Minnesota State Department of Public Safety

State Fire Marshal Division

444 Cedar Street, Suite 145, St. Paul, Minnesota 55101-5145
Phone: 651/201-7200 FAX: 651/215-0525 TTY: 651/282-6555
Internet: http://www.fire.state.mn.us.

Alcohol & Gambling Enforcement

Bureau of Criminal Apprehension

Capitol Security

Crime Victim Services

Driver & Vehicle Services

Emergency Management / Emergency Response Commission

State Fire Marshal / Pipeline Safety

State Patrol

Traffic Safety

ABOVEGROUND STORAGE TANK PLAN REVIEW INFORMATION SHEET

SECTION 1 – INTRODUCTION

The purpose of this information sheet is to provide a general outline to individuals who conduct aboveground storage tank installation plan reviews. This information sheet does not attempt to cover every code requirement or every situation. As of August, 2002, the Minnesota State Fire Marshal Division no longer conducts plan reviews for aboveground or underground storage tank installations. This responsibility has been given to the local code officials to ensure compliance with Minnesota State Fire Code (MSFC) provisions. The requirements outlined in this information sheet apply only to aboveground storage tank plan review regulations.

The requirements for aboveground flammable/combustible tank installations come from MSFC Chapters 22 and 34, along with National Fire Protection Association (NFPA) Standard 30, *Flammable and Combustible Liquids Code,* 2003 Edition.

Unless specifically exempted by MN Statute 299F.014, Minnesota State Fire Code (MSFC) Chapters 22 and 34 apply to all aboveground storage tank installations. It is important to check with the Minnesota Pollution Control Agency (MPCA) since their rules (7151) take precedence over the MSFC on some issues.

Local jurisdictions may have other guidelines that must also be followed in addition to what is outlined in this document. However, this does not relieve the installer from following the requirements outlined in the 2007 Minnesota State Fire Code.

Applicable MSFC code sections are referenced in brackets [ ].

This information sheet will review the code requirements that are commonly overlooked for flammable/combustible liquid dispensing and storage installations. These regulations apply to both new and existing aboveground storage tanks.

There will be several occasions where this document will reference National Fire Protection Association (NFPA) Standards. The State Fire Marshal Division cannot give this information out free of charge due to copyright laws. All NFPA Standards can be purchased by calling NFPA directly at 800-344-3555 or going on-line to www.nfpa.org.

More information can be obtained by contacting the State Fire Marshal Division at 651-201-7200. E-mail questions to firecode@state.mn.us or visit our web site at www.fire.state.mn.us for the latest information on fire in Minnesota.

Important Definitions:

Combustible Liquid-A liquid having a closed cup flash point at or above 100°F. Combustible liquids shall be subdivided as follows:

Class II. Liquids having a closed cup flash point at or above 100°F and below 140°F.
Class IIIA. Liquids having a closed cup flash point at or above 140°F and below 200°F.
Class IIIB. Liquids having a closed cup flash point at or above 200°F.

Flammable Liquid-A liquid having a closed cup flash point below 100°F. Flammable liquids are further categorized into a group known as Class I liquids. The Class I categories are subdivided as follows:

Class IA. Liquids having a flash point below 73°F and having a boiling point below 100°F.
Class IB. Liquids having a flash point below 73°F and having a boiling point at or above 100°F.
Class IC. Liquids having a flash point at or above 73°F and below 100°F.

Flash Point-The minimum temperature in degrees Fahrenheit at which a liquid will give off sufficient vapors to form an ignitable mixture with air near the surface or in the container, but will not sustain combustion. The flash point of a liquid shall be determined by appropriate testing procedures (if the flash point is in question, review the Material Safety Data Sheets or MSDS for the product).

SECTION 2 – TANK CONSTRUCTION

2.1 Tank Construction

Aboveground storage tanks must be constructed in accordance with Underwriter's Laboratories, Inc. (U/L) in accordance with NFPA 30. **All new and existing tanks must meet one of these standards in order to remain in service.** If it does not, it must be replaced with a tank that does meet this requirement.

> *Exception:*
> The State Fire Marshal Division does allow bulk storage tanks to be reused (relocated from a different site) with the understanding that upon relocation the tanks with be tested by a qualified third party engineer to determine the tanks are structurally sound and in good working order. As specified above, all new tanks that are installed in Minnesota must comply with the UL requirements.

Examples of U/L listed tanks approved for aboveground storage include, but are not limited to the following:

> **U/L Standard 142 Tank (Single-Walled Steel Tank)**
> U/L Standard 142 is a plain single-wall steel tank. A metal plate should be posted on the tank indicating it meets U/L standard 142. There will also be a row of openings on the top for emergency venting, normal venting, filling, and product removal.
>
> **U/L Standard 2080 Tanks (Fire-Resistive Tanks)**
> Aboveground tanks and dispensing operations meeting the criteria of NFPA 30A and the UL 2080 (fire resistive tank) listing criteria are NOT considered to provide equivalent protection to tanks complying with Minnesota State Fire Code (MSFC) "fire protected" tanks. NFPA 30 Section 4.2.9 and NFPA 30A Section 4.3.5 defines Protected Aboveground Tanks as meeting the requirements of UL 2085, *Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids.* UL 2080 tanks are allowed for use within the State of Minnesota, but must comply with the same MSFC requirements as a UL 142 tank.

U/L Standard 2085 (Two-Hour Protected Aboveground Tank)
A U/L Standard 2085 tank is constructed and tested in accordance with U/L 2085 and consists of a primary tank provided with protection from physical damage and fire-resistive protection from a high-intensity liquid pool fire exposure. The tank may provide protection elements as a unit or may be an assembly of components, or a combination thereof. A metal plate should indicate that the tank meets the requirements of Underwriter's Laboratories Standard 2085. This is also a double-walled tank. Similar to the STI F-921 tank, the double-wall exempts it from meeting the secondary containment requirements. For the purpose of the MSFC, all references to Protected Aboveground Tanks shall mean a UL 2085 tank. For more information on testing requirements, refer to Southwest Research Institute (SwRI) Procedure 93-01 as referenced in NFPA 30A Section A.3.3.15.4.

SECTION 3 – DISPENSING INTO MOTOR VEHICLES

Dispensing into motor vehicles must be done in accordance with MSFC (07) Chapters 22 and 34. Furthermore, these two chapters will in some circumstances refer to NFPA 30 for additional requirements.

3.1 Location of Dispenser from Tanks

Tank location from the dispenser must in accordance with MSFC (07) Table 2206.2.3.

Exception:

1. For operations not open to the public and for resort operations serving registered guest only, dispensing of Class I liquids from one tank having a capacity of 560 gallons or less having the dispenser located on or adjacent to the tank is permitted.
2. For operations not open to the public, dispensing of Class II liquids from one tank having a capacity of 1000 gallons or less having the dispenser located on or adjacent to the tank is permitted.
3. Tanks on farms and construction sites are permitted to have the dispenser on top of or adjacent to the tank.

3.1.1 Dispenser Proximity to Buildings and Building Openings

Dispensing devices shall be located as follows:

1. Ten feet (3048 mm) or more from lot lines.
2. Ten feet (3048 mm) or more from buildings having combustible exterior wall surfaces or buildings having noncombustible exterior wall surfaces that are not part of a 1-hour fire-resistance-rated assembly or buildings having combustible overhangs.

   Exception: Canopies constructed in accordance with the *International Building Code* providing weather protection for the fuel islands.
3. Such that all portions of the vehicle being fueled will be on the premises of the motor fuel-dispensing facility.
4. Such that the nozzle, when the hose is fully extended, will not reach within 5 feet (1524 mm) of building openings.
5. Twenty feet (6096 mm) or more from fixed sources of ignition.

3.2 Location of Tanks from Buildings, Property Lines and Combustible Storage

Tank location in relation to buildings on the same property, lot lines that are or can be built upon, opposite sides of public way, minimum distance from public way and tank separation shall conform with MSFC (07) Table 2206.2.3 below.

Table 2206.2.3 - Minimum Separation Requirements for Above-Ground Tanks

Class of Liquid and Tank Type	Individual Tank Capacity (gallons)	Minimum Distance from Nearest Important Building on Same Property (feet)	Minimum Distance from Nearest Fuel Dispenser (feet)	Minimum Distance from Lot Line that is or can be built upon, including the opposite side of a public way (feet	Minimum Distance from Any Side of Public Way (feet)	Minimum Distance Between Tanks (feet)
Class I, II and III protected aboveground tanks	Less than or equal to 6,000	5	25[a]	15	5	3
	Greater than 6,000	15	25[a]	25	15	3
Tanks in vaults	0-20,000	0[b]	0	0[b]	0	Separate compartment required for each tank
Other tanks	All	50	50	100	50	3

For SI: 1 foot = 304.8 mm, 1 gallon = 3.785 L.
a. When approved by the fire chief, dispensing devices are permitted to be installed on top of or adjacent to protected aboveground tanks or tanks in vaults.
b. Underground vaults shall be located such that they will not be subject to loading from nearby structures, or they shall be designed to accommodate applied loads from existing or future structures that can be built nearby.

3.3 Capacity of Tanks

Tanks storing Class I, II or III liquids shall not exceed 12,000 gallons individual capacity or 48,000 gallons aggregate capacity [MSFC (07) Section 2206.2.3 #3].

Installations with the maximum allowable quantity shall be separated from other installations by not less than 100 feet.

3.4 Piping, valves, fittings and ancillary equipment for above-ground storage tanks for Class I, II and IIIA liquids

All piping, valves and ancillary equipment for aboveground storage tank dispensing operations shall comply with the following.

3.4.1 Tank openings

Tank openings for above-ground tanks shall be through the top only.
[MSFC (07 Section 2206.6.2.1]

3.4.2 Fill-pipe connections

The fill pipe for above-ground tanks shall be provided with a means for making a direct connection to the tank vehicle's fuel-delivery hose so that the delivery of fuel is not exposed to the open air during the filling operation. Where any portion of the fill pipe exterior to the tank extends below the level of the top of the tank, a check valve shall be installed in the fill pipe not more than 12 inches (305 mm) from the fill-hose connection.

3.4.3 Overfill protection
Overfill protection shall be provided for above-ground flammable and combustible liquid storage tanks in accordance with MSFC (07) Sections 3404.2.7.5.8 and 3404.2.9.6.6.

3.4.4 Siphon prevention.
An approved anti-siphon method shall be provided in the piping system to prevent flow of liquid by siphon action.

3.4.5 Emergency relief venting
Above-ground storage tanks, tank compartments and enclosed secondary containment spaces shall be provided with emergency relief venting in accordance with Chapter 34.

3.4.6 Spill containers
A spill container having a capacity of not less than 5 gallons (19 L) shall be provided for each fill connection. For tanks with a top fill connection, spill containers shall be noncombustible and shall be fixed to the tank and equipped with a manual drain valve that drains into the primary tank. For tanks with a remote fill connection, a portable spill container is allowed.

3.5 Fuel-dispensing systems for flammable or combustible liquids
The design, fabrication and installation of fuel-dispensing systems for flammable or combustible liquid fuels shall be in accordance with the sections listed below.

3.5.1 Listed equipment
Electrical equipment, dispensers, hose, nozzles and submersible or subsurface pumps used in fuel-dispensing systems shall be listed.

3.5.2 Fixed pumps required
Class I and II liquids shall be transferred from tanks by means of fixed pumps designed and equipped to allow control of the flow and prevent leakage or accidental discharge.

3.5.3 Mounting of dispensers
Dispensing devices except those installed on top of a protected above-ground tank that qualifies as vehicle-impact resistant, shall be protected against physical damage by mounting on a concrete island 6 inches (152 mm) or more in height, or shall be protected in accordance with MSFC Section 312 (or refer to Section 3.8 of this document). Dispensing devices shall be installed and securely fastened to their mounting surface in accordance with the dispenser manufacturer's instructions. Dispensing devices installed indoors shall be located in an approved position where they cannot be struck by an out-of-control vehicle descending a ramp or other slope.

3.5.4 Dispenser emergency valve
An approved automatic emergency shutoff valve designed to close in the event of a fire or impact shall be properly installed in the liquid supply line at the base of each dispenser supplied by a remote pump. The valve shall be installed so that the shear groove is flush with or within 1/2 inch (12.7 mm) of the top of the concrete dispenser island and there is clearance provided for maintenance purposes around the valve body and operating parts. The valve shall be installed at the liquid supply line inlet of each overhead-type dispenser. Where installed, a vapor return line located inside the dispenser housing shall have a shear section or approved flexible connector for the liquid supply line emergency shutoff valve to function. Emergency shutoff valves shall be installed and maintained in accordance with the manufacturer's instructions, tested at the time of initial installation and at least yearly thereafter in accordance with MSFC (07) Section 2205.2.2.

3.5.5 Dispenser hose
Dispenser hoses shall be a maximum of 18 feet (5486 mm) in length unless otherwise approved. Dispenser hoses shall be listed and approved. When not in use, hoses shall be reeled, racked or otherwise protected from damage.

3.5.6 Breakaway devices
Dispenser hoses for Class I and II liquids shall be equipped with a listed emergency breakaway device designed to retain liquid on both sides of a breakaway point. Such devices shall be installed and maintained in accordance with the manufacturer's instructions. Where hoses are attached to hose-retrieving mechanisms, the emergency breakaway device shall be located between the hose nozzle and the point of attachment of the hose-retrieval mechanism to the hose.

3.5.7 Fuel delivery nozzles
A listed automatic-closing- type hose nozzle valve with or without a latch-open device shall be provided on island-type dispensers used for dispensing Class I, II or IIIA liquids. Overhead-type dispensing units shall be provided with a listed automatic-closing-type hose nozzle valve without a latch-open device.

Exception: A listed automatic-closing-type hose nozzle valve with latch-open device is allowed to be used on overhead-type dispensing units where the design of the system is such that the hose nozzle valve will close automatically in the event the valve is released from a fill opening or upon impact with a driveway.

3.5.8 Special requirements for nozzles
Where dispensing of Class I, II or IIIA liquids is performed, a listed automatic-closing-type hose nozzle valve shall be used incorporating all of the following features:

1. The hose nozzle valve shall be equipped with an integral latch-open device.
2. When the flow of product is normally controlled by devices or equipment other than the hose nozzle valve, the hose nozzle valve shall not be capable of being opened unless the delivery hose is pressurized. If pressure to the hose is lost, the nozzle shall close automatically.

   Exception: Vapor recovery nozzles incorporating insertion interlock devices designed to achieve shutoff on disconnect from the vehicle fill pipe.
3. The hose nozzle shall be designed such that the nozzle is retained in the fill pipe during the filling operation.
4. The system shall include listed equipment with a feature that causes or requires the closing of the hose nozzle valve before the product flow can be resumed or before the hose nozzle valve can be replaced in its normal position in the dispenser.

3.6 Gravity and pressure dispensing
Flammable liquids shall not be dispensed by gravity from tanks, drums, barrels or similar containers. Flammable or combustible liquids shall not be dispensed by a device operating through pressure within a storage tank, drum or container.

3.7 Secondary Containment
An approved secondary containment system shall be provided in accordance with Section 5 unless a double-walled tank is used.

3.8 Vehicle Impact Protection
Vehicle impact protection shall be required when deemed by the code official to be in danger of impact or collision from other objects. It shall be done in accordance with the following [MSFC (07) Section 312.2]:

- Constructed of steel not less than 4 inches in diameter and concrete filled.
- Spaced not more than 4 feet between posts on center.
- Set not less than 3 feet deep in a concrete footing of not less than 15 inches in diameter.
- Set with the top of the posts not less than 3 feet above ground.
- Located not less than 3 feet from the protected object.

3.8.1 Other Barriers
Other vehicle impact objects are permitted in accordance with MSFC (07) Section 312.3. The physical barrier(s) shall be a minimum of 36 inches in height and shall resist a force of 12,000 pounds applied 36 inches above the adjacent ground surface.

3.9 Emergency Shut-off Switch
An approved clearly identifiable and readily accessible emergency disconnect switch shall be provided on-site at an approved location, to stop the transfer of fuel to the dispensers in the event of a fuel spill or other emergency. Travel to another location or property to contact emergency personnel is not permitted. The sign shall read "EMERGENCY FUEL SHUTOFF". The disconnect switch must be located within 100 feet, but not less than 20 feet from the fuel dispensers. If the fueling facility has 24-hour dispensing, the emergency shut-off switch must be located outside so it is accessible at all times should the store not be open for business at all hours.

3.10 Fire Extinguishers
Approved portable fire extinguishers shall be provided in accordance with MSFC (07) Section 906 and NFPA 10 (2002 Edition). The fire extinguisher shall have a minimum rating of 2-A:20-B:C and shall be located such that an extinguisher is not more than 75 feet from the pumps. If the fueling facility has 24-hour dispensing, the extinguisher must be located outside so it is accessible if the store is closed. Fire extinguisher servicing companies will be able to assist in determining the appropriate location.

3.11 Hazard Identification Signs
Visible hazard identification signs as specified in NFPA 704 (2001 Edition) for the specific material contained shall be placed on stationary containers and aboveground tanks and at entrances to locations where hazardous materials are stored, dispensed, used or handled and at specific entrances and locations designated by the code official [MSFC (07) Section 2703.5]. Additional information can be obtained by reviewing the last few pages of this document under "Fire Properties of Common Liquids" for appropriate hazard identification markings.

3.12 Overfill Prevention
Aboveground tanks shall not be filled in excess of 95 percent of their capacity. An overfill prevention system shall be provided for each tank. During tank filling operations, the system shall comply with one of the following [MSFC (07) Section 3404.2.9.6.6]:

1.) The system shall:
   1.1. Provide an independent means of notifying the person filling the tank that the fluid level has reached 90 percent of tank capacity by providing an audible or visual alarm signal, providing a tank level gauge marked at 90 percent of tank capacity, or other approved means; and
   1.2. Automatically shut off the flow of fuel to the tank when the quantity of liquid in the tank reaches 95 percent of tank capacity. For rigid hose fuel-delivery systems, an approved means shall be provided to empty the fill hose into the tank after the automatic shutoff device is activated.

2.) The system shall reduce the flow rate to not more than 15 gallons per minute (0.95 L/sec) so that at the reduced flow rate, the tank will not overfill for 30 minutes, and automatically shut off flow into the tank so that none of the fittings on the top of the tank are exposed to product because of overfilling.

3.13 Leak Detection Device
Where remote pumps are used to supply fuel dispensers, each pump shall have installed on the discharge side a listed leak detection device that will detect a leak in the piping and dispensers and provide an indication at an approved location [MSFC (07) Section 2205.2.3].

3.14 Warning Signs
Warning signs shall be conspicuously posted within sight of each dispenser in the fuel-dispensing area and shall state the following:

1. No smoking.
2. Shut off motor.
3. Discharge your static electricity before fueling by touching a metal surface away from the nozzle.
4. To prevent static charge, do not reenter your vehicle while gasoline is pumping.
5. If a fire starts, do not remove nozzle—back away immediately.
6. It is unlawful and dangerous to dispense gasoline into unapproved containers.
7. No filling of portable containers in or on a motor vehicle. Place container on ground before filling.

3.15 Clearance from Combustible Materials
All weeds, grass, brush, trash and other combustible materials shall be kept a minimum of 10 feet from fuel-handling equipment [MSFC (07) Section 2205.7].

3.16 Dispenser Operating Instructions
Dispenser operating instructions must be conspicuously posted in approved locations on each dispenser [MSFC (07) Section 2204.2.3]

3.17 Supervision of Dispensing
The dispensing of fuel at service stations shall be conducted by a qualified attendant or shall be under the visual supervision of a qualified attendant at all times or it must meet the requirements for an unattended self-service station in Section 3.22 [MSFC (07) Section 2204.2.4].

3.18 Unattended Self-Service Stations
Where approved by the code official, unattended self service stations are allowed. As a condition of approval, the owner/operator of the site shall be accountable for daily site visits, regular equipment inspection and maintenance. Unattended self-service stations must also comply with applicable requirements outlined in Sections 3.1 through 3.18 of this information sheet.

3.18.1 Emergency Procedures
At unattended self-service stations, an approved emergency procedures sign is required and shall be posted in a conspicuous location and shall read:

IN CASE OF FIRE, SPILL OR RELEASE
1. USE EMERGENCY PUMP SHUT-OFF
2. REPORT THE ACCIDENT!
3. FIRE DEPARTMENT TELEPHONE NO._____
4. FACILITY ADDRESS _____

3.18.2 Communications
A telephone not requiring a coin to operate or other approved, clearly identified means to notify the fire department shall be provided on-site in a location approved by the code official. Travel to another location or property to contact emergency personnel is not permitted.

3.18.3. Quantity Limits
Dispensing equipment used at unsupervised dispensing stations shall comply with one of the following:

1. Dispensing devices shall be programmed or set to limit uninterrupted fuel delivery up to 25 gallons and require manual action to resume delivery.
2. The amount of fuel being dispensed shall be limited in quantity by a preprogrammed card as approved.

3.19 Electrical Equipment and Wiring
All electrical equipment and wiring for aboveground storage tank installations shall conform to the requirements of the Minnesota State Electrical Code.

3.20 Dispensing into portable containers
The dispensing of flammable or combustible liquids into portable approved containers shall comply with the sections listed below [MSFC (07 Sections 2204.4 – 2204.4.3].

3.20.1 Approved containers required
Class I, II and IIIA liquids shall not be dispensed into a portable container unless such container is of approved material and construction, and has a tight closure with screwed or spring-loaded cover so designed that the contents can be dispensed without spilling. Liquids shall not be dispensed into portable tanks or cargo tanks.

3.20.2 Nozzle operation
A hose nozzle valve used for dispensing Class I liquids into a portable container shall be in compliance with Section 2206.7.6 and be manually held open during the dispensing operation.

3.20.3 Location of containers being filled
Portable containers shall not be filled while located inside the trunk, passenger compartment or truck bed of a vehicle.

SECTION 4 – STORAGE OF FLAMMABLE/COMBUSTIBLE LIQUIDS

4.1 Tank Construction for Storage of Flammable/Combustible Liquids
Storage of flammable/combustible liquids inside and outside of buildings must comply with MSFC (07) Chapters 27 and 34 along with National Fire Protection Association Standard 30 (2003 Edition). If the storage is indoors and the maximum allowable quantities listed in Table 2703.1.1(1) are exceeded, then MSFC (07) Chapter 34 must also be followed. The tank construction requirements outlined in Section 2 are also applicable.

4.2 Storage of Flammable/Combustible Liquids Inside Buildings
The storage of flammable and combustible liquids in containers and tanks inside buildings shall comply with MSFC (07) Chapter 27 and Chapter 34, Section 3404. Storage inside buildings must comply with MSFC (07) Table 2703.1.1(1). This Table will outline the maximum allowable quantities (MAQ) that can be within A, B, E, F, I, R and U Occupancies (S and M Occupancies have less stringent guidelines and should follow MSFC (07) Section 2703.11). The amounts given in Table 2703.1.1(1) are the maximum allowable quantities allowed before the facility must comply with the requirements for a hazardous (or 'H-2') occupancy in accordance with the fire and building codes. Please read the footnotes to the Table carefully.

4.2.1 Control Areas

Control areas are spaces within a building and outdoor areas where quantities of hazardous materials not exceeding the maximum allowable quantities in Table 2703.1.1(1) are stored, dispensed, used or handled. Facilities that frequently utilize hazardous materials but do not want to exceed the MAQ can have up to four control areas on a ground floor facility storing the hazardous materials. The advantage of this is a facility can store more hazardous materials without having to upgrade to a hazardous (or 'H') occupancy classification.

For example: MSFC Table 2703.1.1(1) allows 240 gallons of gasoline (I-B Liquid) in a facility as long as it has sprinklers and is stored in approved storage cabinets. If a company wanted to stored more than 240 gallons onsite, but did not want to comply with the requirements for an 'H' Occupancy, they could build up to four control areas on a ground floor each storing the MAQ of 240 gallons. Thus, allowing them to store up to 960 gallons (240 x 4=960) of a Class I-B liquid.

4.2.1.1 Control Area Construction Requirements

In order for a facility to fall under this category, the control area(s) must be separated from other portions of the facility as follows. Control areas shall be separated from other portions of the building and each other by not less than a 1-hour fire barrier constructed in accordance with the 2003 Minnesota State Building Code.

4.2.1.2 Maximum Number of Control Areas per Floor

The maximum number of control areas within a building shall be in accordance with MSFC (07) Table 2703.8.2.2.

4.2.2 Fire Protection

Indoor storage areas of flammable/combustible liquids exceeding the maximum allowable quantities outlined in MSFC (07) Table 2703.1.1(1) shall be equipped with and approved automatic extinguishing system. The design of the system shall not be less than that required for Ordinary Hazard Group 2 with a minimum design area of 3,000 square feet [MSFC (07) Section 2704.5]. Where the materials or storage arrangement are required by other regulations to be provided with a higher level of sprinkler system protection, the higher level of sprinkler system protection shall be provided.

4.2.3 Explosion Control

Indoor storage rooms and areas shall be provided with explosion control in accordance with MSFC (07) Section 911 [MSFC (07) Section 2704.6].

4.2.4 Secondary Containment

Secondary containment shall be provided in accordance with Section 5 unless a double-walled tank is used.

4.2.5 Vehicle Impact Protection

Vehicle protection shall be required when deemed by the code official to be in danger of impact or collision from other objects. Refer to Section 3.8 of this document for more information.

4.2.6 Emergency Isolation Valves

Aboveground tanks with connections located below normal liquid level shall be provided with internal or external isolation valves located as close as practical to the shell of the tank. For liquids that are incompatible with steel, such valves, when external, and their connection to the tank shall be of steel.

4.2.7 Fire Extinguishers
Approved portable fire extinguishers shall be provided in accordance with MSFC (07) Section 906 and NFPA 10 [2002 Edition]. Fire extinguisher servicing companies will be able to assist in determining the location and what type of extinguisher is necessary dependant upon the hazard.

4.2.8 Hazard Identification Signs
Hazard identification signs shall be provided. Refer to Section 3.11 of this document for more information.

4.2.9 Overfill Prevention
Aboveground tanks shall be provided with overfill prevention. Refer to Section 3.12 of this document for more information.

4.2.10 Electrical Equipment and Wiring
All electrical equipment and wiring for aboveground storage tank installations shall conform to the requirements of the Minnesota State Electrical Code.

4.3 Flammable and Combustible Storage Outside of Buildings
The storage of flammable and combustible liquids in containers and tanks shall comply with MSFC (07) Chapter 27 and Chapter 34, Section 3404, along with the applicable requirements of NFPA 30 (2003 Edition).

4.3.1 Separation Distances for Plain Steel Tanks (U/L 142 Tanks)
Tank separation distances for exterior tanks must be in accordance with NFPA 30 (2003 Edition), re-printed below:

		Minimum Distance (ft)	
Type of Tank	**Protection**	**From Property Line that Is or Can Be Built Upon, Including the Opposite Side of a Public Way[1]**	**From Nearest Side of Any Public Way or from Nearest Important Building on the Same Property[1]**
Floating roof	Protection for exposures[2]	½ × diameter of tank	× diameter of tank
	None	Diameter of tank but need not exceed 175 ft	× diameter of tank
Vertical with weak roof-to-shell seam	Approved foam or inerting system[3] on tanks not exceeding 150 ft in diameter[4]	½ × diameter of tank	× diameter of tank
	Protection for exposures[2]	Diameter of tank	× diameter of tank
	None	2 × diameter of tank but need not exceed 350 ft	× diameter of tank
Horizontal and vertical tanks with emergency relief venting to limit pressures to 2.5 psig (gauge pressure of 17 kPa)	Approved inerting system[2] on the tank or approved foam system on vertical tanks	½ × Table 4.3.2.1.1(b) value	½ × Table 4.3.2.1.1(b) value
	Protection for exposures[2]	Table 4.3.2.1.1(b) value	Table 4.3.2.1.1(b) value
	None	2 × Table 4.3.2.1.1(b) value	Table 4.3.2.1.1(b) value
Protected aboveground tank	None	½ × Table 4.3.2.1.1(b) value	½ × Table 4.3.2.1.1(b) value

1. The minimum distance shall not be less than 5 ft.
2. See definition 3.3.35, Protection for Exposures.
3. See NFPA 69, Standard on Explosion Prevention Systems.
4. For tanks over 45 m (150 ft) in diameter, use "Protection for Exposures" or "None," as applicable.

NFPA Table Table 4.3.2.1.1(b)		
Tank Capacity (gallons)	**Minimum distance in feet from property line that is or can be built upon, including the opposite side of a public way**	**Minimum distance in feet from nearest side of any public way or from nearest important building on the same property**
275 or less	5	5
276 to 750	10	5
751 to 12,000	15	5
12,001 to 30,000	20	5
30,001 to 50,000	30	10
50,001 to 100,000	50	15
100,001 to 500,000	80	25
500,001 to 1,000,000	100	35
1,000,001 to 2,000,000	135	45
2,000,001 to 3,000,000	165	55
3,000,001 or more	175	60

4.3.2 Separation Distances for Protected Aboveground Tanks
U/L Standard 2085 protected two-hour tanks shall be separated in accordance with NFPA 30 (2003 Edition). The separation distances from property lines, important buildings and combustible storage can be reduced by ½ versus U/L 142 tanks. Although at no time shall the distance be less than 5 feet.

4.3.3 Secondary Containment
Secondary containment shall be provided in accordance with Section 5 of this document unless a double-walled tank is used.

4.3.4 Vehicle Impact Protection
Vehicle protection shall be required when deemed by the code official to be in danger of impact or collision from other objects. Refer to Section 3.8 of this document for more information.

4.3.5 Emergency Isolation Valves
Aboveground tanks with connections located below normal liquid level shall be provided with internal or external isolation valves located as close as practical to the shell of the tank. For liquids that are incompatible with steel, such valves, when external, and their connection to the tank shall be of steel [MSFC (07) Section 3403.6.7].

4.3.6 Fire Extinguishers
Approved portable fire extinguishers shall be provided in accordance with MSFC (07) Section 906 and NFPA 10 [2002 Edition]. Fire extinguisher servicing companies will be

able to assist in determining the location and what type of extinguisher is necessary dependant upon the hazard.

4.3.7 Hazard Identification Signs
Hazard identification signs shall be provided. Refer to Section 3.11 of this document for more information.

4.3.8 Overfill Prevention
Aboveground tanks shall be provided with overfill prevention. Refer to Section 3.12 of this document for more information.

4.3.9 Electrical Equipment and Wiring
All electrical equipment and wiring for aboveground storage tanks installations shall conform to the requirements of the Minnesota State Electrical Code.

SECTION 5 – SPILL CONTROL AND SECONDARY CONTAINMENT

5.1 Spill Control and Secondary Containment
In accordance with MSFC (07) Section 2704.2.2, any exterior or interior building, room or area that used for storage of hazardous materials that exceeds the maximum allowable quantities outlined in MSFC (07) Table 2703.1.1(1) shall be provided with secondary containment and the individual vessel or the aggregate capacity of multiple vessels exceeds the following:

a. Capacity of an individual vessel exceeds 55 gallons; or,
b. Aggregate capacity of multiple vessels exceeds 1,000 gallons.

5.2 Drainage/Containment Method
The building, room or area shall drain or contain the hazardous materials through one of the following methods [MSFC (07) Section 2704.2.2.1]:

1. Liquid-tight sloped floors or recessed floors in indoor locations or similar areas in outdoor locations.
2. Liquid-tight floors in indoor locations or similar areas in outdoor locations provided with liquid-tight raised or recessed sills or dikes.
3. Sumps and collection system.
4. Drainage system leading to an approved location.
5. Other approved engineered systems deemed acceptable to the code official.

5.3 Indoor Containment Areas
Secondary containment for indoor storage shall be designed to contain a spill from the largest vessel plus the design flow volume of fire protection water calculated to discharge from the fire-extinguishing system over the minimum required system design area or area of the room in which the storage is located. The containment capacity shall be designed to contain the flow for a period of 20 minutes.

5.4 Outdoor Storage Areas
Secondary containment for outdoor storage areas shall be designed to contain a spill from the largest individual vessel. If the area is open to rainfall, the secondary containment shall be designed to include the volume of a 24-hour rainfall as determined by the 25-year storm and provisions shall be made to drain accumulations of ground water and rain water.

5.5 Monitoring of Containment Area
An approved monitoring method shall be provided to detect hazardous materials in the secondary containment system. The monitoring system is allowed to be visual inspection of the primary or

secondary containment, or other approved means. Where the containment area is subject to the intrusion of water, a monitoring method for the detection of water shall be provided.

SECTION 6 – NORMAL AND EMERGENCY VENTING

6.1 Normal Venting

Normal venting requirements must be done in accordance with MSFC (07) Section 3404.2.7.3 and NFPA 30 (2003 Edition). The fumes must be discharged at a safe point at least 12 feet above the adjacent ground level. They shall be so located so that fumes do not get trapped by overhanging eaves or other obstructions and shall be at least 5 feet from building openings or lot lines of properties that can be built upon.

6.2 Emergency Venting

Every aboveground storage tank shall have some form of construction or device that will relieve excess internal pressure caused by exposure fires. Emergency venting must be installed in accordance with NFPA 30 (2003 Edition). The size of the emergency vent is dependant upon the surface area of tank (square feet).

SECTION 7 – OTHER FEATURES FOR ABOVEGROUND STORAGE TANK DISPENSING OR STORAGE

7.1 Additional Features

When required by the local fire chief/fire marshal, a foam fire protection system shall be provided when more than one tank exists on-site, they are less than 50 feet apart, have a liquid surface area in excess of 1,500 square feet and meets one of the following:

1. Used for the storage of Class I or II liquids
2. Used for the storage of crude oil
3. Used for in-process products and is located within 100 feet of an ignition source at a processing plant or petroleum refinery.
4. Considered by the code official as posing an unusual exposure hazard because of topography, nature of occupancy, proximity on the same or adjoining property, height and character of liquids to be stored, degree of private fire protection available (hydrant water pressure, etc.), facilities of the fire department to cope with flammable/combustible liquid fires.

7.2 Elevated Tanks

Tanks elevated more than 12 inches that store Class I, II or IIIA liquids shall have a fire-resistance rating of not less than 2 hours in accordance with the fire exposure criteria specified in ASTM E 1529. There are three exceptions to this regulation:

1. Structural supports tested as part of a protected aboveground tank in accordance with U/L 2085.
2. Stationary tanks located outside buildings when protected by an approved water-spray system designed in accordance with MSFC (07) Chapter 9 and NFPA 15 [2001 Edition].
3. Stationary tanks located inside buildings equipped throughout with an approved automatic sprinkler system designed in accordance with NFPA 13 (2002 Edition).

7.3 Separation requirements for Aboveground Storage Tanks and LPG

Aboveground storage tanks shall be separated by a minimum of 20 feet from propane (LPG) tanks [MSFC (07) Section 3404.2.9.5.3].

7.4 Electrical Equipment and Wiring

All electrical equipment and wiring for aboveground storage tank installations shall conform to the requirements of the Minnesota State Electrical Code.

SECTION 8 – SUMMARY

8.1 Technical Expertise

It is important to note that the requirements for flammable/combustible tank and LP-gas installations are extensive and not possible to condense every code requirement into this information sheet. MSFC (07) Section 104.7.2 allows the code official to seek technical expertise on issues that are beyond his/her knowledge or capabilities. There are several fire consulting companies in the State of Minnesota that are very capable to ensure proper installation requirements. The State Fire Marshal Division is not allowed to recommend or refer individuals to certain companies. For further information please contact the code specialist at the State Fire Marshal Division at firecode@state.mn.us.

8.2 Minnesota Pollution Control Agency

The Minnesota Pollution Control Agency (MPCA) also regulates aboveground storage tanks in excess of 1,100 gallons. The State Fire Marshal Division does not enforce MPCA regulations. Please contact the MPCA at 651-296-6300 for their regulations.

NAME	FLASH POINT (ºF)	BOILING POINT (ºF)	CLASSIF-ICATION	HAZARD I.D. (NFPA 704)		
				H	F	R
Acetaldehyde (Acetic Aldehyde) (Ethanol)	-38	70	IA	3	4	2
Acetone (Dimethyl Ketone) (2-Propanone)	-4	133	IB	1	3	0
Acetyl Chloride (Ethanoyl Chloride)	40	124	IB	3	3	2 W
Acrolein Dimer	118	304	II	1	2	1
Acrylonitrile (Vinyl Cyanide) (Propenenitrile)	32	171	IB	4	3	2
Alcohol – Butyl	98	243	IC	1	3	0
Alcohol – Ethyl	55	173	IB	0	3	0
Alcohol – Isopropyl	53	181	IB	1	3	0
Alcohol – Methyl	52	147	IB	1	3	0
Alcohol – Propyl	74	207	IC	1	3	0
Allyl Alcohol	70	206	IB	4	3	1
Allylamine (2-Propenylamine)	-20	128	IB	4	3	1
Amyl Acetate (1-Pentanol Acetate)	60	300	IB	1	3	0
Amyl Alcohol (1-Pentanol)	91	280	II	1	3	0
Amylene (Pentene)	0	86	IA			
Asphalt (Typical) (Petroleum Pitch)	400+	>700	IIIB	0	1	0
Benzene (Benzol)	12	176	IB	2	3	0
Benzyl Alcohol (Phenyl Carbinol)	200	403	IIIB	2	1	0
Butyl Acetate (Butylethanoate)	72	260	IB	1	3	0
Butyl Acrylate	84	260	IC	2	2	2
Butyl Alcohol (1-Butanol) (Propylacarbinol) (Propyl Methanol)	98	243	IC	1	3	0

H = Health F = Flammability R = Reactivity

NAME	FLASH POINT (°F)	BOILING POINT (°F)	CLASSIF-ICATION	HAZARD I.D. (NFPA 704)		
				H	F	R
Carbon Disulfide (Carbon Bisulfide)	-22	115	IB	3	3	0
Creosote Oil	165	382-752	IIIA	2	2	0
Cumene (Cumol) (2-Phenyl Propane) (Isopropyl Benzene)	96	306	IC	2	3	1
Cyclohexane (Hexahydrobenzene) (Hexamethylene)	-4	179	IB	1	3	0
Denatured Alcohol	60	175	IB	0	3	0
Dibutylamine	117	322	II	3	2	0
Dibutyl Ether (1-Butoxybutane) (Butyl Ether)	77	286	IC	2	3	1
Diesel Fuel Oil No. 1-D	100 Min		II	0	2	0
Diesel Fuel Oil No. 2-D	125 Min		II	0	2	0
Diethylamine	-9	134	IB	3	3	0
Epichlorohydrin (2-Chloropropylene Oxide) (Chloropropylene Oxide)	88	239	IC	3	3	2
Ether-Ethyl	-49	95	IA			
Ethyl Acetate (Acetic Ester) (Acetic Ether) (Ethyl Ethanoate)	24	171	IB	1	3	0
Ethyl Acrylate	50	211	IB	2	3	2
Ethyl Alcohol (Grain Alcohol, Cologne Spirits, Ethanol)	55	173	IB	0	3	0
Ethylamine (Aminoethane)	<0	62	IA	3	4	0
Ethyl Chloride (Chloroethane) (Hydrochloric Ether) (Muriatic Ether)	-58	54	IA	1	4	0

H = Health F = Flammability R = Reactivity

NAME	FLASH POINT (ºF)	BOILING POINT (ºF)	CLASSIF-ICATION	HAZARD I.D. (NFPA 704)		
				H	F	R
Ethylene Dichloride (1,2-Dichloroethane) (Glycol Dichloride)	56	183	IB	2	3	0
Ethylene Glycol	232	387	IIIB			
Ethylene Oxide (Dimethylene Oxide) (1,2-Epoxyethane) (Oxirane)	-20	51	IA	3	4	3
Ethyl Methacrylate (Ethyl Methyl Acrylate)	68	239-248	IB	2	3	0
Ethyl Ether (Diethyl Ether) (Diethyl Oxide) (Ether) (Ethyl Oxide)	-49	95	IA	1	4	1
Formic Acid Butyl Ester Methyl Ester	 64 -2	 225 90	 IB IA			
Fuel Oil No. 1 (Kerosene) (Range Oil) (Coal Oil)	100-162	304-574	II/IIIA	0	2	0
Fuel Oil No. 2	126-204		II/IIIA	0	2	0
Fuel Oil No. 4	142-240		II/IIIA	0	2	0
Fuel Oil No. 6	150-270		II/IIIA	0	2	0
Furan	<32	88	IA			
Gasoline	-45 to -50	100-400	IB	1	3	0
Gasoline 115-145 Octane (Aviation Grade)	-50			1	3	0
Heptane	25	209	IB			
Hexane (Hexyl Hydride)	-7	156	IB	1	3	0
Isopentane	-60	82	IA			
Isopropyl Alcohol (Isopropanol) (Dimethyl Carbinol) (2-Propanol)	53	181	IB	1	3	0
Isopropyl Ether	-18	156	IB			
Isopropylamine	-35	89	IA			

H = Health F = Flammability R = Reactivity

NAME	FLASH POINT (ºF)	BOILING POINT (ºF)	CLASSIF-ICATION	HAZARD I.D. (NFPA 704)		
				H	F	R
Jet Fuels Jet A and A-1 Jet B JP-4	 110-150 -10 to 30 -10	 400-550	 II IB	 0 1	 2 3	 0 0
Kerosene	See fuel Oil No. 1		II			
Linseed Oil, Raw	432	600+		0	1	0
Methyl Alcohol (Methanol) (Wood Alcohol) (Columbian Spirits)	52	147	IB	1	3	0
Methyl Chloride (Chloromethane)	-50	-11	IA	1	4	0
Methyl Ethyl Ether	-35	51	IA			
Methyl Ethyl Ketone (2-Butanone) (Ethyl Methyl Ketone)	16	176	IB	1	3	0
Methyl Isobutyl Ketone	64	244	IB			
Methyl Methacrylate	50	212	IB	2	3	2
Mineral Oil	380	680	IIIB	0	1	0
Mineral Spirits	104	300	II			
Motor Oil	Varies		IIIB			
Naphtha V.M. & P. 50º Flash	50	240-290	IB	1	3	0
Naphtha V.M. & P. High Flash	85	280-350	II	1	3	0
Naphtha V.M. & P. Regular	28	212-320	IB	1	3	0
Nitrobenzene (Nitrobenzol) (Oil or Mirbane)	190	412	IIIA	3	2	1
Nitromethane	95	214	IC	1	3	4
Octane	56	258	IB			
Pentane	-40	97	IA			
Petroleum, Crude, Sweet	20-90			1	3	0
Petroleum Ether (Benzine) (Naphtha, Petroleum)	<0	95-140	IA/IB	1	4	0

H = Health F = Flammability R = Reactivity

NAME	FLASH POINT (°F)	BOILING POINT (°F)	CLASSIF-ICATION	HAZARD I.D. (NFPA 704)		
				H	F	R
Phenol (Carbolic Acid)	175	358	IIIA	4	2	0
Propyl Alcohol (1-Propanol)	74	207	IC	1	3	0
Propylene Glycol	210	370	IIIB			
Propylene Oxide	-35	94	IA	3	4	2
Styrene (Cinnamene) (Phenylethylene) (Vinyl Benzene)	88	295	IC	2	3	2
Tetrahydrofuran (Diethylene Oxide)	6	151	IB	2	3	1
Toluene (Methylbenzene) (Phenylmethane) (Toluol)	40	231	IB	2	3	0
Turpentine	95	300	IC	1	3	0
Vinyl Acetate (Ethenyl Ethanoate)	18	161	IB	2	3	2
Vinyl Ethyl Ether	-50	96	IA			
o-Xylene (1, 2-Dimethylbenzene) (o-Xylol)	90	292	IC	2	3	0

H = Health F = Flammability R = Reactivity