of reported fires at LP-Gas bulk storage facilities remains small and has fallen since 1980, but substantial variation exists from year to year. During the five-year period from 2012 through 2016, all civilian casualties with propane listed as the first ignited material, the casualty rate is .00007. Of all civilian injuries with propane listed as the first ignited material, the injury rate is .00004.

Other Guidance Regulations:

Additional NFPA Resources • The National Fuel Gas Code Handbook (NFPA 54) • The LP-Gas Code Handbook (NFPA 58) • Customized training classes (classroom, onsite, and online) • NFPA 30A, Motor Fuel Dispensing Facilities and Repair Garages, 2016 edition • NFPA 70®, National Electrical Code (NEC®), 2017 edition • NFPA 30, Flammable and Combustible Liquids Code, 2016 edition Related Regulations • Title 49, Code of Federal Regulations, Parts 173.301(h)(3), 173.315(n), and 192.283(b) • Title 49, Code of Federal Regulations, Part 192, Appendix D • Title 49, Code of Federal Regulations, Part 192.281(e), "Transportation" • Title 49, Code of Federal Regulations, Parts 171–180, 393, 396, and 397 • Interstate Commerce Commission (ICC), Rules for Construction of Unfired Pressure Vessels

EXAMPLE FSA AS FOLLOWS:

FIRE SAFETY ANALYSIS FOR LP-GAS (PROPANE) STORAGE

Reference: National Fire Protection Association Pamphlet No. 58, LP Gas Code 2008 edition

Type of Facility: Manufacturing/Industrial Facility

Facility: **Mayberry Pipe & Foundry Company**
Street Address: **1234 Mayberry Street**
City, State, Zip: **Mayberry, North Carolina 28218**

Surry County, NC

Home Office:

Same

Home Office Phone:

704-123-4567 or (800) 123-4567

Web Site:

<http://www.mayberrypipe.com/>

MANAGEMENT APPROVAL

Authorized Agents Name: Mr. Barney Phife **Title:** Maintenance Manager

Signature: _____

Signature indicates compliance with the contents of this plan and authority to carry out these requirements.

ENGINEERING CERTIFICATION:

The undersigned certifies and attests (1) that he is familiar with this Regulation, (2) that he has visited and examined the site, (3) that the Fire Safety Analysis has been prepared in accordance with good engineering practice and with the requirements of this regulation, (4) that he has reviewed any and/or all construction documents, (5) the Fire Safety Analysis is adequate for the above- named facility. Signature does not relieve the owner/operator of their responsibility of implementing the requirements of this code. This engineer did not test for proper operation of any electrical/mechanical/safety equipment, overfill devices, vents, emergency venting, valves, corrosion control systems and any other equipment systems not specifically mentioned.

Prepared by:

Name: Gomer Pyle, PE #ABC022012
Raleigh, NC 27612, Phone 919-123-4567

Signature: _____

Date: April 5, 2022

(SEAL)

A Fire Safety Analysis or Incident Prevention Review (FSA) may be required by the State Agency for the installation of LP-Gas storage tank(s) having an aggregate water capacity of more than 4,000 gallons subject to exposure from a single fire. The State Agency will review and approve the Fire Safety Analysis by policies set forth in their department. The State Agency approval should be accomplished before construction/modification of the LP-Gas storage system(s). The guidelines used to prepare this analysis are the American Petroleum Institute (API) publication No. 2510 "Design and Construction of LPG Installations", API publication No. 2510A "Fire-Protection Consideration for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities", and (most importantly) the National Fire Protection Associations (NFPA) Pamphlet No. 58 "LP Gas Code". This engineer has used for guidance the National Propane Gas Associations (manual download at www.npga.org) Fire Safety Analysis Manual for LP-Gas Storage Facilities. **(The NPGA Fire Safety Analysis (FSA) Manual, based on the 2020 edition of NFPA 58, is a continuation of the effort to fulfill a need for an easily used and simple aid for the members of propane industry to fulfill their obligations under the NFPA 58 which require developing a written FSA.)**

EPA's Risk Management Plan regulations and Landview 5 Environmental Mapping Software were also used. This Fire Safety Analysis is contingent upon the proper installation of all equipment in accordance with NFPA 58.

Although very rare, propane tank system failures and explosions do happen. The risks associated with propane fires and explosions have undeniably been reduced with the advent of modern emergency control systems and installation codes. However, in order to determine hazards of this installation, a worst-case propane release case scenario will be analyzed. The credible case scenario of a propane vapor cloud explosion is considered but not analyzed under this FSA.

The FSA and required assessment of the installation provides several important benefits:

1) A structured assessment by which each facility can be evaluated for conformity of installed equipment with Code requirements.

2) A means to evaluate the capability of systems and equipment installed to control and contain potential LP-Gas releases during day-to-day operations.

3) An approach to evaluate the informational needs of the facility, based on factors such as the type and frequency of transfer operations, size of the storage containers, location of the facility with respect to other buildings and the existing procedures and systems in place.

4) A means to describe product control and fire protection features which exceed the minimum requirements of NFPA 58.

5) A tool for facilitating a cooperative and effective dialogue with local emergency response agencies and authorities having jurisdiction.

NFPA 58 Section-6.29.3 Protection of ASME Containers.

- *Fire protection shall be provided for all installations with an aggregate water capacity of more than 4000 gal (15.1 m³) and for ASME containers on roofs.*
- *The modes of fire protection shall be specified in a written fire safety analysis for new installations and for existing installations that have an aggregate water capacity of more than 4000 gal (15.1 m³) and for ASME containers on roofs. Existing installation shall comply with this requirement within 2 years of the effective date of this code.*
- *The fire safety analysis will be submitted by the owner, operator, or their designee to the authority having jurisdiction and local emergency responders.*
- *The fire safety analysis shall be updated when the storage capacity or the transfer system is modified.*
- *The fire safety analysis shall be an evaluation of the total product control system, such as the emergency shutoff and the internal valves equipped for remote closure and*

automatic shutoff using thermal (fire) actuation, pull away protection where installed, and the optional requirements of Section 6.26.

- *If in the preparation for the fire safety analysis it is determined that a hazard to adjacent structures exists that exceeds the protection provided by the provisions of this code, special protection shall be provided in accordance with 6.25.5*
- *Other Protection Requirements.*
- *Roadways or other means of access for emergency equipment, such as fire department apparatus, shall be provided.*
- *Each industrial plant, bulk plant, and distributing point shall be provided with at least one approved portable fire extinguisher having and minimum capacity of 18 lb. (8.2 kg) of dry chemical with a B:C rating. Where fire extinguishers have more than one letter classification, they shall be considered to satisfy the requirement of each letter class.*
- *LP-Gas fires shall not be extinguished until the source of the burning gas has been shut off.*
- *Emergency controls shall be conspicuously marked, and the controls shall be located so as to be readily accessible in emergencies.*

EMERGENCY CONTROL OBJECTIVES

The emergency control objectives consist of three operational phases:

- 1) Stopping or slowing down the rate of LP-Gas release
- 2) Dissipating LP-Gas vapors and/or preventing flammable gas-air mixtures from reaching ignition sources and entering structures.

- 3) Keeping fire exposed containers and equipment cool.

Attaining these objectives requires the application of both equipment arrangement and human performance.

THE EFFECTIVENESS OF TOTAL PRODUCT CONTROL MEASURES

Experience has shown that the most frequent cause of accidents leading to leaks and fires in LP-Gas facilities are associated with liquid transfer operations. All (Total Product Control) equipment, piping, valves, excess flow valves, emergency pull stations & valves (ESVs), tank(s), and back check valves will be installed in accordance with NFPA 58 at time of installation. The safety valves and manual breach stations will provide for propane flow shut down in the event of pipe/valve failure and tanker truck pull away. The liquid line is approximately 2.00 inches in size and the vapor line is 1.5 inches.

Most causes of LPG Fires are: Leakage of LP-Gas transfer pump seals, valve stem seals, flange gaskets, sampling or drawing water and leaking transfer piping/storage tank containers due to poor maintenance (corrosion). Other causes are tank overfilling, truck pull away and vehicular collision.

In many cases, the evaluation of the total product control system can conclude the FSA. The NFPA 58 Chapter 6 has code language on “Emergency shutoff valves and backflow check valves & annual testing. The results of the test shall be documented.”

LOCAL CONDITIONS OF HAZARDS WITHIN THE CONTAINER SITE

This property is located near the intersection of Mayberry St. and West Summit Ave., Mayberry County, Mayberry, NC. Mayberry Pipe & Foundry Company began operations at this location in 1901 as a cast iron pipe foundry.

The new LP-Gas tank(s) became operational in 2009. This facility includes two 30,000-gallon LP-Gas tank(s) and associated piping, valves, bulkheads, emergency shut-off systems and other equipment. Unloading petroleum liquids by truck transports are accomplished by using truck mounted PTO pumps or stationary mounted pumps while the driver/attendant stands by. The public is not allowed on the property. There is large.

motor vehicle truck traffic and parking on this property. There is significant fork truck traffic at this facility.

This facility includes one propane vaporizer across the street, approximately 120 feet from the tanks (see site print). Propane vaporizer construction type is direct fired vertical water bath. Vaporizer can provide 1,375 LP-Gas gallons per hour. Piping from LP-Gas tanks to vaporizer is underground, underneath South Clarkson Street.

Vaporizer meets the design requirements of NFPA-58 for gas fired water bath vaporizers.

- *The LPG heat exchanger is designed and constructed to conform to ASME Pressure Vessel Code.*
- *Float activated high LPG liquid level shutdown switch. Electronic flame safeguard assures positive and safe ignition.*
- *Two electronically operated main fuel safety shutoff valves in gas train.*
- *475-gallon water bath capacity.*

The minimum safe firefighting approach distance is considered 300 feet from tank sides. The long axis (direction West by East) of the LP-Gas tank(s) does point to possible fire control staging area(s). API 2510 requires a minimum separation distance of 50 feet between tank(s) and high voltage power lines. Low voltage power lines are installed at this facility on the west side of South Clarkson St. This facility is manned during normal business hours and has manned security during off hours.

SECURITY MEASURES

NFPA-58 Has Specific Language on Tank/Piping Security: The facility operator shall provide security measure to minimize entry by unauthorized persons. (1) Security awareness training; (2) Limitation of unauthorized access to plant areas that include container appurtenances, pumping equipment, loading, and unloading facilities, and container filling facilities.

Areas that include features required per code shall be enclosed with at least 6 ft. high industrial type fence, chain link fence, or equivalent protection.

Optional guard service can be provided as equivalent.

EXPOSURE TO AND FROM OTHER PROPERTIES

Ignition of a dispersing vapor cloud or plume may result in a flash-back type of vapor fire. In extremely rare cases, and only when the physical conditions are conducive, will a vapor explosion occur, resulting in a blast wave. If the dispersing cloud is not ignited it poses no hazard to the surrounding area.

Hazardous Effects: The effect of a propane fire on an off-site property will depend on the type and material of construction of the structure and its distance from the fire and fire size. Similarly, the number of off-site persons adversely impacted by a fire in a LP-Gas facility will also depend on, (in addition to the characteristics of the fire and the distance between the fire and the population) the type of population, the timeliness of notification, the effectiveness of the evacuation planning and implementation, etc.

Release Cases: A number of credible propane release cases in LP-Gas facilities have been developed by NPGA and the NFPA for FSA assessment. Each case of release has very low probability of occurrence.

However, because of the flammability of propane, such releases may pose hazards. The hazard distance (to a property outside the facility boundary or to off-site persons) from a propane release within the facility will depend on the size and duration of release, and the type of fire that occurs.

The credible case scenario indicates that a 251-foot radius for propane vapor to ignition sources exists. If the vapor cloud is ignited within the 251-foot radius, then the explosion/fireball hazard radius is 111 feet. There are no High Value Population Sources within this radius.

The worst-case scenario includes the total failure of one 30,000-gallon tank. The worst-case scenario of a propane vapor cloud explosion of 30,000 gallons of propane

could cause 2nd degree burns (exposure for duration of fireball) and 1 psi overpressure over a circular radius of approximately 0.40 miles (2112 feet) from center. Census software (year 2000) indicates approximately 293 people (105 homes) live within the 0.40-mile radius area. There are no High Value Populations within this radius.

This area is primarily urban, industrial, and commercial with some residential areas. A propane vapor cloud could possibly collect in a low area or flow in the direction of the prevailing wind (SW to NE) at the overpass bridge of I-277 on Mayberry St.

If the event of a fire at the tank(s), truck transport tanker/bobtails, or other facilities, each individual fire on site, could feasibly impact the other facilities in the worst possible way. The fire department and other emergency personnel must be prepared for evacuating all areas in the event of a fire of significant magnitude, i.e., evacuating the residential/commercial areas, and closing highways, city streets and other roadways. Emergency personnel must be prepared to control simultaneous fires.

This site is located in what the 2008 edition of NFPA-58, section A6.25.3 (3) refers to as a "population density or congested area". However, this site is required to have a Fire Safety Analysis (FSA) completed to conclude if "hazard(s) to adjacent structure exists" in accordance with 2008 NFPA 58 sections 6.25.3 and 2001 NFPA 58 Handbook Supplement 1 "Guidelines for Conducting an FSA".

THE PROBABLE EFFECTIVENESS OF PLANT FIRE BRIGADES or LOCAL FIRE DEPARTMENTS

This section will deal with the emergency response actions of the employees of this facility and/or the employees of LP-Gas tanker delivery trucks to accomplish the Emergency Control Objectives. The employee's role must be able to meet Emergency Control Objectives 1 and 2. The employees are much more responsive to shutting off or stopping an LP-Gas leak than anyone else, not immediately at the accident scene. The primary focus of employee LP-Gas safety training must focus on stopping or slowing the rate of LP-Gas releases. As far as Objective No. 2 is concerned, Mayberry Pipe and Foundry employees must shut down all sources of probable ignition of the propane gas that has escaped. The responsibility of each employee can be rehearsed with safety training. Examples would include turning off all equipment, which could be a possible ignition source, closing windows and doors, and turning off exposed electric motors, etc. In the event of a propane gas emergency, the owner or his designated employees shall ensure that all sources of ignition be shut off and extinguished. Probable sources of ignition could be motor vehicles and motorized equipment on the property and nearby highway and streets.

It is the requirement of this FSA that the owner provide emergency response training to specified employees and other necessary personnel. Every LP-Gas facility must have a written/verbal emergency action plan (OHS 1910.38) which includes actions to accomplish Objectives 1 and 2. The written emergency response plan should be reviewed as part of this Fire Safety Analysis. Written operations and maintenance instructions must also be provided in accordance with 2008, NFPA 58 Chapter 14. Mayberry Pipe & Foundry shall appoint emergency action employees to ensure all sources of ignition are shut down in the event of an LP-Gas leak/spill during transfers. Emergency evacuation plans shall be revised to reflect this.

Elements of an Emergency Action Plan 1) Sounding an alarm. 2) Notifying emergency responders. 3) Controlling the release, where possible. 4) Shutting down the plant with the Emergency Safety Valve operation. 5) Shutting down plant storage and transfer points. 6) Shutting down of all electrical power systems and welding/cutting operations. 7) Shutting down of all known ignition sources, where possible. 8) Evacuating the plant area. 9) Identifying pre-designated locations at which the plant personnel should meet. 10) Evacuating personnel to higher ground, when deemed appropriate. 11) Evacuating neighbors, if necessary. 12) Assessing the status of missing or injured employees. 13) Securing the perimeter. 14) Securing outdoor objects. 15) Providing assistance to emergency responders. 16) Other relevant action items.

LOCAL FIRE DEPARTMENT CAPABILITY AND AVAILABLE WATER SUPPLY

The planning for effective measures for control of inadvertent LP-Gas release or fire shall be coordinated with local emergency handling agencies such as fire and police departments. Planning shall include consideration of the safety of emergency personnel, workers, and the public.

The City of Mayberry Fire Department has a station (Station #5) approximately 1 mile from this site and Station #2 approximately 1.25 miles away. Fire Department personnel have stated that probable response time and applying enough cooling water from the onset of the fire alarm would be under the allowed 10 minutes. Calculation of response time to company gate is based on: Alarm Receipt & Handling Time - 1 minute for the fire department first receiving the alarm and 3 minutes for mutual aid fire departments, Turnout Time - 1 minute if the apparatus is staffed by career fire fighters and 4 minutes if the apparatus is staffed by volunteer fire fighters, Travel Time - 2 minutes for each mile the fire apparatus must travel in an urban/suburban setting and 1.5 minutes for each mile the fire apparatus must travel in a rural setting.

The total response time will give Mayberry Pie and Foundry an idea of how long it will take resources to reach the facility gate. Fire fighters must then determine the nature and severity of the emergency, determine how they are going to deal with the emergency, establish water supply and implement their attack. This can take anywhere from 2 minutes to upwards of 30 minutes. A pumper truck and water shuttle can be on site and applying water within 10 minutes for duration of approximately 3 to 4 minutes for this site. The above calculation estimates first response and applying water to the LP-Gas tank at 6 to 10 minutes.

The availability of water to cool or extinguish an LP-Gas fire is crucial for the fire department to effectively manage and control the LP-Gas fire/leak. There is a City operated fire hydrant approximately 100 feet from the site (see map FH #1). This fire hydrant has estimated flow rates over the 250-gpm range (tested flow rate @ 2072 gpm). Fire Hydrant #2 on attached map has a tested flow rate of 2534 gpm approximately 600 feet from the tanks.

To control an LP-Gas emergency, the Fire Department water flow rates must be 250 to 500 gallons per minute for each involved LP-Gas tank or tanker truck for duration of 10 minutes. Additional cooling water is needed (250 gpm) for nearby structures and vaporizer and for use by firefighters to protect personnel when approaching the container or its valves to control the flow of product.

The Local FD does have the proper firefighting equipment and F.D. personnel have been trained in LP-Gas fires and emergencies for protection of exposures only. Mayberry Pipe & Foundry should conduct a fire-evacuation and emergency fire drill with local Fire Departments within a reasonable time frame (1-year) upon completion of this FSA. Education and training on controlling and extinguishing an LP-Gas fire for fire department personnel must be conducted on a regular basis. The prevailing wind is from the west, southwest to the east, northeast and does impact probable ignition sources.

The Local FD needs at least one safe entrance point to the LP-Gas tanks. API publication No. 2510A recommends two entry points not in line with the tanks long axis (ends). Failure to provide two safe right of entry points to the tank will lower the Fire Departments capability to effectively control a LP-Gas fire/leak and could cause a serious hazard to exist. Upon review of the property, there is one safe firefighting access points to the transport truck(s), and tank(s). Possible staging area exists adjacent to the property on Mayberry St. and if needed on I-277.

The Fire Department must “control and not extinguish” the LP-Gas fire. If the fire department cannot “control and not extinguish” then public safety officials should limit their emergency response to control of onlookers and evacuation of the blast overpressure area.

DESIGNATED TIME FOR REVIEW OF THIS FSA WITH LOCAL EMERGENCY RESPONSE AGENCIES FOR PREPLANNING AND EMERGENCY RESPONSE PLANS

Within one year of the date of the FSA, Mayberry Pipe will conduct emergency drill with local Mayberry Fire Departments and Authority Having Jurisdiction (AHJ) officials and designated company employees.

CONCLUSION OF ANALYSIS

Any future LP-Gas storage tank installations are not considered in this analysis. This engineer visited this site on June 2, 2009. This engineer did not review any construction documents.

NFPA-58 states that two conditions must be met for Special Fire Protection to be required, that serious hazards to adjacent structures exist and that the local fire department be incapable of managing an LP-Gas fire/leak. It is the judgment of the NFPA & NPGA guidelines, that this Fire Safety Analysis has concluded that a serious hazard does not apply and therefore no additional fire protection be provided. In reaching the guideline conclusions the additional information below was used:

1) The "Guidelines for Conducting a Fire Safety Analysis" states the following: "The total product control system can eliminate leakage, prevent flame impingement on storage tanks, and reduce the need for the availability of large volumes of water." Mayberry Pipe & Foundry should revise their emergency response plan to incorporate this FSA.

All present liquid withdrawal openings on containers over 4000 gallons water capacity must have/retrofitted with internal valves with the emergency features stated in NFPA-58.

This facility has pneumatically operated (via pressured nitrogen gas) emergency shut off valves (ESV). An ESV with the same features installed as close as practical to a presently installed manual shutoff valve in combination with an excess-flow valve installed in the container will meet these new requirements. In addition, The NCDA has additional requirements on bulkhead construction: 1. Piping must have a shear point on the truck side of the bulkhead. 2. Piping must rise a minimum 12" above the shear point to provide enough leverage. 3. Automatic activation of Emergency Safety Valves (ESV) must be incorporated to activate ESV with a pull in any direction. This does not negate the requirement in NFPA 58 for manual activation. This facility currently meets the July 1, 2011 ESV standards.

This facility has state of the art emergency shut down systems and statistics (API) indicates an installation of this type has about 1 failure per 100,000 vessel years.

2) The Local Fire Department has stated that they will be able to handle a propane fire-emergency within the FSA guidelines that require a minimum time of 10 minutes for applying cooling water. They have been properly trained and have the proper equipment. Local FD has mutual aid with other Fire Departments.

Local FD should coordinate with NC Highway Patrol and City Police Department for emergency response (closing of I-277 and I-77) and evacuation routes in the event of a LP-Gas leak or fire. If the above recommendations cannot be accomplished, then local FD must evacuate all persons from within the overpressure boundary area as noted on the attached site map.

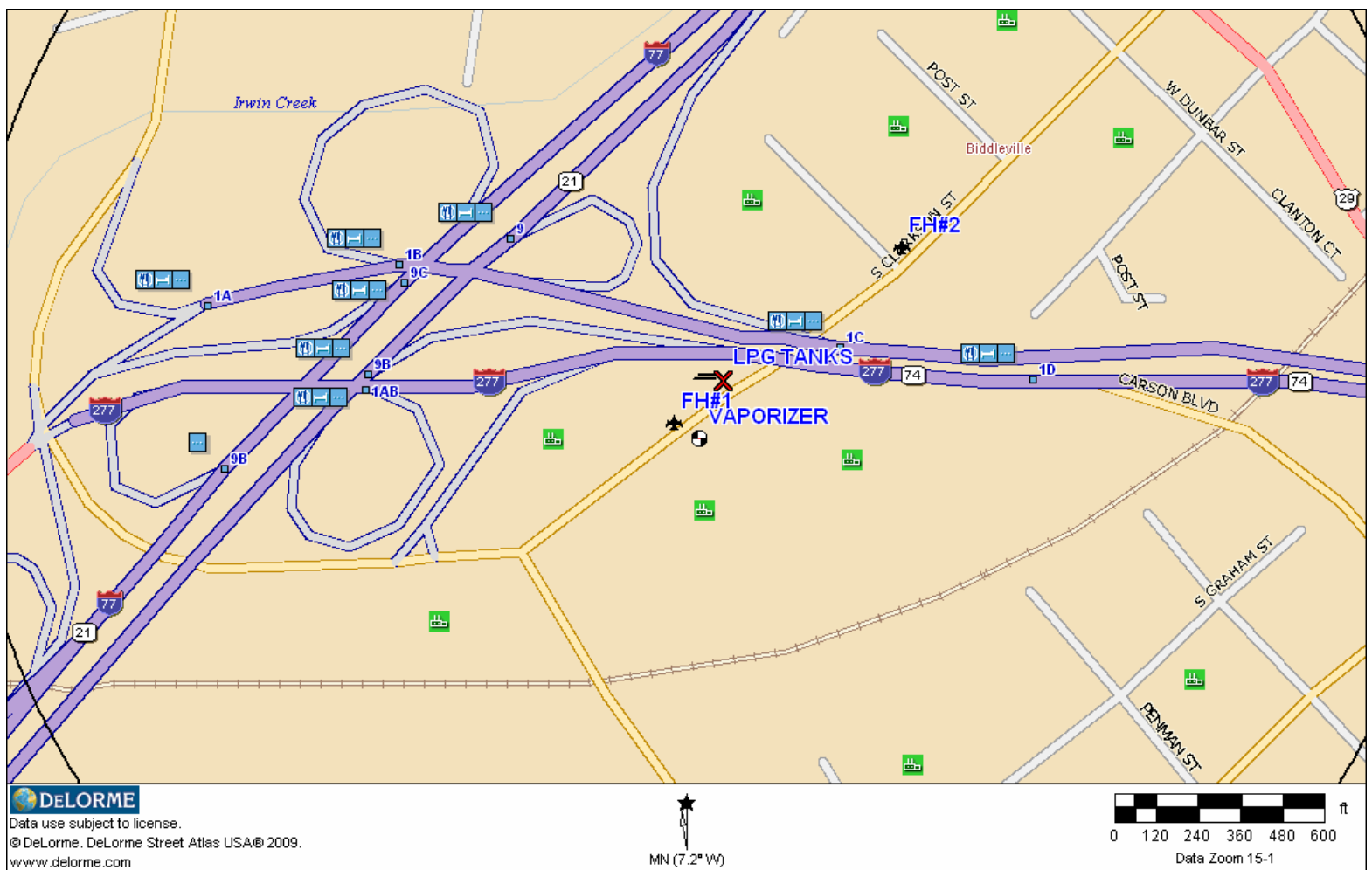
3) NFPA 58 states: "Sources of ignition shall be turned off during transfer operations, while connections or disconnections are made, or while LP-Gas is being vented to the atmosphere. (A) Internal Combustion Engines shall be shut down within 15 feet of a point of transfer....with exceptions... (B) Smoking, open flame, portable electrical tools, and extension lights capable of igniting LP-Gas shall not be permitted within 25 ft. of a point transfer while filling operations are in progress. (C) Metal cutting, grinding, oxygen-fuel gas cutting, brazing, soldering, or welding shall not be permitted within 35 feet of a point transfer while filling operations are in progress. (D)

Materials that have been heated above the ignition temperature of LP-Gas shall be cooled before LP-gas transfer is started.”

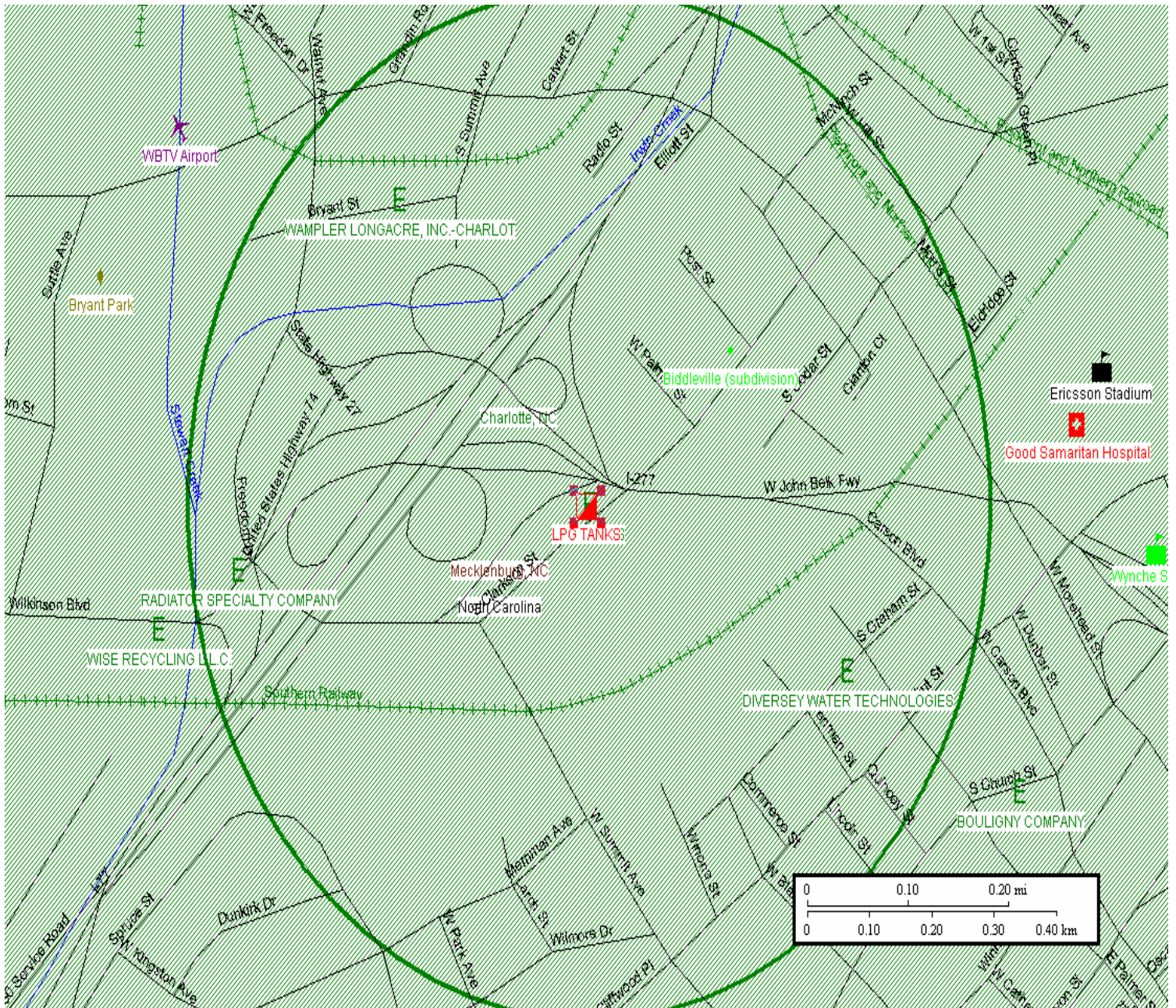
- 4) **NFPA 58 states: Qualification of Personnel. Persons who transfer liquid LP-Gas, who are employed to transport LP-Gas, or whose primary duties fall within the scope of this code shall be trained in proper handling procedures. Refresher training shall be provided at least every three years. The training shall be documented.** A documented training session involving the basic properties of propane combined with Mayberry Pipe & Foundry employee job-specific duties should be sufficient. Mayberry Pipe and Foundry’s propane supplier may be able to offer this training.

MAP DATA

GPS Data 35° 13.46'-N; 80° 51.72'-W



Landview Census Data



**OPERATIONS & MAINTENANCE
(O&M)
FOR
PROPANE STORAGE FACILITIES
(EXAMPLE)**

Reference: National Fire Protection Association (NFPA) Pamphlet No. 58
Liquefied Petroleum Gas Code, 2020, Chapter 15

Type of Facility: Petroleum Propane Bulk Plant Facility

Company: _____
Facility: _____
Street Address: _____
City, State, Zip: _____
Home Office: _____
Date: _____

MANAGEMENT CONTACT INFORMATION

Authorized Agents Name: _____
Title: _____
Phone Number: _____
Facility Phone Number: _____

LOCAL EMERGENCY RESPONDER CONTACT INFORMATION

Fire Department: _____
Phone Number: _____
Emergency Medical Responder(s): _____
Phone Number(s): _____
Emergency Medical Facilities(s)/Hospital(s): _____

Phone Number(s) _____

Coast Guard Phone number(s) (if applicable) _____

INTRODUCTION

This document was prepared to satisfy the requirements of National Fire Protection Association (NFPA) Pamphlet No. 58 Liquefied Petroleum Gas Code, 2020, Chapter 15.

This document contains:

- Documentation of Operating and Maintenance Procedures
- Safety Information

Continuing Requirements

Safety Information	Must be updated whenever process changes occur.
Operating Procedures	Maintain written operating procedures. Update whenever process changes.
Maintenance Procedures	Maintain maintenance procedures. Documentation of most recent maintenance inspection must be retained.

2020 NFPA 58

Chapter 15 Operations and Maintenance

Scope. This chapter includes requirements related to the operations and maintenance of bulk plant, industrial plant, refrigerated, marine and pipeline LP-Gas systems. The provisions of this chapter shall be applicable to all new and existing installations.

If stated elsewhere in this code, operations and maintenance requirements are referenced to those sections.

Multiple containers in vapor services only, with individual water capacity not exceeding 1200-gal water capacity with a maximum aggregate of 6,000 gal shall not require Written operations and maintenance procedures where they are not manifolded together.

Operating Requirements.

The procedures required in NFPA 59 shall address all aspects of LP-Gas transfer, as appropriate for the facility, including inspection of hoses and fittings and connection and disconnection procedures.

Operating procedures shall include operator actions to be taken if flammable concentrations of flammable liquids or gases are detected in the facility using fixed detectors, portable detectors, operating malfunctions, or human senses.

Operating procedures for vaporizers shall include maintenance of vaporization rate, pressure control, and temperature. Procedures shall include specific actions to be taken when parameters exceed normal operations limits and criteria for emergency shutdown.

In facilities where propane is stored as a refrigerated liquid, operating procedures shall include monitoring of liquid temperature and pressure and procedures to be taken if these temperature or pressures exceed operating limits. These procedures shall minimize the release of flammable gases to the atmosphere.

Each facility shall prepare and maintain in a common location or locations written operating procedure manuals that contain the written operating procedures required by NFPA 58.

Operating Procedures

Persons who operate LP-Gas bulk or industrial plant systems shall use written procedures for safely conducting activities associated with these duties.

Equipment owners or operators shall ensure that the operating procedures are updated, if necessary, whenever a major change occurs and prior to startup of a changed system.

OPERATING PROCEDURES REQUIREMENTS
A copy of NFPA 58 must accompany this operating procedure.

General Operating Procedures

Procedure	The following sections in NFPA 58 shall be company procedure. Paragraphs cited in this document shall be assumed to contain all subparagraphs and numbered or lettered lists within the cited paragraph as printed in NFPA 58 unless specifically noted.
2. Combustible material	Loose or piled combustible material and weeds and long dry grass shall be separated from containers by a minimum of 10 ft. (3 m). The surface on which the containers are placed shall be level and if not paved shall be clear of dry grass and weeks and other combustible material within 10 ft (3 m).
3. Sources of ignition	Control of other sources of ignition (includes NFPA 58 reference sections) Sources of ignition shall be turned off during transfer operations & Smoking Prohibition.
4. Signage and markings	Design, fabrication, testing, and marking of DOT, ASME Containers. OPD exemptions Every container designed to be filled on a volumetric basis shall be equipped with a fixed maximum liquid level gauge(s) to indicate the maximum filling level(s) for the service(s) in which the container is to be filled or used (see 7.4.3.3). Requirements for Variable liquid level gauges.
4. Signage and markings (cont.)	Container inlet and outlet connections on ASME containers of more than 2000-gal (7.6 m3) water capacity shall be labeled to designate whether they communicate with the vapor or liquid space.

4. Signage and markings (cont.)	<p>Where LP-Gas cylinders are to be stored or used in the same area with other compressed gases, the cylinders shall be marked to identify their content in accordance with ANSI/CGA C-7, Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers.</p> <p>Marking of emergency remote shutdown stations</p> <p>Emergency shutoff valves shall be installed so that the temperature-sensitive element in the valve, or a supplemental temperature-sensitive element [250°F (121°C) maximum] connected to actuate the valve, is not more than 5 ft (1.5 m) from the nearest end of the hose or swivel-type piping connected to the line in which the valve is installed.</p> <p>The [emergency shutoff valve] shutoff device shall be located not less than 25 ft (7.6 mm) or more than 100 ft (30.5 m) in the path of egress from the emergency shutoff valve.</p> <p>An identified and accessible switch or circuit breaker shall be installed at a location not less than 20 ft (6.1 m) or more than 100 ft (30.5 m) from the dispensing device(s) to shut off the power in the event of a fire, accident, or other emergency.</p> <p>Emergency controls shall be conspicuously marked, and the controls shall be located so as to be readily accessible in emergencies.</p> <p>Emergency remote shutdown stations shall be identified as such by a sign incorporating the words "Propane" and "Emergency Shutoff" in block letters of not less than 2 in. (5.1 cm) in height on a background of contrasting color to the letters. The sign shall be visible from the point of transfer.</p> <p>Fixed maximum liquid level gauges shall not be used to determine the maximum permitted filling limit at a low emission transfer site.</p> <p>Caution signs and chock blocks for railcar unloading.</p> <p>Placarding of vehicles transporting cylinders.</p> <p>Painting and Marking Cargo Tank Vehicles.</p> <p>ASME Container Nameplate. Marking of over-the-road general-purpose vehicles powered by LP-Gas.</p>
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	<p>Where containers are to be filled volumetrically by a variable liquid level gauge in accordance with 7.4.3.3 (b), provisions shall be made for determining the liquid temperature.</p> <p>General Location of Cylinders. Cylinders in storage shall be located to minimize exposure to excessive temperature rises, physical damage, or tampering.</p> <p>Cylinders in storage having individual water capacity greater than 2.7 lb. (1.1 kg) [nominal 1 lb. (0.45 kg) LP-Gas capacity] shall be positioned so that the pressure relief valve is in direct communication with the vapor space of the cylinder.</p> <p>Cylinders stored in buildings in accordance with NFPA 58 shall not be located near exits, stairways, or in areas normally used, or intended to be used, for the safe egress of occupants.</p> <p>If empty cylinders that have been in LP-Gas service are stored indoors, they shall be considered as full cylinders for the purposes of determining the maximum quantities of LP-Gas permitted 8.3.1, 8.3.2.1, and 8.3.3.1. Cylinders shall not be stored on roofs.</p> <p>Cylinder valves shall comply with the following:</p> <ul style="list-style-type: none"> (1) Valves of cylinders shall be protected in accordance with NFPA 58 (2) Screw-on-type protecting caps or collars shall be secured in place. (3) The provisions of NGPA 58 shall apply.
<p>6. Security and Access</p>	<p>Public access to areas where LP-Gas is stored and transferred shall be prohibited except where necessary for the conduct of normal business activities.</p>
<p>7. Fire Response</p>	<p>LP-Gas fires shall not be extinguished until the source of the burning gas has been shut off.</p>

Loading and Unloading Procedures

1. Hoses	<p>Hose length, listing, and securing against damage. Hose Inspection.</p> <p>(For marine shipping and receiving only) At the completion of the transfer, and prior to disconnect of the transfer hose or arm, the transfer connection shall be purged of all liquid and depressurized. The liquid and vapor pressure shall be returned either to the vessel or to the shore facility. LP-Gas shall not be vented to the atmosphere</p>
2. Chocks	<p>During the time railroad tank cars are on sidings for loading or unloading, the following shall apply: (2) Wheel chocks shall be placed to prevent movement of the car in either direction.</p> <p>Chock Blocks for Cargo Tank Vehicles. Each cargo tank vehicle and trailer shall carry chock blocks, which shall be used to prevent rolling of the vehicle whenever it is being loaded or unloaded or is parked.</p>
3. Fire extinguisher	<p>Each industrial plant, bulk plant, and distributing point shall be provided with at least one approved portable fire extinguisher having a minimum capacity of 18 lb. (8.2 kg) of dry chemical with a B: C rating. Where fire extinguishers have more than one letter classification, they can be considered to satisfy the requirements of each letter class.</p> <p>Require a fire extinguisher with the same spec. as in NFPA 58 for storage locations and cargo tank vehicles.</p> <p>For marine shipping and receiving only) Medical first aid equipment and fire extinguishers shall be available at the shore facility. This equipment shall be in accordance with the following:</p> <p>(1) Extinguishers shall be ready for use at all times. (2) Emergency equipment shall be positioned and ready to operate prior to the start of the transfer operation. (3) The locations of all fire extinguishers shall be marked and readily accessible.</p>

4. Sources of ignition	<p>Sources of ignition shall be turned off during transfer operations, while connections or disconnections are made, or while LP-Gas is being vented to the atmosphere.</p> <p>Ignition source control for transfers to containers serving agricultural or industrial equipment requiring refueling in the field.</p> <p>Ignition source control for cargo tank vehicles filled directly from railroad tank cars on a private track with nonstationary storage tanks involved.</p> <p>Smoking Prohibition.</p>
5. Personnel	Transfer Personnel.
6. Containers	Cylinders shall be continued in service and transported in accordance with DOT regulations (See 5.2.3 for cylinders filled on site).
	A cylinder with an expired requalification date shall not be refilled until it is requalified by the methods prescribed in DOT regulations (see NFPA 58 for cylinders filled on site).
	Filling and evacuating containers.
	Cargo tank vehicles unloading into storage containers shall be at least 10 ft. (3.0 m) from the container and so positioned that the shutoff valves on both the truck and the container are readily available.
	Cylinders and their appurtenances shall be determined to be leak-free before being loaded into vehicles.
	Cylinders shall be loaded into vehicles with flat floors or equipped with racks for holding cylinders.
	Cylinders shall be fastened in position to minimize the possibility of movement, tipping, and physical damage.
7. Signage	Requirements for railroad tank cars on sidings for loading or unloading.
8. Security and access	Public access to areas where LP-Gas is stored and transferred shall be prohibited except where necessary for the conduct of normal business activities.
9. Fire Response	LP-Gas shall not be extinguished until the source of the burning gas has been shut off.
	Emergency controls shall be conspicuously marked, and the controls shall be located so as to be readily accessible in emergencies.
10. Ammonia contamination	Acceptable levels of ammonia and testing of systems that have been converted from ammonia service.

Maintenance Checklist

This checklist will be completed annually for the propane storage facilities and the most recent inspection will be kept on file. Additionally, the North Carolina Department of Agriculture, Standards Division performs annual inspections of propane bulk plant installations. Copies of the most recent State inspections will also be kept on file. Maintenance manuals for all equipment at the facility shall be kept at the facility and shall be available to maintenance personnel. Maintenance records must be kept for the life of the equipment.

Maintenance Inspection Checklist and Tests for Propane Storage Facilities

I	Construction Code Compliance	Yes	No and Comment
a)	Check manufacturer's data plate. Is it securely attached and legible?		
	For Each storage vessel?		
	On installations with vaporizers, for each vaporizer?		
b)	Is the tank constructed to a minimum 250 psi working pressure (with exceptions as noted in NFPA 58)?		
II	Conditions of Container(s), Vaporizer(s) & Paint	Yes	No and Comment
a)	Are aboveground containers properly painted and free of excessive corrosion?		
	Fixed Storage tanks?		
	On installations with vaporizers, the vaporizers?		
III	Foundations	Yes	No and Comment
a)	Are foundations in good condition?		
b)	Are footings free of settling, which might cause misalignment or piping strain?		
c)	Are containers and vaporizers free of corrosion at masonry contact area?		
d)	Are saddle pads in good condition?		
IV	Tank Fittings	Yes	No and Comment
a)	Are all unused openings plugged or capped?		
b)	Are all ACME (or other type) connectors in good condition with good gaskets and are they plugged or capped?		
c)	Are all fittings and hoses leak free?		

Maintenance Inspection Checklist and Tests for Propane Storage Facilities			
IV	Tank Fittings (cont.)	Yes	No and Comment
d)	Are all hoses marked "for LP-Gas service" with a pressure rating of 350 psig (see NPGA Bulletins # 107-91 and #121-89)?		
e)	Are all hoses properly secured, protected, and in serviceable condition and are dust caps on delivery hoses when not in use?		
f)	Are all hoses free from cuts or abrasions that expose the reinforcing fabric and free from soft spots or bulges when under pressure and without kinks, dents, or flat spots?		
V	Gauges	Yes	No and Comment
a)	Are pressure gauges in good condition and are they suitable for 250 psig service (such as 0-400 psig)?		
b)	Are thermometers in good condition?		
c)	On installations with vaporizers having temperature controls, are they in good condition and have they been tested in accordance with manufacturer's recommendations?		
d)	Are liquid level gauging devices approved for the service involved and in good condition?		
e)	On installations with vaporizers having level control devices, are they in good condition and have they been tested in accordance with manufacturer's recommendations?		
VI	Pressure Relief Valves	Yes	No and Comment
a)	Is the relief valve data legible?		
b)	Do relief valves or vent stacks have protective caps or closures to prevent entry of foreign matter?		
c)	Are weep holes for moisture drainage open and is gas impingement on the container avoided?		
d)	Does external visual inspection of the relief valve indicate no corrosion or obstruction?		
VII	Emergency Shut-off Valves	Yes	No and Comment
a)	Are valves in good condition and do they shutoff tightly?		
b)	Does the emergency shutoff control system function properly?		

Maintenance Inspection Checklist and Tests for Propane Storage Facilities			
VII	Emergency Shut-off Valves (cont.)	Yes	No and Comment
c)	Are the remote shutoff controls installed in an accessible area away from the transfer area?		
d)	Are the shutoff controls clearly identified?		
e)	On installations with vaporizers having automatic shutoff controls, are they accessible, identified and been tested according to manufacturer's recommendations?		
f)	Are the emergency shutoff valves and manual transfer valves on your loading or unloading stations protected from pull away damage in any direction?		
VIII	Presence of Combustibles	Yes	No and Comment
a)	Is the area within 10 ft. of the container(s) and vaporizers free of weeds, long grass, rags, paper, wood, or other combustible debris?		
IX	Piping	Yes	No and Comment
a)	Are connections labeled "liquid" or "vapor," or color-coded?		
b)	Is piping supported and protected from vehicular traffic when necessary?		
c)	Are there visible signs of exterior corrosion?		
X	Valves (for Fixed Storage Tanks and Vaporizers)	Yes	No and Comment
a)	Are valves in good working order?		
b)	Do seats shut off tightly?		
c)	Is packing free of leaks?		
d)	Are necessary valve handles available at the valve location?		
XI	Hydrostatic Relief Valves (for Fixed Storage Tanks and Vaporizers)	Yes	No and Comment
a)	Are valves in working order & not leaking?		
b)	Are the valves fitted with protective caps or pointing in a downward direction?		
XII	Transfer Areas	Yes	No and Comment
a)	Are hoses in good condition and free of deterioration, wear, and blisters? See NPGA Bulletin #114 "Guide to Hose Inspection."		
b)	Are hose couplings properly attached and fully seated on the hose?		

Maintenance Inspection Checklist and Tests for Propane Storage Facilities			
XII	Transfer Areas (cont.)	Yes	No and Comment
c)	Are hose couplings worn or damaged?		
d)	Are coupling gaskets in good condition?		
e)	Is ACME wrenches available?		.
f)	Are emergency shutoff valves (ESV) closing when remote station is activated?		
g)	Is ESV remote actuation identified with a sign?		
h)	Have your fire extinguishers been tested and/or serviced?		
i)	Is adequate transfer hose storage available?		
j)	Are bulkheads located at least 10 feet from the fixed storage tank(s)? If not, are means available to prevent trucks from parking within 10 feet of tanks while loading?		
XIII	Pumps and Compressors	Yes	No and Comment
a)	Are pumps equipped with a by-pass valve where required?		
b)	Is the by-pass valve functioning properly?		
c)	Are drive belts or couplings protected by suitable guards?		
d)	Is the compressor crank case oil at the proper level?		
XIV	Electrical Equipment	Yes	No and Comment
a)	Do all switches, etc. function properly?		
b)	Are all housings explosion-proof as required by NFPA 58?		.

Equipment	Brief description of repair	Date performed

These Maintenance items were last reviewed or inspected by: Name (signature)	Date:

SAFETY INFORMATION

Propane is a gas at normal temperatures and pressures. It is liquefied by storing it in a closed container at pressures higher than its equilibrium vapor pressure. There is a direct relationship between ambient temperature and the pressure inside the storage container. As the ambient temperature increases, the pressure of the container increases proportionately. According to NFPA 58, (a), commercial propane when heated to a temperature of 105° F will produce a pressure of 233 pounds per square inch, absolute (psia). NFPA 58 sets the current maximum allowable working pressure (MAWP) for an ASME tank at 250 pounds per square inch, gauge (psig). This design allows for a maximum vapor pressure of 215 psig at 100° F. The discharge piping for pumps and compressors and vapor piping should have a minimum working pressure set in accordance with NFPA 58. The steel used in design of the storage tank and piping determines the minimum temperatures. Liquid propane (if released at atmospheric pressure) can refrigerate steel pipes and tanks down to temperatures of -44° F.

Another property of propane in its liquid form is its ability for the liquid to greatly expand when heated. Therefore, N.C. G.S. 119 sets the maximum filling capacity of large tanks at 85% to avoid overfilling.

Modern propane bulk plant installations utilize several engineered safety features to minimize the risks associated with propane. These include:

- Break-away piping at loading and unloading stations;
- Excess flow valves at liquid and vapor inlets/outlets;
- Check valves and emergency shutoff valves in loading and unloading liquid and vapor lines;
- Emergency shutoff systems;
- Pressure relief valves;
- Hydrostatic relief valves.
- Automatic activation of Emergency Shut Off Valves (ESV), in the event of a pull away in any direction.

CONTACTS

National Fire Protection Association (NFPA)	(800) 344-3555
National Propane Gas Association (NPGA)	(202) 466-7200
North Carolina Department of Agriculture and Consumer Standards (NCDA & CS).....	(984) 236-4750
North Carolina Propane Gas Association (NCPGA)	(919) 787-8485
North Carolina Petroleum & Convenience Marketers (NCPCM)	(919) 782-4411

**ATTACHED LPG MSDS SHEET
(END O&M PLAN)**

**FSA PLAN WORK SHEET
(circle correct information Based on NFPA 58)**

Facility Type: Bulk Plant Com./Gov./Manf./Inst. Other Farm

Facility Address: _____

Propane Supplier: _____

Location of Facility:	Type of Adjacent Property (or within 250 feet)
Rural/County	Agricultural fields and Agricultural product storage
	Commercial (offices, stores, malls, gasoline stations, etc)
Suburban/County	Metal cutting, welding , metal fabrication
	Petroleum and other Hazardous material storage, wholesale dispensing, etc.
Commercial Area within a City or Town	Residential, Sub-Divisions, Homes, Schools, Hospitals, Daycare, Churches, Jails
Industrial Area within a City or Town	

Special Hazard Exists :(Urban/Congested/Populated) Yes No

TANKS (New) (Existing)

Tank(s) installed in _____
 Painting Needed: YES NO
 Tanks installed on: gravel concrete/asphalt earth steel masonry

PUMPS & PIPING

Piping from tanks to pumps is: aboveground underground
 Piping from pumps to transfer area is: aboveground underground
 Piping is properly I.D. YES NO
 Pumps installed on: concrete/steel pad Gravel Earth

OTHER

Area Lights: YES NO
 Fence and gates installed: YES NO
 Petroleum Stored on Site YES NO

GPS INFO: N: _____ W: _____

Additional Information on the LP-Gas Facility

- LP-Gas liquid supply by: _____ Bobtail _____ Truck Transport _____ Rail Tank Car _____ Barge _____ Ocean Tanker _____ Pipeline
- LP-Gas Distribution by: _____ Bobtail _____ Truck Transport _____ Cylinders _____ Pipeline _____ Dispensing or Vehicle fueling.
- Number of vehicle entrances: _____ One _____ Two _____ More than two

4) Type of access roads to the plant: _____ Rural _____ City or Town _____ Highway
 (One check per line) Entrance 1 _____ Dirt road _____ Gravel road _____ Paved
 (One check per line) Entrance 2 _____ Dirt road _____ Gravel road _____ Paved
 Tank(s) ends (long axis) access points? YES NO
 Ignition Sources in direction of prevailing wind? YES NO

5) Number of rail tracks into the plant _____ None _____ One _____ Two _____ More than two
 6) Staff presence _____ Not staffed _____ Only during transfer operations.
 _ Staffed always (24/7) _____ Only during business hours.
 _ Other (Explain) _____

7) Neighborhood to the Plant: _____ Rural _____ Suburban _____ Urban _____ Central City/Town
 8) Location and distances to High Value Populations surrounding the plant, if any, within 330 ft from the plant boundary in the direction of the assets.

9) Does the Facility have a bottling plant? _____ Yes _____ No
 (If yes provide the following information)
 Average Number of filled/empty cylinders stored on site. _____
 10) Is an overview of the plot plan of the facility attached? _ Yes _____ No

Important data on the closest Fire Departments

A	B	C	D
Item #	Data Item	Nearest Fire Department	Next Fire Department within
1	Type of Fire Department	Volunteer firemen Career firemen	Volunteer firemen Career firemen
2	Distance to the Fire Department from the LP Gas plant gate.	Feet _____ Miles _____	Feet _____ Miles _____
3	Fire Service Capability Class (Based on the Insurance Service Office Public Protection Classification System; ISO	Class 1 through 8 Class 9 Class 10	Class 1 through 8 Class 9 Class 10
4	Number of firefighters on duty at any time.		
5	Number of firefighters with knowledge of and training in LP-Gas properties and fires and who can respond to the emergency in the plant.		
6	Number of available initial fire attack apparatus(with 250 gpm pump, water tank and hose body to initiate fire suppression attack)		
7	Number of Fire Pumpers available in the FD for response to LP-Gas plant emergency or fire. (with 750 gpm pump, water tank and hose body to combat structural and associated fires).		

NOTE The requirements of NFPA 1710 and 1720 for the initial attack on fire include, (1) At least, four firefighters are present before initiating a fire attack, and (2) The fire fighters must work at a minimum of two.
 For fighting a fire in or near a 18,000 gal or a 30,000 gal LP-Gas container the following minimum requirements are to be observed: (1) Two fire pumpers or six initial attack fire apparatus complying with NFPA 1901, (2) A minimum of 12 firefighters, (3) At least, one command officer, (4) At least, one incident safety officer and (5) A minimum of four firefighters whose role are to perform a rescue of one or more firefighters that may be injured during the operation. The ISO-PPC for any Fire Department can be obtained from the ISO's website: <http://www.isomitigation.com>

FD Address: _____

FD Phones & Contacts: _____

Is Local Fire Department trained to handle LPG Fire? YES NO

Local FD Response Time upon alarm notification in minutes? 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 minutes/

Fire Training Evaluation

#	A Evaluated Element	B Question	C D Does the fire services provider meet minimum resources criteria or	
			Yes	No
1	Firefighter training	Are the firefighters who respond to the LP-Gas bulk or industrial plant certified as meeting the NFPA 1001 requirements for Firefighter I or II?		
2	Firefighter training	Is at least one member of each responding crew certified as meeting the NFPA 1001 requirements for Firefighter II?		
3	Firefighter training	Are the firefighters who respond to the LP-Gas bulk or industrial plant certified as Awareness or Operations level requirements of NFPA 472?		
4	Capability & Capacity	Will at least 4 firefighters be present before initiating a fire attack?		
5	Capability & Capacity	Will the alarm assignment include at least 12 firefighters, an incident safety officer, and incident commander, and 4 firefighters whose only role is to perform a rescue of one or more firefighters who may be injured during the firefighting operations?		
6	Capability & Capacity	Is the Department's apparatus compliant with edition of NFPA 1901 that was adopted at the time of manufacturer?		
7	Capability & Capacity	Is the Fire Department assigned an ISO Property Protection Classification within the range of 1 to 8?		
8	Response Time	Can the 1 st alarm assignment establish a water supply and deploy fire streams within 10 minutes of an immediate notification of a LP-Gas release or fire?		

Evaluation of Water Availability in or Near the LP-Gas Plant

Water flow rates needed for fire:

6.5 K Tank: 71.3 gpm,

9.2 K Tank: 98.8 gpm,

12 K Tank: 123.8 gpm,

18.0 K Tank: 145.0 gpm,

30 K Tank: 201.3 gpm

Estimate 250 gpm for other cooling water if needed?

TOTAL WATER NEEDED: _____

A Item #	B Water Available from	C YES	D NO	E Quantitative information		
1	Municipal supply or by another piped-in supplier through one or more fire hydrants in or near the plant			Hydrant data	Distance from Plant gate (feet)	Available water flow rate ⁽¹⁾ (gpm)
				Hydrant 1		
				Hydrant 2		
				Hydrant 3		

2	A nearby large water source (stream, pond, lake, etc)			Distance to the water source = Feet _____ Miles _____	
3	Only through mobile water tanks either by the FD or through other contractual arrangements.				
	Evaluated Element	Question		Is the water supply adequate	
				Yes	No
4	Fire Flow	Is a sufficient fire flow available from either a public or private water supply system or by use of mobile water supply apparatus to maintain a minimum 10 minute demand duration?			

Types of Occupancies Near or Surrounding the LP-Gas Plant

Type of Occupancies	Exists within the hazard distance from the Facility ⁽²⁾ ?	
	Yes	No
Assembly Occupancies (Places of worship, Libraries, Theaters and Auditoriums, Food or Drink Bars, Sports Stadiums, Amusement Parks, Transportation Centers, etc.).		
Institutional Occupancies (Elderly Persons Home or Nursing Home, Hospitals, Alcohol & Drug Rehabilitation Centers, Prisons,		
Educational Occupancies (Elementary Schools, Day Care facilities, etc)		

NOTE: (2) Within 250 feet from the container or the transfer point in the direction of the Occupancy group of interest.

Exposure to LP-Gas Plant from External Hazards

A	B	C	D	
Item #	Type of Neighboring Operation		Hazard DOES exist to LP-Gas Plant	
			YES	NO
1	Petroleum and other hazardous material storage, wholesale			
2	Metal cutting, welding , and metal fabrication			
3	Industrial Manufacturing that can pose			
4	Ports, rail yards and trans-shipment terminals handling			
5	Other operations that may pose hazards (Gasoline and other hazardous material dispensing stations,			

Electrical (overhead) Lines Location:

Separation Distances between Points of Transfer and other Exposures

A #	B Type of Exposure within or outside the facility Boundary	C Check if exposure is present	D Minimum Distance (ft)	E F Is the Facility compliant?		G NFPA 58 Section Reference
				Yes	No	
1	Buildings, mobile homes, recreational vehicles, and modular homes with fire-resistive walls		10			Table 3.2.3.3
2	Buildings with other than fire resistive walls		25			
3	Building wall openings or pits at or below the level of the point of transfer		25			
4	Line of adjoining property that can be built		25			
5	Outdoor places of public assembly, including school yards, athletic fields, and playgrounds		50			
6	From points of transfer, Public ways, including in LP-Gas dispensing public streets, stations and at vehicle highways, fuel dispensers, thoroughfares, sidewalks.		10			
	From other points of transfer		25			
7	Driveways		5			
8	Mainline railroad track centerlines		25			
9	Containers other than those being filled		10			
10	Flammable and Class II combustible liquid dispensers and aboveground and underground containers		20			Table 3.2.3.3 & 3.2.2.6 (E)
11	LP-Gas dispensing device located close to a Class I liquid dispensing device.		10			3.9.4.3

FSA	Person or Position Assigned Responsibility
Safety Information	
Operating Maintenance Procedures	
Training	

Process Safety Information: Propane		
Item	Description	
Maximum Intended Inventory, Tank Sizes	_____gallons 1) 30K___ 2)18K___ 3)10K___ 4)4K___ 5)2K___ 6)1K___ -	
Nominal Water Capacity of Largest Tank-		
Temperature	Upper: ambient max 110° F	
	Lower: ambient min -15° F	
Pressure	Upper: 240 psi @ 110° F	
	Lower: 35 psi @ 35° F	
Flow Rate	Loading: 100 GPM (max)	
	Unloading: 265 GPM (max)	
Vapor Piping	250 psig	
Liquid Piping	350 psig	
Safety Relief Valves (press.)	YES	NO
Excess Flow Valves	YES	NO
Liq./Vapor in & outlets		
Emergency Shutoff Valves	YES	NO
Liq./Vapor in & outlets		
Hydrostatic Relief Valve	YES	NO
Pump 1	YES	NO
Pump 2- OTHER		
Compressor 1	YES	NO
Vaporizer	YES	NO
Strainer(s)	YES	NO
Check Valves Liq./Vapor in & outlets	YES	NO
Sight flow Indicator	YES	NO
Tank Level Indicator	YES	NO
Tank Temperature Indicator	YES	NO
Tank Pressure Indicator	YES	NO
Other Temperature Indicators	YES	NO
Other Pressure Indicators	YES	NO

Hazard Review Checklist			
Siting		Yes/No/NA	Comments
1.	Does the arrangement of your fixed storage tanks conform to the minimum distances allowed in NFPA 58		
2.	Are your fixed storage tanks separated from any oxygen or hydrogen storage by the minimum distances given in NFPA 58		
3.	Are your transfer points separated from the exposure points by the minimum distances given in NFPA 58		
Piping, Equipment & Container Appurtenances		Yes/No/NA	Comments
1.	Is your storage facility designed according to ASME code for pressure vessels?		
	Fixed storage tank ASME?		
	Vaporizers ASME?		
2.	Is the pressure rating of your storage tanks appropriate for the product in service?		
	Storage tanks UL Rated?		
	Vaporizers UL Rated?		
3.	Is the stored product properly identified?		
4.	On installations with multiple tanks, are the elevations of your storage tanks arranged to prevent unintentional overfilling of the lowest container?		
5.	On installations with stairways or ladders, are they well anchored, supported and of slip-proof construction?		
6.	On installations with stairways or ladders, are railings provided and in good condition?		
7.	On installations with stairways or ladders, are catwalks provided so personnel need not walk on any portion of the container?		
8.	Is your piping designed according to NFPA 58		
	Are your pump and compressor discharge and liquid transfer lines suitable for a working pressure of 350 psi?		
	Is your vapor piping suitable for a working pressure of 250 psi?		
	On installations with vaporizers, are your vaporizers designed according to of NFPA 58		

Piping, Equipment & Container Appurtenances		Yes/No/NA	Comments
10.	Is the capacity of your pressure relief devices designed according to of NFPA 58 <i>Have devices been TESTED?</i>		
11.	Do you have appropriate level gauges, temperature indicators, and pressure gauges installed on your fixed ASME storage tanks as specified in NFPA 58		
12.	Do you have the appropriate hydrostatic relief valves installed between every section of liquid piping which can be blocked by manual or automatic valves according to NFPA 58		
13.	Do you have the appropriate corrosion protection required by NFPA 58		
14.	On installations with pumps, are they installed according to NFPA 58		
	On installations with automatic bypass valves, are they installed on the discharge of your pump according to NFPA 58		
15.	On installations with compressors, are they installed according to NFPA 58.		
	On installations with compressors, is there either an integral means of preventing liquid from entering the compressor or a liquid suction protection trap according to NFPA 58		
16.	Do your compressor and pump motors conform to NFPA 58		Compressor and pump motors conformed to NFPA-58 at time of installation and have passed annual State inspections.
17.	On installations with liquid strainers, are they installed on the suction of your pump or meter according to NFPA 58, & is capable of being clean		
18.	On installations with flexible connections on pumps, compressors or loading and unloading bulkheads, are they installed as specified under NFPA 58		Installations conformed to NFPA-58 at time of installation and have passed annual State inspections.

Piping, Equipment & Container Appurtenances		YES/NO/NA	Comments
19.	Do you have either excess flow valves, backflow check valves or internal valves as specified by NFPA 58		
20.	Do you have container appurtenance protection as specified in NFPA 58		
21.	Do you have manual valves and emergency shutoff valves as required by NFPA 58		
22.	On installations with vaporizing equipment, is it installed according to NFPA 58		Installations conformed to NFPA-58 at time of installation and have passed annual State inspections. Vaporizers installed in _____.
	Have the liquid traps, temperature controls, and interlocks been tested per the manufacturer's guidelines?		
23.	On installations with regulators, are they installed according to NFPA 58		
24.	Do you have a breakaway stanchion as required by NFPA 58		
25.	On installations with swivel-type piping, are they installed as required by NFPA 58		
26.	Are all aboveground lines securely fastened to structural members of adequate strength and supported at proper intervals?		
27.	Are pressure gauges located so that they will not be exposed to physical damage?		
28.	Are there sufficient lines for all purposes, without improper dual use of make-shift connections being used for some operations?		
29.	Are hoses the correct type for each use?		
30.	Are hose couplings of the correct type and properly attached (fully seated on the hose)?		
31.	Is adequate transfer hose storage provided?		Keep Hose Off Ground
32.	Are the written transfer, loading and unloading instructions available?		Note CETP NFPA 58 Chapter 15
Human Factors		Yes/No/NA	Comments
1.	Have your operators been trained on the written operating instructions for this propane storage facility?		Operators will be trained by CETP and/or NFPA 58.
2.	For operators on the job before July 1, 2001, do they have the required knowledge, skills, and ability to perform their duties safely?		
Human Factors		YES/NO/NA	Comments

3.	Do your operators whose job duties require the use of the above listed equipment understand the operating limits of the system in regards to:		Refresher Training Needed
	Level?		
	Pressure?		
	Temperature?		
	Adverse Weather or Natural Conditions?		
4.	Have your operators been trained in the correct response to conditions, which exceed the operating limits of the system?		May work with Local Fire Department Needs Refresher Training
5.	Have your operators been trained in their duties under emergency conditions?		Operators will be trained for duties under emergency conditions.
	Fire?		May work with Local Fire Department
	LP Gas Release?		
	Adverse Weather or Natural Conditions?		
6.	Are the written operating instructions available to the operators?		Operators will be provided with copies of operating procedures.
7.	Do the written operating instructions reflect current operation of the facility?		Must Provide (see CETP) and NFPA 58 Chapter 15
8.	Have major modifications to your propane storage facility taken place?		
9.	Are contractors used at the facility?		
10.	Are safe work practices such as lock/tag, hot work and line opening followed at the facility?		Log/Tag procedures are used. Hot work permit procedures not realistic at small self-contained process.
11.	Is there a written emergency response plan?		If required.
			Employees Instructed to Evacuate Facility Immediately
	Is it current?		.
	Have your operators been trained?		
	Do you provide emergency response equipment?		
	Has it been checked?		
General Hazards		Yes/No/NA	Comments
1.	Does your propane storage facility have protection against tampering required by NFPA 58, SECURITY FENCING		
General Hazards		Yes/No/NA	Comments
2.	Does your propane storage facility have lighting as specified in NFPA 58		

3.	Is the area around your containers and transfer piping free of all combustible material?		
4.	Has your facility been required by your local fire authority to provide special protection?		
	Fixed Water Sprays/Monitor Nozzles?		
	Insulating Coatings?		
	Mounding/Burial?		
	Other types?		
5.	Has a federal, state, or local agency or fire authority required:		
	Local Gas Detection Monitors?		
	Perimeter Gas Monitors and Public Alarms?		
I.	Container Connections	Yes/No	Comment
a)	Have excess flow and back flow check valves been recently checked for proper operation?		
II.	Tank Fittings	Yes/No	Comment
a)	Are all ACME (or other type) connectors in good condition with good gaskets and are they plugged or capped? (See NPGA Bulletin #134 "Care and Inspection of ACME Threaded Hose Couplings.")		
b)	Are all unused openings plugged or capped?		
c)	Are all fittings and hoses leak free?		
d)	Are all hoses marked "for LP-Gas service" with a pressure rating of 350 psig (see NPGA Bulletins # 107- 91 and #121-89)?		
e)	Are all hoses properly secured, protected, and in serviceable condition and are dust caps on delivery hoses when not in use?		
f)	Are all hoses free from cuts or abrasions that expose the reinforcing fabric and without kinks, dents, or flat spots?		
III.	Gauges	Yes/No	Comment
a)	Are pressure gauges in good condition and are they suitable for 250 psig service (such as 0-400 psig)?		
b)	Are thermometers in good condition and checked for accuracy?		
c)	On installations with vaporizers having temperature controls, are they in good condition and have they been tested in accordance with manufacturer's recommendations?		
d)	Are liquid level gauging devices approved for the service involved and in good condition?		

IV.	Gauges	Yes/No	Comment
e)	On installations with vaporizers having level control devices, are they in good condition and have they been tested in accordance with manufacturer's recommendations?		
V.	Emergency Shut-off Valves	Yes/No	Comment
a)	Are valves in good condition and do they shutoff tightly?		
b)	Does the emergency shutoff control system function properly?		
c)	Are the remote shutoff controls installed in an accessible area away from the transfer area?		
d)	Are the shutoff controls clearly identified?		
e)	On installations with vaporizers having automatic shutoff controls, are they accessible, identified and been tested according to manufacturer's recommendations?		
f)	Are the emergency shutoff valves and manual transfer valves on your loading or unloading stations protected from pull away damage by a break-away-stanchion?		
VI.	Presence of Combustibles	Yes/No	Comment
a)	Is the area within 10 ft. of the container(s) and vaporizers free of weeds, long grass, rags, paper, wood, or other combustible debris?		
VII.	Pipe (for fixed storage tanks & Vaporizers)	Yes/No	Comment
b)	Are there sufficient lines for all purposes, without dual use, or are make-shift connections being used for some purposes?		
c)	Are connections labeled "liquid" or "vapor"?		COLOR CODE USED
d)	Are there visible signs of exterior corrosion?		
VIII.	Valves (for Fixed Storage Tanks and Vaporizers)	Yes/No	Comment
a)	Are valves in good working order?		
b)	Are necessary valve handles available at the valve location?		
IX.	Hydrostatic Relief Valves (for Fixed Storage Tanks and Vaporizers)	Yes/No	Comment
a)	Are valves in good working order and not leaking?		
b)	Are the valves fitted with protective caps?		
c)	Are the valve discharges positioned to avoid impinging gas on the tank?		
XI.	Transfer Areas	Yes/No	Comment
a)	Are hoses in good condition and free of deterioration, wear, and blisters? See NPGA Bulletin #114 "Guide to Hose Inspection."		

XII.	Transfer Areas	Yes/No	Comment
b)	Are hoses capped or plugged when not in use? Not in code.		
c)	Are hose couplings properly attached and fully seated on the hose?		
d)	Are hose couplings worn or damaged?		
e)	Is mesh filter in hose ends?		
f)	Are coupling gaskets in good condition?		
g)	Are correct coupling wrenches available?		
h)	Are excess flow valves operating correctly?		
i)	Are the loading and unloading risers protected from traffic?		
j)	Are chock blocks provided for trucks?		
k)	Have your fire extinguishers been tested and/or serviced?		
l)	Is adequate transfer hose storage available?		
m)	Are the written transfer instructions readily available?		See O&M
XIII.	Pumps and Compressors	Yes/No	Comment
a)	Are pumps equipped with a spring-loaded by-pass valve where required?		
b)	Are drive belts or couplings protected by suitable guards?		
XIV.	Electrical Equipment	Yes/No	Comment
a)	Are all housings properly assembled to maintain seal?		

Inspected By:	Inspection Date:

NOTES:
