



the Energy to Lead

Installation Guidance: CNG Refueling Stations

Gas Technology Institute

> Delaware Valley Regional Planning Commission
(DVRPC) Webinar

Gas Technology Institute (GTI) Overview

Natural Gas Research and Development Focus

- > Established in 1941
- > Staff of ~300
- > 350 active projects
- > 1,200 patents; 500 products



Gas Technology Institute (GTI) Barrier Reduction Grant – US Dept. of Energy

GTI and Lake Michigan Consortium created webinars on important alternative fuel topics:

- Inspection Guidelines for CNG/LPG Vehicle Conversions
- Considerations for Garage & Maintenance Shops When Using CNG/LPG
- Station Installation Guidelines for CNG
- Station Installation Guidelines for LPG
- Best Practices for End Users for CNG, LPG & Electric Vehicles



Presentations are available on Chicago, SSCC, and WI Clean Cities websites

Objectives

- A. CNG Fuel
- B. Fueling Basics
- C. Codes and Standards
- D. Station Basics
- E. Equipment Location
- F. Electrical Hazardous Area Classification
- G. Station Installation
- H. Station Operation & Fire Protection

CNG Fuel

- CNG or Compressed Natural Gas is predominately Methane (chemical formula CH_4).
- It is a nontoxic, colorless, and odorless gas (odorant is typically added for detection).
- Natural Gas typically exists in a gaseous vapor form.
- Unlike gasoline, diesel, or propane; natural gas is **lighter than air**.
- 5.66 lbs (~125 SCF) of natural gas is a Gasoline Gallon Equivalent (GGE)
 - 6.312 lbs (~139 SCF) is a Diesel Gallon Equivalent (DGE) – Proposal to NIST

CNG Fueling Basics

- Nominal pressure of CNG fuel systems in the U.S. have been standardized to 3600 psig. Older 3000 psig systems have largely been phased out.
- CNG fuel tanks are allowed to be filled to 3600 psig at 70° F (settled pressure), and no more than 4500 psig at any temperature.
- Fueling is either stopped by the dispenser when a temperature compensated full fill pressure is achieved or manually stopped by operator with a switch at the dispenser.

Codes and Standards

CNG Station Codes (current editions listed – NOT PA jurisdiction specific editions):

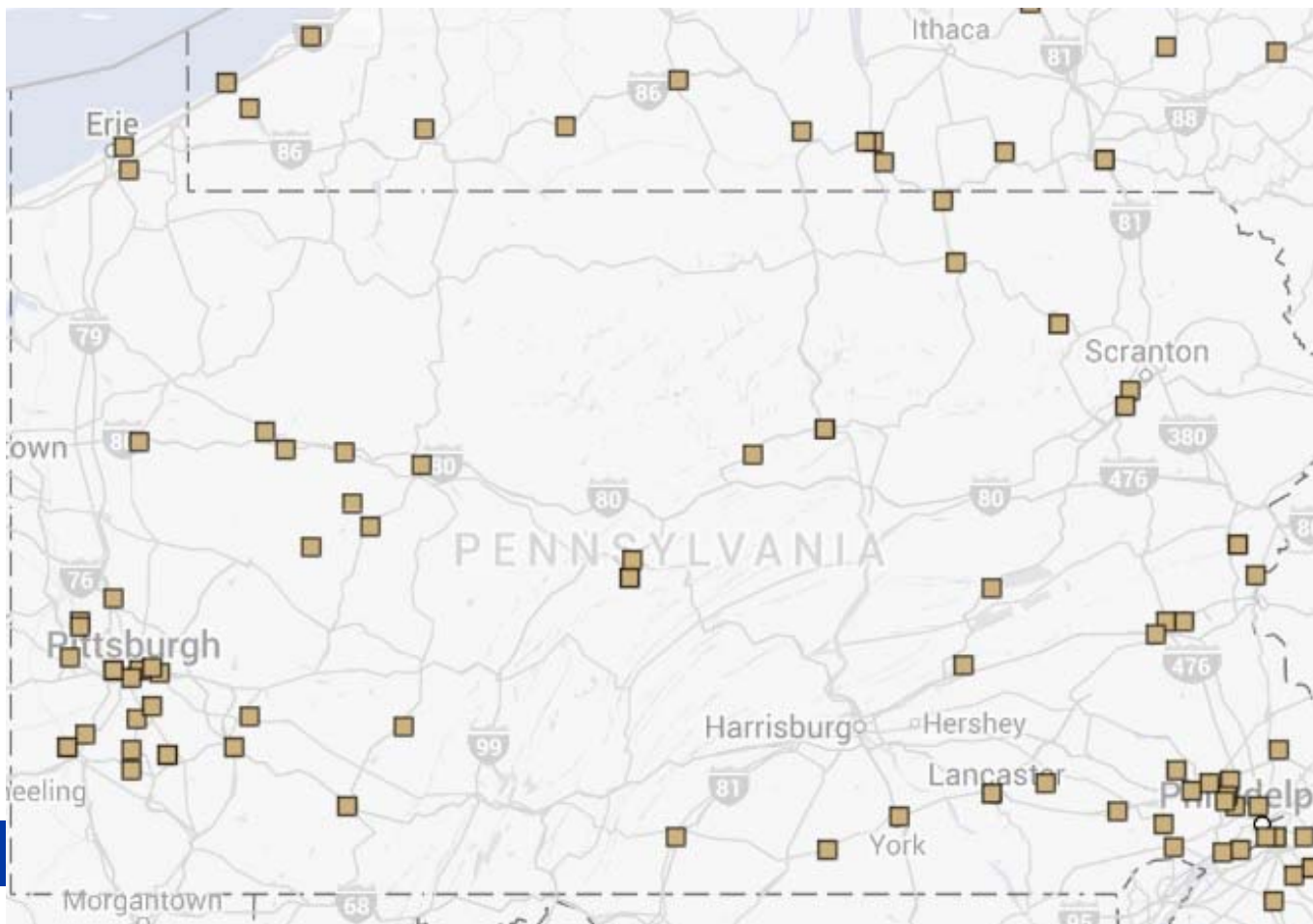
- NFPA 52: Vehicular Gaseous Fuel Systems Code 2013
- NFPA 70: National Electric Code (NEC) 2011:
Article 500: Hazardous (Classified) Locations,
Article 501: Class 1 Div.1 & 2 Hazardous Locations
- NFPA 30A: Code for Motor Fuel Dispensing Facilities and Repair Garages 2012 (Addresses additional requires when CNG fueling is added to existing liquid petroleum station)
- International Fire Code (IFC)

PA Dept. of Environmental Protection (DEP) Guidelines

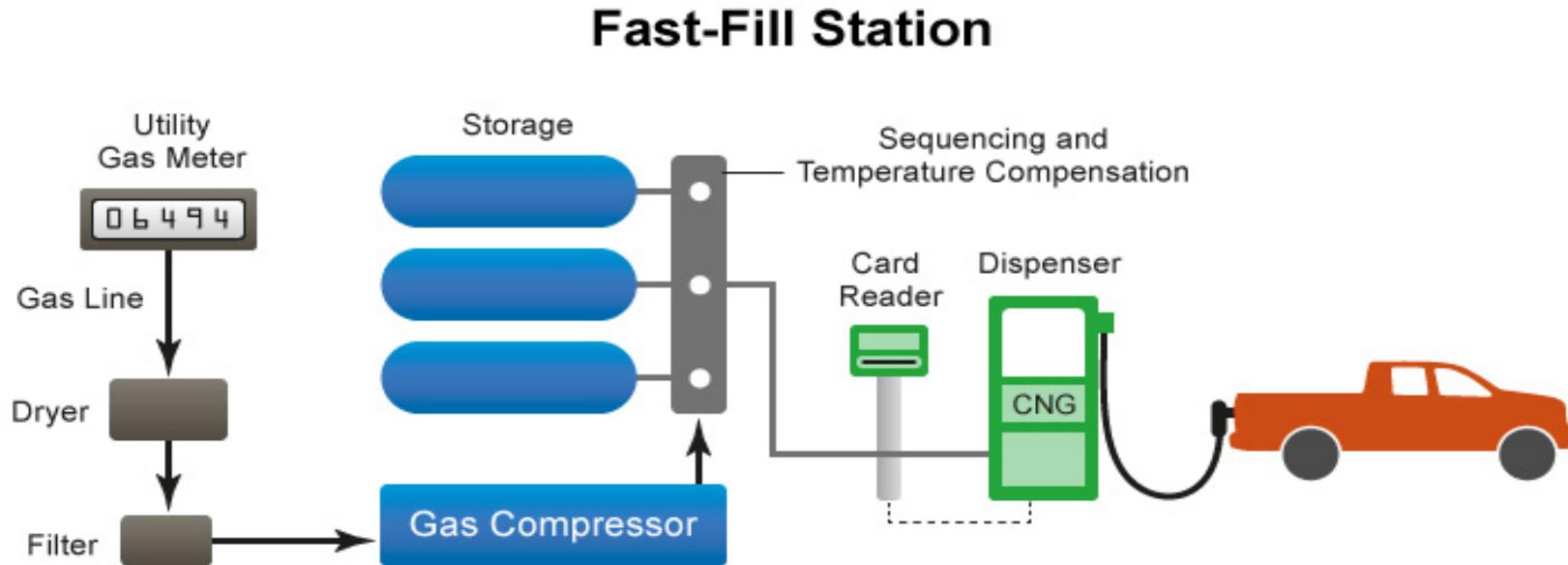
- List of permits to consider (NOT all inclusive):
 - CNG Vehicle Fuel Facility Application to Install
 - CNG Dispenser Registration and Inspection (W&Ms)
 - Alternative Fuel Tax License
 - Highway Occupancy Permit (HOP)
 - Construction Stormwater (Ch 102) and Water Obstruction and Encroachment (Ch 105) permits
 - Air Quality Plan Approval
- Permitting Guide to Building and Operating (CNG) Fueling Stations In Pennsylvania
<http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-95403/0340-FS-DEP4412.pdf>

PA CNG Station Locations

- Public/Private/Planned Stations in PA – 79 currently
 - http://www.afdc.energy.gov/fuels/natural_gas_locations.html

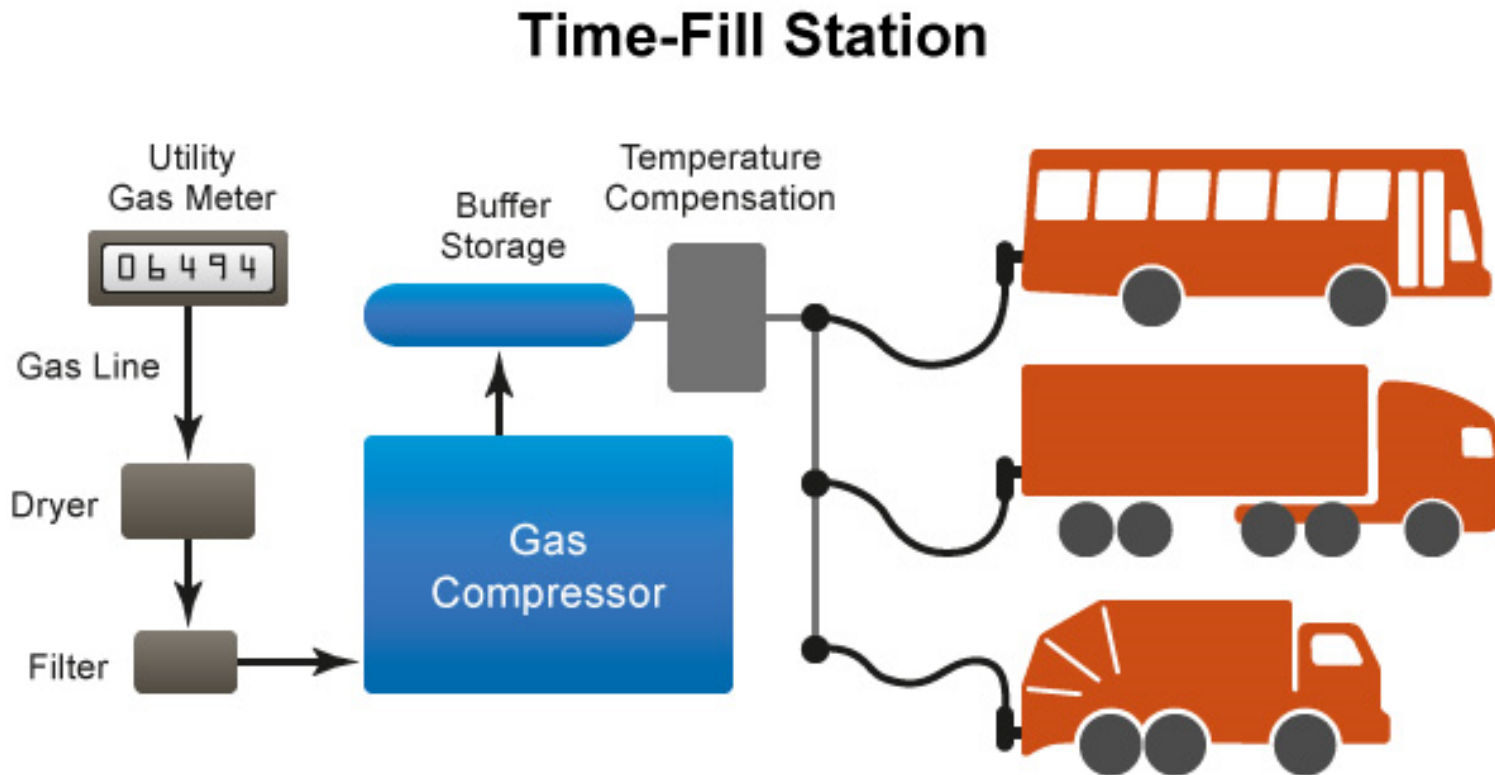


Fast-fill Station Basics



- Dryer required to remove moisture from gas.
- Compressor, Dryer, Metering Devices, and Dispensers: Rated for Hazardous Locations.
- Card Reader System or Fuel Management System to authorize transactions.

Time-fill Station Basics



- Time-fill can lower station costs by reducing compression and storage needs

Station Basics

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Station Basics

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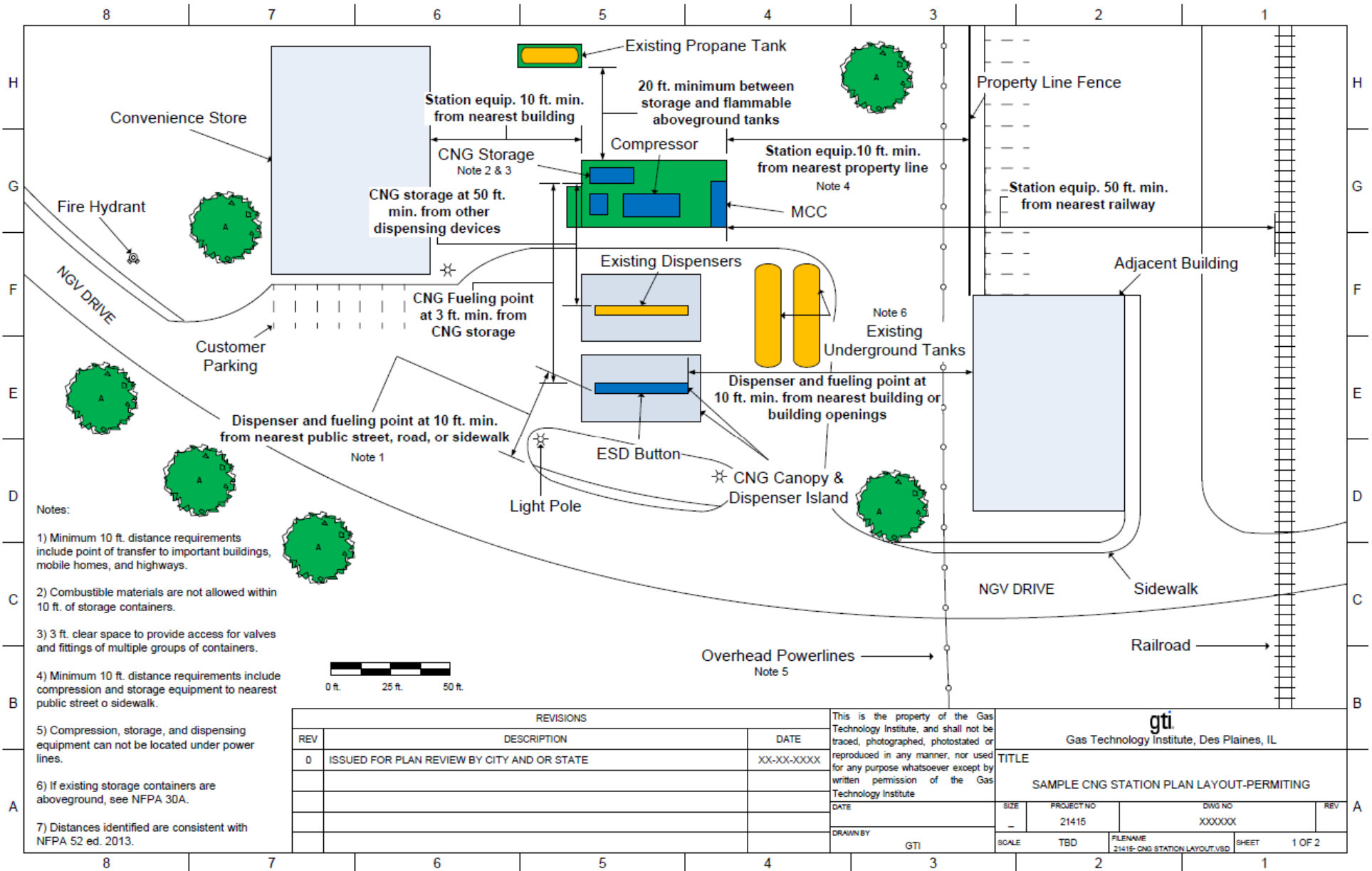


Equipment Location

NFPA 30A, Chapter 12 & NFPA 52, Chapter 7 address equipment placement and set backs.

- Compression, Storage, and Dispensing Equipment are addressed in these chapters.
- Location, either indoors and outdoors, of the equipment matters.
- In some instances a combination of both codes will give guides on final equipment placement e.g. tank separation (from other aboveground fuel tanks & dispenser).

Equipment Location- Sample Layout



REVISIONS		
REV	DESCRIPTION	DATE
0	ISSUED FOR PLAN REVIEW BY CITY AND OR STATE	XX-XX-XXXX

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TITLE
SAMPLE CNG STATION PLAN LAYOUT-PERMITTING

SIZE	PROJECT NO	DWG NO	REV
-	21415	XXXXXX	
SCALE	TBD	FILENAME	SHEET
		21415-CNG STATION LAYOUT.VSD	1 OF 2

Electrical Hazardous Area Location

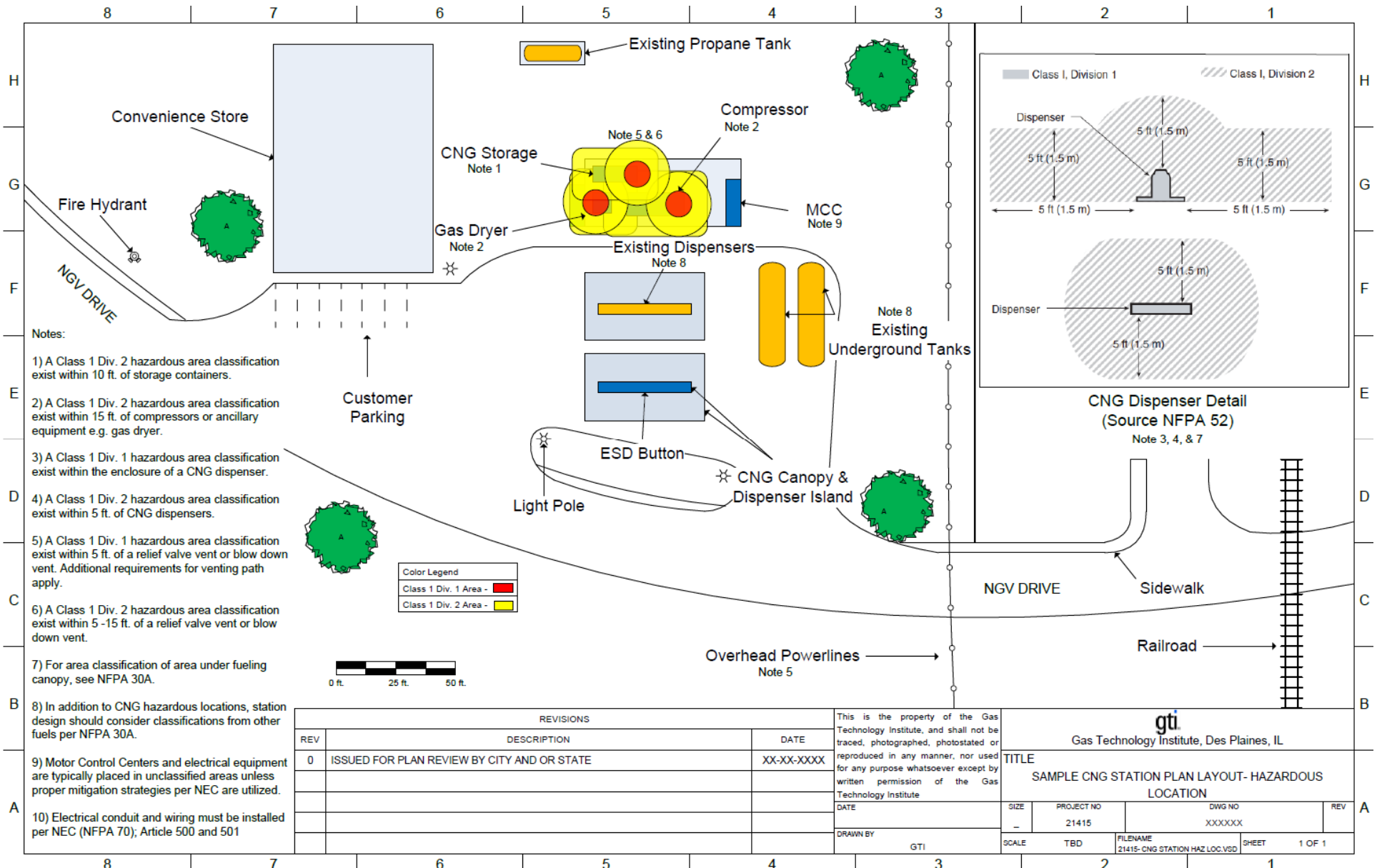
NFPA 30A & NFPA 52 establish electrical area classification for CNG fueling stations.

- Compressors, Aboveground Storage Tanks, Dispensers, Pressure Relief Discharge, Vents and ancillary equipment (dryers) are classified per Table 7.4.2.9 in NFPA 52.

Electrical Conduits and Wiring must be installed per approved methods indicated in NEC for classified areas.

With AHJ approval, classified areas specified in Table 7.4.2.9 are permitted to be reduced or eliminated by positive pressure ventilation from a source of clean air and/or inert gas per NFPA 496.

Electrical Hazardous Area Location



Station Installation - General Requirements

NFPA 52 addresses general site requirements of station construction and installation.

- Major equipment (compression, storage, or dispensers) shall be protected to prevent damage from vehicles and minimize physical damage and vandalism.
- Where compression equipment operates unattended, it shall be equipped with high discharge and low suction pressure automatic shutdown control.
- Control circuits that are shut down shall remain shutdown until manually reset.

Station Installation - General Requirements

NFPA 52 ed. 2013 incorporates new sections emphasizing general requirements of station construction.

- Installation CNG systems shall be supervised by qualified personnel with reference to their construction and use.
- Modifications to fuel stations requires a HAZOP and start up plan completed prior to completion or operation of the facility.
- Compression, storage, and dispensing equipment shall be installed on foundations with anchoring system designed to meeting building code requirements and able to withstand seismic and wind loads.

Station Installation – Storage Containers

- Storage containers are to be installed above ground on stable, non combustible foundations or in vaults with proper ventilation and drainage.
- Individual groups of manifolded ASME vessels without individual storage valves shall be limited to a maximum of 10,000 scf.
- PRVs are to be periodically inspected

Station Installation – Piping/Tubing

- Piping and fittings are to be fabricated, installed, and tested per ASME B31.3, Process Piping Code.
- Exterior piping shall be buried or installed above ground and supported and protected against mechanical damage.
- Underground and aboveground piping shall be protected from corrosion in compliance to recognized practices.
- Threaded pipe and fittings are not allowed underground.

Station Installation- Safety Valves and Devices

- Storage: A manual shutoff valve installed at the outlet of storage.
- Dispenser: Breakaway protection shall be provided in the event of a pull away fuel stops to flow due to separation.
- Dispenser: A quarter turn manual shutoff valve may be required at a fast fill station upstream of the breakaway device.

Station Installation- Emergency Shutdown Device (ESD)

- Manual ESD's are to be installed within the dispensing area and outside of the dispensing area.
- When activated the ESD's should shut off power and gas supply for compressor and dispenser.

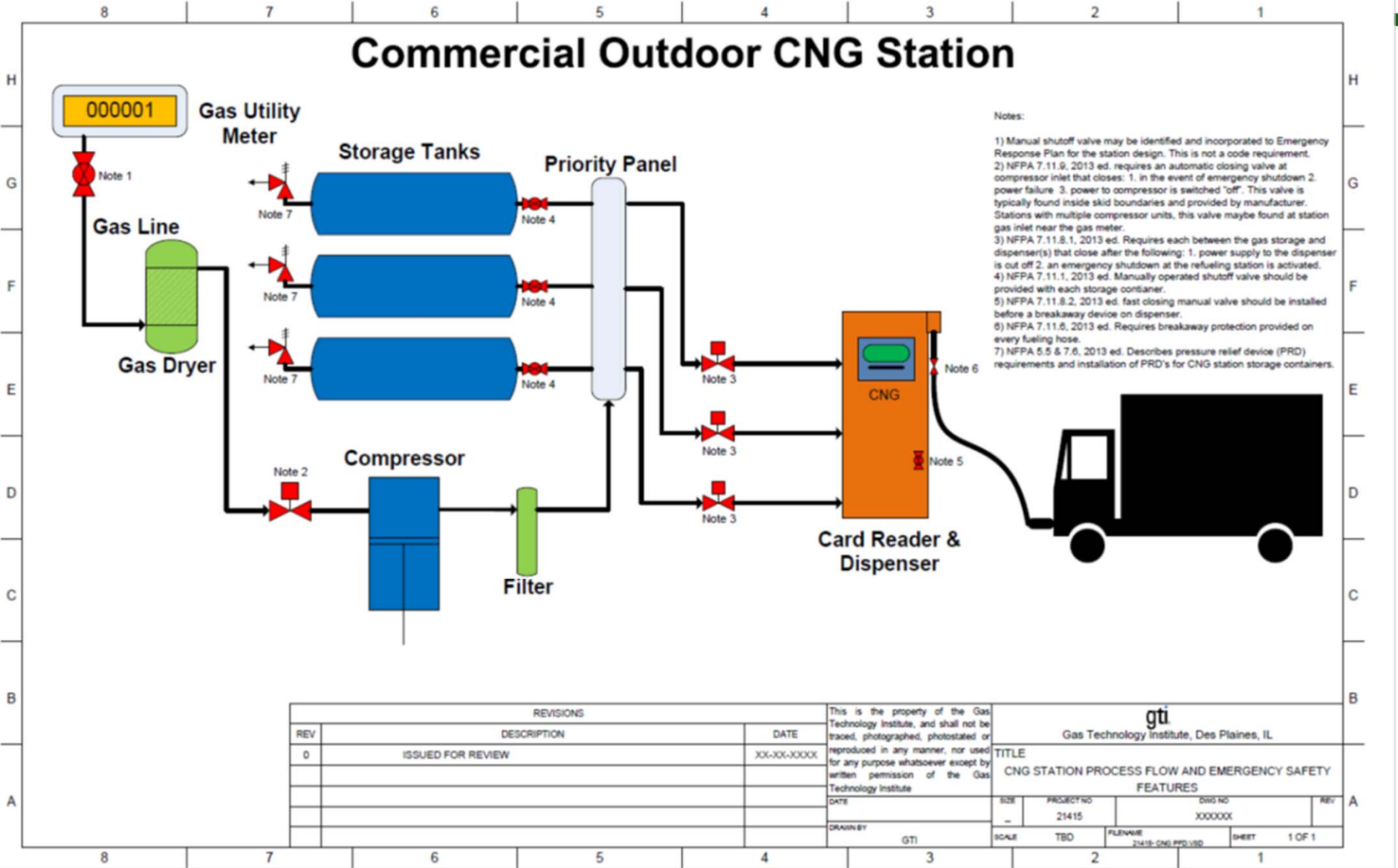


Station Installation- Emergency Shutdown Device (ESD)

For Fast Fill Stations:

- Automatic shutoff valves are to be installed between storage and the dispenser and close in the event power is lost and/or a ESD is activated.
- A self closing valve should be provided on the compressor inlet that shuts off gas supply if ESD is activated, power lost occurs, and/or power to compressor if turned to off position.

Station Installation- ESD and Safety Device Schematic



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REV	DESCRIPTION	DATE		TITLE				
0	ISSUED FOR REVIEW	XX-XX-XXXX		CNG STATION PROCESS FLOW AND EMERGENCY SAFETY FEATURES				
				DATE	SIZE	PROJECT NO	DWG NO	REV
					-	21415	XXXXXX	
			DRAWN BY	SCALE	TBD	FILENAME	SHEET	
			GTI			21415-CNG PFL/ESD	1 OF 1	

Station Operation & Fire Protection

- During fueling a vehicle should be turned off.
- Sources of ignition shall not be permitted inside transfer point. Vehicles themselves are not considered source of ignition.
- Warning signs are to be displayed at dispensing points.
- A portable fire extinguisher having a rating of not less than 20 - B:C shall be provided at the dispensing area.

Acknowledgement of Support

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