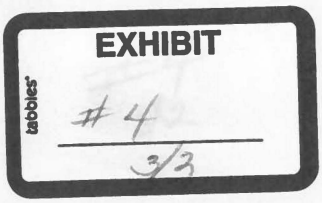



Valley Green Natural Gas, LLC
Docket No. DG 15-155
EXHIBIT 4

Valley Green Non-Confidential Discovery Responses

TABLE OF CONTENTS

Section

A. Staff 1-3 (Witness: James W. Campion, IV)
B. Staff 1-4 (Witness: Kenneth Stanley)
C. Tech Session 2 Supplementing Staff 1-5 (Witness: James W. Campion, IV, Kenneth Stanley)

D. OCA 1-9 (Witness: Jonathan W. Carroll, Kenneth Stanley)
E. OCA 1-23 (Witness: Jonathan W. Carroll)
F. OCA 1-27 (Witness: James W. Campion, IV)
G. OCA 3-4 (Witness: James W. Campion, IV)
H. OCA 3-7 (Witness: James W. Campion, IV)

I. City of Lebanon 1-1 (Witness: Kenneth Stanley, James W. Campion, IV)
J. City of Lebanon 1-3 (Witness: Kenneth Stanley, Jonathan W. Carroll)

K. Energy North 1-1 (Witness: James W. Campion, IV)
L. Energy North 1-3 (Witness: James W. Campion, IV)
M. Energy North 1-10 (Witness: Jonathan W. Carroll)
N. LU Tech 1-1 (Witness: James W. Campion, IV)

O. NG Advantage 1-1 (Witness: James W. Campion, IV)

P. Arwen 1-2 (Witness: Kenneth Stanley)

Q. Almy-Wood 1-2 (Witness: James W. Campion, IV)

Total Pages 178

# SECTION A

**DG 15-155**
**Valley Green Natural Gas, LLC**
**Petition for Franchise Approval**
**Staff Set 1 to Valley Green Natural Gas, LLC**

Date Request Received: 8/5/15 Date of Response: 8/17/15
Request No. 1-3 Witness: James W. Campion, IV

REQUEST: Regarding the services to be provided Valley Green by Gulf and TRI-MONT, did Valley Green issue and RFP for services? If so, please provide a copy of the RFP, a description of the responding bids and how the bids were evaluated. If Valley Green did not issue an RFP, please explain why not.

RESPONSE:

Valley Green did not issue an RFP for the services to be provided by either TRI-MONT or Gulf due to the unique nature of its project but pursued a process that was equivalent to an RFP. Pursuing an RFP process wasn't feasible because Valley Green needed to engage development partners before it was in a position to fully define scopes of work for aspects of its project. Also, an RFP is of limited usefulness when the pool of qualified providers is limited, as is the case with gas pipeline engineers and gas supplier-operators.

As to TRI-MONT:

There are very few firms in the New England region that have the capacities and experience required to shoulder the range of engineering responsibilities Valley Green has charged to TRI-MONT. Valley Green originally sought to retain a New Hampshire engineering firm located in the state with the full range of qualifications and experience the project required (specialized experience in gas processing, transmission and distribution via pipeline, and operations and maintenance of process applications, in addition to the full range of civil, mechanical, and environmental engineering services). Valley Green researched the New Hampshire engineering market and identified only two New Hampshire firms as meeting these standards - CHI Engineering and Sanborn Head & Associates. Valley Green contacted both firms to determine their interest. Both firms responded that they were unable to work with Valley Green due to a conflict of interest raised by their work with another gas utility. Because CHI and Sanborn Head were unavailable, Valley Green was forced to look out of state for providers with in-state New Hampshire experience. An additional benefit is that TRI-MONT also serves as a development partner.

As to Gulf:

Valley Green contacted many potential gas suppliers, including GDF Suez, Irving Oil, Clean Energy (truck fueling), Liberty Utilities, UGI Utilities, and Gas Metro and determined it needed the following basic gas supply requirements to best serve its customers:

- Firm pricing over a long period of time (15 years plus) because prospective customers are interested in stability of pricing over time.

- The capacity to supply large volumes of gas when Valley Green reaches full build-out of its distribution network.

- The flexibility to limit any take or pay requirement to accommodate a gradual build-out of the distribution network and use of supplemental fuels.

- Commitment to provide LNG & CNG fleet truck service.

During the course of discussions, Valley Green came to the conclusion that liquefied natural gas (LNG) was better suited to meet Valley Green's needs than compressed natural gas (CNG), for the following reasons:

- LNG has higher energy density than CNG. Accordingly, LNG is easier to store in quantities necessary to meet 7-day storage requirement. Further, because of storage advantages, LNG allows for purchases outside peak demand periods. By contrast, the CNG business model largely relies on just-in-time inventory.

- LNG is more stable in price. CNG prices vary markedly by season.

- CNG equipment would cost more.

- Using CNG would result in much heavier traffic because three times as many truck trips would be needed to deliver the same amount of fuel. Less traffic is a benefit sought by customers and the municipalities.

- During periods when CNG prices are low, Valley Green can augment its LNG supply with CNG as needed. Valley Green is designing its plant to include a CNG takedown station to mix CNG with our vaporized product when it is competitive with its base supply source, LNG. This too required special considerations in the supply contract. It would be harder to do the opposite (supplement a system designed around CNG with LNG).

- Seasonal storage of LNG allows purchase outside.

- Using LNG means Valley Green can lease extra tank space to defray costs.

The best opportunities for LNG supply are from the new liquefaction plants under construction, such as Gulf's. Older LNG facilities are dedicated to other markets or are requiring large take or pay commitments. With everyone adding loads of capacity and new trains from Gulf, Liberty, UGI and others due to come on line in 12-24 months, aggressive pre-selling of that capacity is well underway.

Gulf was willing to commit supply for this project over the long term from a planned 100,000 gallons/day liquefaction train, with a bridge supply agreement until that facility comes on-line. Gulf has offered to dedicate an LNG-powered truck fleet to the project. No other potential suppliers matched this cost-effective commitment.

In addition, other suppliers did not match Gulf's experience with and commitment to on-site operation and maintenance of the system equipment and to lease additional Valley Green LNG tank storage capacity. Gulf is willing to match through an option of first refusal, any offer to spot price Valley Green supply from competitors before the liquefaction "train" comes on line. This price security is attractive.

Valley Green had multiple contacts with Clean Energy prior to its purchase of NG Advantage. NG Advantage's focus, however, was on CNG and vehicle fueling. Valley Green attended a presentation at Clean Energy's office in Concord after it purchased NG Advantage but Clean Energy never followed up with pricing for Valley Green. Clean Energy stated it had access to LNG supply, but the sources were from Tennessee and Ohio and Clean Energy did not own those sources. NG Advantage's closest LNG asset was in Michigan. NG Advantage and Clean Energy continued to push hard for CNG preference for base load and transportation fuel but could supply ample LNG for back-up.

Having surveyed the market thoroughly, Valley Green is confident that Gulf is currently the best match for the benefits Valley Green and its customers are seeking.

# SECTION B

**DG 15-155**
**Valley Green Natural Gas, LLC**
**Petition for Franchise Approval**
**Staff Set 1 to Valley Green Natural Gas, LLC**

Date Request Received: 8/5/15 Date of Response: 8/17/15
Request No. 1-4 Witness: Kenneth Stanley

REQUEST: Reference Stanley Testimony p. 3, lines 4-14. (a) Please provide a detailed description of the project to establish a new natural gas LDC for a municipality in Massachusetts, including TRI-MONT's responsibilities and the status of that project. (b) Please provide a detailed description of storage facilities designed and/or constructed by TRI-MONT that are similar to that proposed for Valley Green. (c) Please provide a detailed description of pipeline distribution systems that TRI-MONT has operated, constructed and/or maintained that are similar to that proposed for Valley Green.

RESPONSE:

**(a) Town of Sterling Municipal Gas Company (SMLD)**
The purpose of this project is to provide SMLD a high level view of how a municipally owned natural gas distribution system would be configured and its estimated cost to implement. The specific areas that this scope addresses is the following:

- Tie-in locations to a natural gas transmission pipeline
- Interim options to transmission tie-in i.e. CNG, LNG
- Identification of potential residential, commercial, industrial customers
- Configuration of the distribution system
- Operations & Maintenance requirements to meet all local, state and federal codes
- Provide representation at Public Open Houses and formal Town Meetings

*Status* – The Scope defined herein has been completed, Open Houses were conducted and presentations given on September 30, 2014 and October 2, 2014. A Special Town Meeting was conducted to vote on the Town's desire to pursue obtaining the Franchise Rights for the Town of Sterling; a 78% yes vote was achieved. Currently the Town of Sterling is pursuing legislative support to continue with its pursuit of Franchise Rights, once this step is achieved the Town anticipates moving forward.

*Planning*
The following provides more details related to the scope of services we provided the Town of Sterling, MA to date.

- Determine potential customer base and potential natural gas consumption, base includes the following end user types:
  - Residential
  - Large & Small Commercial
  - Industrial
  - Power Generation (small)

    - Estimated 1,250 Subscribers
- Totaling approximately 1MMCFD
- Potential Supply Connections - Identification of natural gas transportation options:
    - Direct Connect to transmission pipeline
    - Coordinate Meetings with Transmission Company
    - Determine Location of bordering LDC Facilities
    - CNG transportation inclusive of:
        - Connection to Transmission Pipeline for Compression Station
        - CNG Trucking Options
        - In-Town unloading (regulation) station and location
        - CNG Storage Options
    - LNG Unload Station, vaporization, storage option (conceptual)
- Duration Schedule to implement Phase 1 of Project

*Conceptual Design*

- Direct Connect Transmission Pipeline – Tie-in Facilities, Routing Options, Metering & Regulating Facilities, and Methodologies
- Distribution System Siting and Selection
- Trunk Line – Provide hydraulic model of Trunk line distribution supply lines
- Distribution Mains and Services
    - Develop in phased buildout based on Town expected growth
    - Identifying a "7" Zone Distribution System to ensure operational redundancy
- Above Ground Facilities
- Operation and Maintenance Requirements
- Regulatory Requirements
- Estimated Project Timeline
- Alternatives to direct connect to pipeline gas transmission (CNG or LNG)

*Conceptual Budget Costs*

- Connection Pipeline Option (Permitting, Design, Procurement, Construct & Commission)
- CNG Option Compression & Regulation Station & Contracted Trucking (Permitting, Design, Procurement, Construct & Commission)
- LNG Concept Budget
- Interconnect Facilities (Metering & Regulation)
- Distribution System – Trunk Line, Mains & Services
- Financing option
- Conceptual Rate Structure

**(b) Describe Storage Facilities:**
The projects listed below represent the experience that TRI-MONT Engineering, Co. and/or its staff have related to Storage Facilities for LNG:

- New England Gas Company – LNG Storage facility Exeter, RI – efforts involved the design/build of LNG spill containment adjacent to the loading & unloading pad and vaporization equipment
- National Grid – LNG Storage Facility Tewksbury, MA – design/build drainage modifications
- National Grid – LNG Storage Facility Providence, RI – design/build expansion of dike containment system to ensure compliance with FERC regulatory requirements
- Distrigas of Massachusetts – Everett, MA – annual LNG piping facilities design & construction services
- Stratton Mountain Resort – Propane Distribution System, Stratton, VT – efforts involved inspection/oversight, regulatory compliance reporting and pressure testing of all active facilities associated their propane system; 9-miles of mains; 300 services; 60,000 gals storage and vaporization equipment. In addition DIMP & O&M documentation was developed and implemented. Also provided coordination support with the VT PUC.

**(c) Describe pipeline distribution systems:**
The experience provided below represents TRI-MONT Engineering, Co.'s and/or its staff directly involved in the following projects:

- Braintree Electric Light Department – Current – Operations & Maintenance of the Thomas Watson Meter and Regulation Station. This is a natural gas supply facility connected to a transmission pipeline that was built in 2009 to provide a high pressure natural gas supply to the new Thomas Watson Power Generation station. Three of TRI-MONT's current staff were involved in the Design/Build effort that resulted in this facility coming on line in 2009. Current and/or completed responsibilities include:
    - Review in detail BELD's written O&M Manual and its Emergency Response Plan
    - Review the historical and documented monthly inspection reports to document the current operational performance of the facilities.
    - Perform all code-required surveillance tasks such as patrols over the below ground portion of the outlet pipeline.
    - Perform annual inspection of the facilities per the manufacturer's recommendations.
    - Make recommendations associated with the replacement of worn parts
    - Perform monthly inspections at the station to ensure/observe the integrity of structures, systems, piping, general operation of electric and instrument systems
    - Provide monthly inspection reports documenting the condition of the facilities, report on any deficiencies and or make recommendations for improving the performance of the equipment or replace/repair worn or broken parts.
    - Facilitate and when approved execute the required repairs and upgrades

- Peabody Municipal Light Plant – Current – Contracted Gas Pipeline Manager - performing in this capacity, associated with 2,000-feet of 10-inch high pressure natural gas transmission pipeline connected to the Tennessee Gas Pipeline.
    - TRI-MONT provides O&M Support Services for PMLP's Peabody/Danvers Supply Line as required consistent with PMLP's current O&M and ER Manual;

it's current Integrity Management Plan (IMP), and the associated Codes and Regulations pertinent to these documents and services.

- TRI-MONT will coordinate for and ensure approved and qualified subcontractors are hired as needed to satisfy the Qualification and Training requirements of Codes, Standards, and Regulations.
- Prepare and Submit Pipeline Report to DOT Office of Pipeline Safety
- Conduct and document Annual Review of IMP, Base Line Assessment, Quality Assurance Program, and O&M Manual; implementing required modifications as determined by same
- Maintain Required Records
- Schedule and/or Conduct and document required Qualifications and Awareness Training
- Address Public Awareness requirements
- Track and implement required modifications based on Changes to Regulations, Codes, and Standards
- Ensure Compliance with Drug and Alcohol Testing for Staff and Contractors
- Initiate and Perform Intelligent Internal Inspection Operations on the pipeline to develop a baseline standard for which integrity compliance can be measured and maintained.
- In the event of anomaly discovery, develop mitigation measures to perform repairs/replacement as required, in accordance with PMLP's Integrity Management Plan

- Unitil Corporation – Current –Natural Gas Inspection Team - In support of Unitil's multiyear facility upgrade (replacement of cast iron pipe) and system expansion. TRI-MONT provides NGA OQ Qualified Inspectors that are assigned to coordinate, Inspect, document, and oversee construction at various locations annually. Responsibilities include ensuring that the construction contractor is installing the new facilities in accordance with the plans, specifications, permits, and operating procedures under which the work is to be done. As part of the requirement to provide inspectors TRI-MONT'S Inspectors maintain "Operator Qualifications" in over 32 "Covered Tasks".

- Massachusetts Municipal Wholesale Electric Company (MMWEC) – Past – Contracted Gas Pipeline Operations & Maintenance Team. Facilities included 5-miles of 24-inch high pressure natural gas transmission pipeline and associated metering/regulating facilities. TRI-MONT Staff provided O&M Support Services for the Stony Brook Pipeline and provided a written Operating and Maintenance and Emergency Procedure document required by federal and state code. Prior to the commissioning of the pipeline, staff members provided various support services to assist with the ongoing operation and maintenance of their pipeline. These services included providing emergency response capabilities, administration of their DOT mandated drug/alcohol testing program, assistance with annual reporting requirements to federal and state regulating agencies, and assistance with numerous ongoing compliance and operational issues.

- Conducted and documented Annual Review of IMP, Base Line Assessment, Quality Assurance Program, and O&M Manual; implementing required modifications as determined by same
- Maintained Required Records
- Addressed Public Awareness requirements
- Tracked and implemented required modifications based on Changes to Regulations, Codes, and Standards
- Ensured Compliance with Drug and Alcohol Testing for Staff and Contractors
- Initiated and Performed Intelligent Internal Inspection Operations on the pipeline to develop a baseline standard for which integrity compliance could be measured and maintained.
- In the event of anomaly discovery, develop mitigation measures

- Connecticut Municipal Electric Energy Cooperative (CMEEC) – Past – Contracted Gas Metering & Regulating Facilities & Low pressure pipe, Operations & Maintenance Team.
  - Provided emergency, operations and maintenance work and services for the Owner's Natural Gas (NG) facilities as required and as detailed in the project's Emergency Operations and Maintenance Manual ("EOM Manual")
  - Maintained Operator Qualifications credentials for all personnel supervising tasks that require Operator Qualifications under Subpart N of 49CFR Part 192.
  - Ensured that all persons performing operations, maintenance or emergency response tasks were included in the Operator's Part 199-compiant drug and alcohol program.
  - Performed all code-required surveillance tasks such as patrols over the below ground portion of the outlet pipeline.
  - Performed annual inspection of equipment of the Operator's Scope NG Facilities per the manufacturer's recommendations. Performed replacement of worn parts
  - Performed annual calibration of electronic instruments
  - Performed check of gauge readings
  - Performed monthly station checks to ensure integrity of structures, systems, piping, and general operation of electric and instrument systems.
  - Operated and maintained the NG Facilities in such a way as to satisfy all requirements, taking such samples and performing and reporting such tests as required and promptly provided Notice to the Owner of any areas of conflicts or violations or unsatisfactory conditions or test results.
  - Disposed of all waste materials, including Hazardous Waste, generated by the performance of the Services, if any, in accordance with Owner's waste disposal agreements.
  - Procured and maintained appropriate insurance coverages
  - Responded to operating upsets such as overpressure, under pressure, lack of flow, erratic operation, gas leaks, etc.
  - Repaired or replaced equipment.
  - Performed Inspections, rebuilds, site visits, & required meetings

# SECTION C

**DG 15-155**

**Valley Green Natural Gas, LLC Responses to 9/8/15**
**Tech Session Data Requests**

Date Request Received: 8/5/15
Request No. Tech Session 2

Date of Response: 8/17/15; 11/5/15
Witness: James W. Campion, IV
Kenneth Stanley

Request No. Staff 1-5

REQUEST: Reference Stanley Testimony p. 9, lines 10-15. Please describe the assets and personnel that will be employed to operate and maintain the Valley Green pipeline distribution system and where those assets are, or will be, located.

RESPONSE:

It is expected that Valley Green Natural Gas will contract with qualified contractors to provide all operations and maintenance functions until such time as those capabilities can be provided efficiently and effectively with in house staff. The Primary Pipeline Distribution System O&M Contractor is expected to be TRI-MONT Engineering, Co. (TRI-MONT). TRI-MONT will contract and manage additional 3rd party services as required for specific tasks and requirements. It is TRI-MONT's intension to establish Operations & Maintenance Human Resources local to the facilities that will act in a Supervisory role and report to Valley Green Natural Gas Management/Ownership Staff. We anticipate the following Roles & Responsibilities protocol:

- O&M and IMP Personnel and Responsibility Structure:
  - General Manager – Valley Green Natural Gas Staff

  Responsible for:
    - VGNG governance ,asset management, and general oversight
    - Ensure Contractors have adequate support to perform their responsibilities
    - Financial Management
    - Media and Public relations

  - Chief Operating Officer – Valley Green Natural Gas Staff

  Responsible for:
    - Contracts Management
    - Overall Operating Control, Management, and Oversight
    - Ensure Contractors have adequate support to perform their responsibilities
    - Securing and managing consumer accounts

- Supervising Engineer (Contracted)

  Contractor: TRI-MONT Engineering, Co.

Responsible for:

- Overall O&M and DIMP management and Contractor oversight & Coordination
- Ensure O&M and DIMP, along with associated Plans and Procedures are established and maintained
- Participate in O&M and DIMP annual review and review of associated documents, Procedures, and Plans
- Management of Changes
- Quality Assurance and Quality Control
- Record keeping - File and Manage historical records, plans, and evaluations
- Oversight of Qualifications and Awareness Training as well as Public Awareness Program
- Monitor, File, and participate in review ongoing evaluations and activities
- Communicate O&M and DIMP performance and needs to Chief Operating Officer
- Management, planning, and oversight of all Maintenance and Emergency response actions
- Ensure compliance with Codes, Regulations, Standards, and Permits
- Oversee Reporting requirements and Documentation requirements

- Gas Pipeline Distribution System Manager (Contracted)

  Contractor: TRI-MONT Engineering, Co.

Responsible for:

- Performance of ongoing and annual of HCA Threat & Risk analysis review
- Review of O&M and DIMP Inspections and Reports and make recommendations for actions to be taken
- Review ongoing evaluations/activities and make recommendations for actions to be taken
- Support management of historical records, plans, and evaluations
- Recommending, coordinating, and supporting completion of O&M and IMP related Training requirements
- Ensure Public Awareness requirements are met
- Drug and Alcohol Program Compliance of its and Contractors Personnel
- Corporate data systems updates, availability and integration
- Record keeping, including GIS system maintenance and updates
- Operator qualification training and record keeping

- Pipeline Distribution System Operation Supervisor (Contracted)
  Contractor: TRI-MONT Engineering, Co.

Responsible for:

- Distribution System Day-to-Day operations
- Perform required IMP Inspections and Surveys per 49 CFR part 191 and 192 requirements and other DOT covered tasks
- Ensuring a 24 hour emergency call center and response system is maintained and functional
- Operator Qualifications Training, O&M Training, and IMP Familiarization Training, to include documentation of same
- Drug and Alcohol Program Compliance of its Personnel and of Contractors Personnel
- Record Keeping for actions taken
- Incident Reporting
- Participate in repairs, evaluations, and upgrades as requested

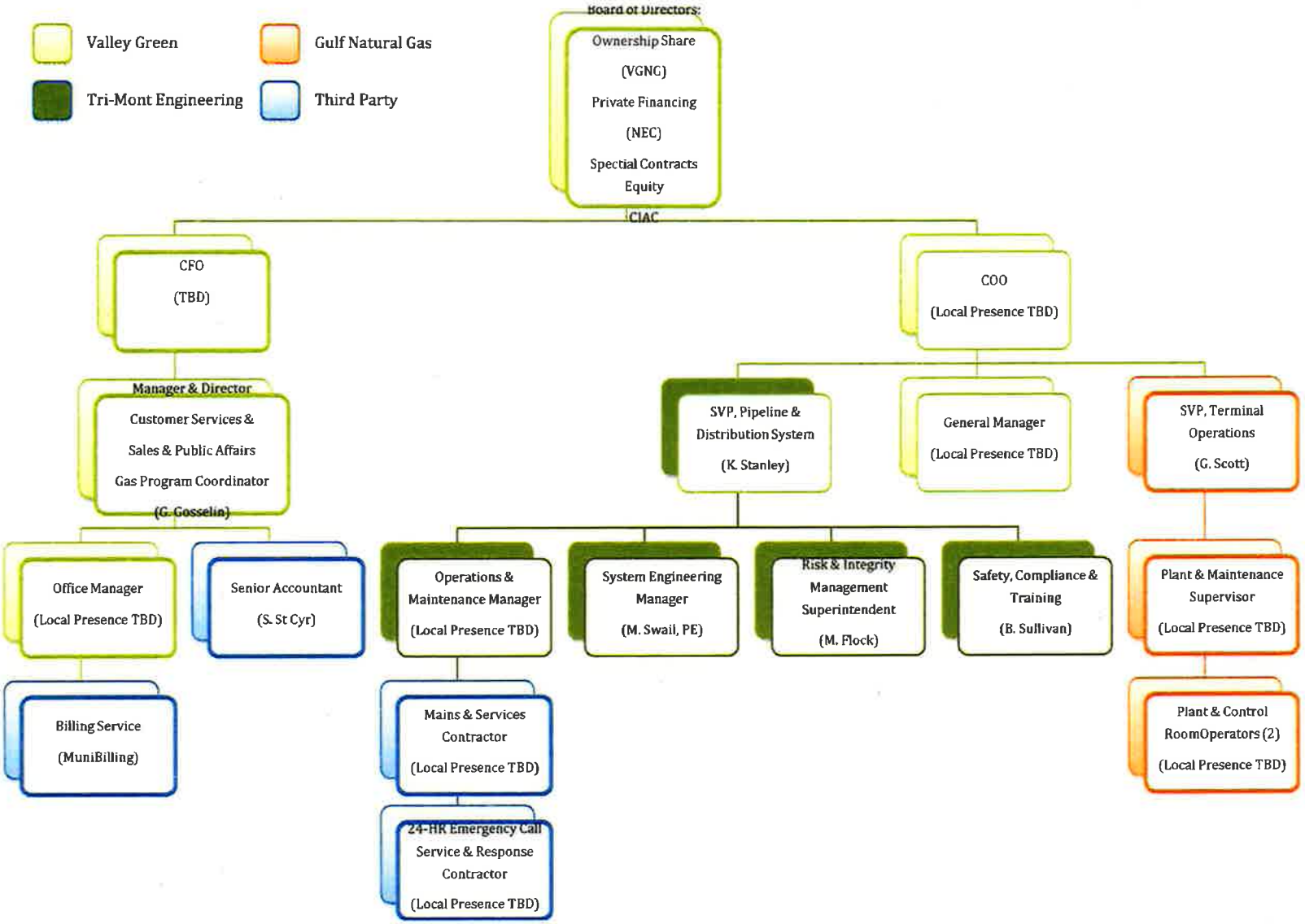
- Pipeline Distribution System Maintenance & Emergency Response (Contracted)
  Contractor: Third Party

Responsible for:

- Operator Qualifications Training. O&M Training, to include documentation of same
- Drug and Alcohol Program Compliance of its Personnel
- Perform Maintenance and Emergency response actions as required
- Perform required repairs, evaluations, and upgrades as requested

SUPPLEMENTAL REQUEST:
Please state whether these positions are full time and where will they be located. Please identify personnel and assets.

SUPPLEMENTAL RESPONSE: See attached organization chart that identifies Valley Green Natural Gas, LLC; Tri-Mont Engineering, Inc.; Gulf Natural Gas; and third party vendor services.


Valley Green
Gulf Natural Gas
Tri-Mont Engineering
Third Party
Board of Directors:
Ownership Share
(VGNG)
Private Financing
(NEC)
Spectial Contracts
Equity
CIAC
CFO
(TBD)
COO
(Local Presence TBD)
Manager & Director
Customer Services &
Sales & Public Affairs
Gas Program Coordinator
(G. Gosselin)
SVP, Pipeline &
Distribution System
(K. Stanley)
General Manager
(Local Presence TBD)
SVP, Terminal
Operations
(G. Scott)
Office Manager
(Local Presence TBD)
Senior Accountant
(S. St Cyr)
Operations &
Maintenance Manager
(Local Presence TBD)
System Engineering
Manager
(M. Swail, PE)
Risk & Integrity
Management
Superintendent
(M. Flock)
Safety, Compliance &
Training
(B. Sullivan)
Plant & Maintenance
Supervisor
(Local Presence TBD)
Billing Service
(MuniBilling)
Mains & Services
Contractor
(Local Presence TBD)
Plant & Control
RoomOperators (2)
(Local Presence TBD)
24-HR Emergency Call
Service & Response
Contractor
(Local Presence TBD)

# SECTION D

DG 15-155

Valley Green Natural Gas, LLC

OCA Set 1 to Valley Green Natural Gas, LLC

Date Request Received: 06/15/15 Date of Response: 06/25/15

Witnesses: Jonathan W. Carroll

Request No. OCA 1-9 Kenneth H. Stanley

REQUEST: Please provide all known details related to the physical transportation of LNG from the source to Valley Green's facilities, including the number of trucks per day that will be transporting LNG to Valley Green's facilities, based on the volumes expected during the first year of Valley Green's utility service.

RESPONSE: LNG by truck is the expected source of supply as currently planned. As stated on page 3, lines 10-20 in Jonathan Carroll's testimony, Gulf will provide as many trucks as are needed to meet Valley Green's customer demand and on-site storage needs. TRI-MONT has analyzed volumes at initial build-out in order to adequately size the storage facilities. See testimony of Kenneth H. Stanley, at 5, lines 1-4.

The number of trucks delivering LNG to Valley Green will vary with the demand and the number and type of customers being served. Utilizing the projected loads as calculated to date for the initial three service areas (as noted in the petition), which may or may not be fully served in the first year, and assuming 10,000 gallon LNG delivery trailers, Valley Green anticipates needing between three to seven trailer loads a day; three during average day demand periods and up to seven during peak demand periods.

Valley Green continues to be open to using other forms of supply like CNG, landfill gas, etc. if such fuels make sense for Valley Green and its customers. Delivery of these other fuels would be considered as part of any decision on such fuels.

# SECTION E

DG 15-155
Valley Green Natural Gas, LLC
OCA Set 1 to Valley Green Natural Gas, LLC

Date Request Received: 06/15/15 Date of Response: 06/25/15; 12/17/15
Request No. OCA 1-23 Witness: Jonathan W. Carroll

REQUEST: Please provide further detail with respect to the transportation route between Gulf's proposed liquefaction facility in the Marcellus Shale Region and the receipt point for Valley Green.

RESPONSE: Gulf has recently delivered LNG to New Hampshire peak shaving facilities in Concord, Manchester and Tilton from terminals in Pennsylvania. These deliveries are performed in accordance with all applicable state and federal requirements for the transport of hazardous materials. Utilizing industry best practices, Gulf maximizes travel on major interstate highways. The same process will be employed for deliveries to Valley Green. Starting in Great Bend, PA, Gulf anticipates trucks will travel on I-81 N to I-88 E to I-90E to I-91N to I-89 S. Gulf is planning for the trucks to exit I-89 S at the S.R. 120 N exit and turn onto Etna Rd in Lebanon in 1.4 miles. The entire route is under 350 miles with an estimated drive time of approximately 5 hours.

In addition, Gulf is a member of the LNG Steering Committee of the Northeast Gas Association and the company adheres to the guidelines of the LNG Trucking Emergency Response Plan.

SUPPLEMENTAL RESPONSE: Gulf and Valley Green are evaluating using rail transportation between Pennsylvania and New Hampshire. Transportation via rail will follow existing routes between Pennsylvania to New Hampshire. As with any competitive business, Valley Green's team will continue to incorporate efficiencies and evaluate cost-effective alternatives to its initial gas supply proposal. Energy prices remain in flux and affect costs associated with transportation. In demonstrating the managerial and technical expertise for its franchise request, Valley Green and Gulf intend to remain nimble to capitalize on cost savings from rail transportation when that transportation cost is less than truck/highway transportation.

# SECTION F

DG 15-155

Valley Green Natural Gas, LLC

OCA Set 1 to Valley Green Natural Gas, LLC

Date Request Received: 06/15/15 Date of Response: 08/17/15

Request No. OCA 1-27 Witness: James W. Campion, IV

REQUEST: When does Valley Green anticipate filing tariffs for utility services?

RESPONSE: Valley Green is in the process of developing its tariff and will provide a copy to the parties as soon as the draft is completed.

SUPPLEMENTAL RESPONSE: Please see attached draft tariff.

**N.H.P.U.C. No. 1 – GAS**

**VALLEY GREEN NATURAL GAS, INC.**

**TARIFF**

**For**

**GAS SERVICE**

**Valley Green Natural Gas, Inc.**

# TABLE OF CONTENTS


1. GENERAL ..... 4
2. CHARACTER OF SERVICE ..... 5
3. CUSTOMER'S INSTALLATION ..... 6
4. APPLICATION FOR SERVICE ..... 7
5. CREDIT ..... 8
6. SERVICE EXTENSION TERMS AND CONDITIONS ..... 9
7. INTRODUCTION OF SERVICE ..... 11
8. COMPANY EQUIPMENT ON CUSTOMER'S PREMISES ..... 12
9. SERVICE CONTINUITY ..... 13
10. CUSTOMER'S USE OF SERVICE ..... 14
11. INSPECTIONS ..... 15
12. MEASUREMENT ..... 16
13. TESTS ..... 17
14. STANDARD PAYMENT TERMS AND METER READING ..... 18
15. DISCONNECTION BY THE COMPANY ..... 19
16. CANCELLATION BY CUSTOMER ..... 20
17. COST OF GAS ..... 21
18. ATTACHMENT POLICY ..... 23

GENERAL RATE SCHEDULE RESIDENTIAL ..... 24

GENERAL RATE SCHEDULE INDUSTRIAL, INSTITUTIONAL, AND COMMERCIAL ..... 25




Issued: January 1, 2016
Effective: January 1, 2016

Issued by: JAMES W. CAMPION, IV
Title: President

## I. SERVICE AREA

The territory authorized to be served by this company and to which this tariff applies is as follows:

The complete area of the following city: Lebanon, New Hampshire, 03766

The complete area of the following town: Hanover, New Hampshire, 03755

## II. TERMS AND CONDITIONS

### 1. GENERAL

(a) Filing. A copy of this tariff is on file with the New Hampshire Public Utilities Commission and is open to inspection at the offices of the company.

(b) Revisions. This tariff may be revised, amended, supplemented, or otherwise changed from time to time in accordance with the rules of the New Hampshire Public Utilities Commission and such changes, when effective, shall have the same force as the original tariff.

(c) Application. The tariff provisions apply to everyone lawfully receiving gas service from the company under the rates herein and receipt of gas service shall constitute the receiver a customer of the company as the term is used herein whether service is based upon contract, agreement, accepted signed application, or otherwise.

(d) Statement by Agents. No representative has authority to modify a tariff rule or provision or to bind the company by a promise or representation contrary thereto.

(e) No Prejudice of Rights. The failure of the company to enforce any of the terms of this tariff shall not be deemed a waiver of its right to do so.

(f) Gratuities to Employees. The company's employees are strictly forbidden to demand or accept any personal compensation or gifts for service rendered by them while working for the company on the company's time.

(g) Assignment. Subject to the rules and regulations, all contracts by the company shall be binding upon, and oblige, and continue for the benefit of, the successors and assigns, heirs, executors, and administrators of the parties hereto.

## II. TERMS AND CONDITIONS

### 2. CHARACTER OF SERVICE

Gas Supply. This tariff applies only to the supply of gas at the company's standard heat content value, adjusted for temperature and pressure, in the locality in which the premises to be served are situated. That standard heating value is, nominally, one (1) therm in each one hundred (100) cubic feet.

(a) Delivery of Gas Supply. The rates specified in this tariff are based upon the supply of service to a single customer through one delivery and metering point.

(b) Combined Service on Same Property. A single customer permitted to take service at two or more locations on premises or property provided that the customer shall cost of all additional service connections required. Service so used will be combined for billing purposes.

(c) Use of Service at Separate Properties. The use of service at two or more separate properties will not be combined for billing purposes.

## II. TERMS AND CONDITIONS

### 3. CUSTOMER'S INSTALLATION

(a) Point of Delivery. Upon request, the company will designate a point at which the customer shall terminate the piping for connection to the meter of the company but such information does not constitute an agreement or obligation on the part of the company to furnish service.

(b) Space for Meter. The customer shall provide, free of expense to the company, a dry, warm, and otherwise suitable place for the regulator or regulators, meter or meters, or other equipment of the company which may be necessary for the fulfillment of such contracts as may be entered into with the company.

(c) Location of Meter. The space provided for the company's meters and equipment shall be of convenient access to the company's employees and as near as possible to the point where the service supply pipe enters the customer's building. Its location shall be such that the meter connections are not concealed by plaster or sheathing and shall be otherwise acceptable to the company.

(d) Reverse Flow. The customer may be required to install check valves or other devices to prevent compressed air or other gases from entering the company's mains.

## II. TERMS AND CONDITIONS

### 4. APPLICATION FOR SERVICE

(a) Service Contract. Every applicant for gas service may be required to sign a contract, agreement, or other form then in use by the company covering the special circumstances of his use of gas and must agree to abide by the rules and regulations and standard requirements of the company.

(b) Right to Reject. The company may reject any application for service which would involve excessive cost to supply, or which might affect the supply of service to other customers, or for other good and sufficient reasons.

(c) Special Contracts. Standard contracts shall be for terms as specified in the statement of the rate but where large or special investment is necessary for the supply of service, contracts of longer term than specified in the rate, or with a special guarantee of revenue, or both, may be required to safe- guard such investment.

(d) Unauthorized Use. Unauthorized connection to the company's gas service supply facilities, and/or the use of service obtained from the company without authority, or by any false pretense, may be terminated by the company without notice. The use of service without notifying the company and enabling it to read its meter will render the user liable for any amount due for service supplied to the premises from the time of the last meter reading of the company's meter immediately preceding his occupancy as shown by the company's books.

## II. TERMS AND CONDITIONS

### 5. CREDIT

(a) Prior Debts. Service will not be furnished to former customers until any indebtedness to the company for previous service has been satisfied.

(b) Deposits. Before rendering or restoring service, the company may require a security deposit. Conditions for such deposit will be in compliance with PUC 1203.03.

All deposits shall accrue simple annual interest from the date of deposit to the date of termination.

Interest shall be payable by the company on all deposits at a rate equal to the base rate on corporate loans at large U.S. money center commercial banks (Prime Rate).

Said Prime Rate is to be fixed on a quarterly basis for periods ending March, June, September and December of any given year. The Prime Rate is to be established as reported in The Wall Street Journal on the first business day of the month preceding the calendar quarter. If more than one Prime Rate is reported in The Wall Street Journal, the average of the reported rates shall be used. Customer accounts shall be credited with simple annual interest and paid upon the refund of deposit.

## II. TERMS AND CONDITIONS

### 6. SERVICE EXTENSION TERMS AND CONDITIONS

(a) Mains and Services. In areas where the company is authorized to operate, subject to other provisions of this tariff, service is available as described below:

(1) Residential.

Existing Mains: Service is available without a contribution when the length of service is eighty (80) feet or less per customer (or an average of eighty (80) feet or less when multiple customers are connected) and there are no abnormal costs, as defined below.

Main Extension: Service is available without a contribution when the twenty-five percent (25%) test is met and there are no abnormal costs, as described below.

(2) Non-Residential.

Regardless of whether service is taken from an existing main or if a main extension is required, service is available without a contribution when the twenty- five percent (25%) test is met and there are no abnormal costs, as described below.

(3) Twenty-Five Percent (25%) Test.

The twenty-five percent (25%) shall be calculated as follows:

When the Company's estimate of the net annual revenue from the customer exceeds twenty-five percent (25%) of the company's estimate of construction cost, no contribution toward the cost of the main or service extension shall be deemed necessary from the customer.

Net annual revenue is the total annual revenue less the weighted average cost of gas.

(4) Contribution in Aid of Construction (CIAC).

Service is available to customers who do not meet the above twenty- five percent (25%) test provided that the customer(s) make a contribution to reduce the company's investment. Such contribution may be apportioned by agreement among the customers served.

The amount of contribution will be the difference between the construction cost and twenty-five percent (25%) of the net annual revenue. Unless otherwise agreed to by the company, the contribution is required before construction is commenced. The contribution will be based on the company's estimates of construction cost and net annual revenue.

## II. TERMS AND CONDITIONS

The company will refund the contribution received that is in excess of the contribution needed. The contribution needed is based on actual construction cost and actual net revenue for the first twelve (12) months of service ending April.

(5) Abnormal Costs.

Where costs for any main or service extension are expected to be higher than normal, the customer may be required to contribute for the amount by which the costs exceeds that which is considered normal. Such abnormal costs would include costs attributable to frost, ledge, ditching, backfill and/or other conditions not uniformly encountered in service and/or main construction and that are peculiar to the particular service and/or main construction concerned.

(b) Shortest Distance. Services are run the shortest safe practical distance to the premises. However, a customer may have the company install a longer alternate service provided that the customer defrays the extra expenses.

(c) Winter Construction. Ordinarily no new service pipes or main extensions are installed during winter conditions (when frost is in the ground) unless the customer defrays the extra expenses.

(d) Perpetual Easement. Before installing a main or service the company may require a perpetual easement to install and maintain the main or service.

(e) Reasonable Duration and Non-Discrimination. Under none of the foregoing provision's will the company be required to install service pipes or to construct main extensions where the business to be secured will not be of reasonable duration or will tend, in any way, to constitute discrimination against other customers of the company.

## II. TERMS AND CONDITIONS

### 7. INTRODUCTION OF SERVICE

(a) Defective Installation. The company may refuse to connect if, in its judgment, the customer's installation is defective, or does not comply with such reasonable requirements as may be necessary for safety, or is in violation of the company's standard requirements.

(b) Unsatisfactory Installation. The company may refuse to connect if, in its judgment, the customer's equipment or use thereof might injuriously affect the equipment of the company or the company's service to other customers.

## II. TERMS AND CONDITIONS

### 8. COMPANY EQUIPMENT ON CUSTOMER'S PREMISES

(a) Meters and Regulators. The company shall furnish and install, maintain and own, any meter or meters, regulator or regulators, required in the supply of service.

(b) Customer's Responsibility. The customer shall be responsible for safekeeping of the company's property while on the customer's premises. In the event of injury or destruction of any such property the customer shall pay the costs of repairs and replacements.

(c) Protection by Customer. The customer shall protect the equipment of the company on his premises and shall not permit any persons, except a company employee having a standard badge of the company or other company identification, to break any seals upon or do any work on any meter, service supply pipe, or other equipment of the company located on the customer's premises.

(d) Tampering. In the event of the company's meter or other property being tampered with or interfered with, the customer being supplied through such equipment shall pay the amount which the company may estimate is due for service used but not registered on the company's meter and for any repairs or replacements required as well as for costs of inspections, investigations, and protective installation.

(e) Right of Access. The company's identified employees shall have access to the premises of the customer at all reasonable times for the purpose of reading meters, testing, repairing, removing, or exchanging any or all equipment belonging to the company.

(f) Ownership and Removal. All equipment supplied by the company shall remain its exclusive property and the company shall have the right to remove the same from the premises of the customer at any time after the termination of service from whatever cause.

## II. TERMS AND CONDITIONS

### 9. SERVICE CONTINUITY

(a) Regularity of Supply. The company will use all reasonable diligence to provide a continuous, regular, and uninterrupted supply of service but should the supply be interrupted by the company for the purpose of making repairs, changes, or improvements in any part of its system for the general good of the service or the safety of the public; or should the supply of service be interrupted or fail by reason of accident, strike, legal process, State or Municipal interference, or any cause whatsoever beyond its control, the company shall not be liable for damages, direct or consequential, resulting from such interruption or failure.

(b) Notice of Trouble. The customer shall send written notice to the office of the company immediately should the service be unsatisfactory for any reason or should there be any defects, leaks, trouble, or accident affecting the supply of gas.

## II. TERMS AND CONDITIONS

### 10. CUSTOMER'S USE OF SERVICE

(a) Resale Forbidden. The customer shall not, directly or indirectly, sell, sublet, assign, or otherwise dispose of to others gas purchased from the company or any part thereof without the consent of the company. This rule does not apply to a public utility company purchasing gas in bulk expressly for the purpose of distributing it to others.

(b) Fluctuations. Gas service must not be used in such a manner as to cause unusual fluctuations or disturbances in the company's supply system. In the case of violation of this rule, the company may discontinue service, or require the customer to modify his installation, and/or equip it with approved controlling devices.

(c) Additional Load. The service supply pipe, regulators, meters, and equipment supplied by the company for each customer have definite capacities. The customer shall notify the company of substantial changes in service requirements or location of appliances.

## II. TERMS AND CONDITIONS

### 11. INSPECTIONS

(a) Company's Right to Inspect. The company shall have the right, but shall not be obliged, to inspect any installation before service is introduced or at any time later and reserves the right to reject any piping or appliances not in accordance with the company's standard requirements. However, such inspection, or failure to inspect or to reject, shall not render the company liable or responsible for any losses or damage resulting from defects in the installation, piping, or appliances, or from violation of company rules, or from accidents which may occur upon the premises of the customer.

## II. TERMS AND CONDITIONS

### 12. MEASUREMENT

(a) Supply of Meters. In accordance with PUC 505.01, the measurement of gas service shall be by meters furnished and installed by the company. The company will select the type and make of metering equipment and may, from time to time, change or alter the equipment. Its sole obligation being to supply meters that will accurately and adequately furnish records for billing purposes.

(b) Special Measurements. The company shall have the right, at its option and its own expense, to place demand meters, pressure gauges, special meters, or other instruments on the premises of any customer for the purpose of determining the adequacy of the company's service or for making tests of all or any part of the customer's load.

## II. TERMS AND CONDITIONS

### 13. TESTS

(a) Meter Tests. Meters will be tested according to PART PUC 505.

(b) Customer-Requested Tests. Meters in use will be tested at the request of the customer in accordance with PART PUC 505. The fee for a customer-requested meter test is twenty dollars ($_____.00) when scheduled at the mutual convenience of the Company and the customer; otherwise the fee is thirty dollars ($____.00).

(c) Adjustments for Error. Should any meter become defective or fail to register correctly, the quantity of gas consumed will be determined in accordance with PART PUC 505.

## II. TERMS AND CONDITIONS

### 14. STANDARD PAYMENT TERMS AND METER READING

(a) Billing Period. Meters will be read and billings will be rendered on a monthly basis.

(b) Payment Period. Bills are due upon presentation. Amounts not paid prior to the next following meter reading date (normally 30 days from the prior meter reading date) are subject to a late payment charge of one and on-half percent (1 1/2%) per month on the unpaid balance (equivalent to an 18% annual rate).

(c) Estimated Bills. When the company's meter readers are unable to gain access to customer's premises on any regular reading date for the purpose of reading the meter, the company may, for the convenience of the customer, render an estimated bill subject to the privilege of the customer to defer payment until an actual meter reading has been secured and bill rendered therefore.

(c) Bad Check Fees. For each bad check tendered for payment, the Company will charge the lesser of fifty dollars ($50.00) or the actual costs of recovery.

## II. TERMS AND CONDITIONS

### 15. DISCONNECTION BY THE COMPANY

(a) Disconnection by the Company. The Company may disconnect its service to a customer for violation of its rules subject to PUC 1203.11 and 1203.12.

(b) Non-Payment Shut-Off. The company may disconnect its service on reasonable notice and remove its equipment in case of non-payment of bill pursuant to PUC 1203.11.

(c) Shut-Off for Cause. Pursuant to PUC 1203.11, the company may disconnect its service on reasonable notice if entry to its meter or meters is refused, or if access thereto is obstructed or hazardous, or for other violation of these rules and regulations or the company's standard requirements.

(d) Safety Shut-Off. The company may disconnect without notice if the customer's installation has become dangerous or defective.

(e) Defective Equipment Shut-Off. The company may disconnect without notice if the customer's equipment or use thereof might injuriously affect the equipment of the company or the company's service to other customers.

(f) Shut-Off for Fraud. The company may disconnect without notice for abuse, fraud, or tampering with the connections, meters, or other equipment of the company.

(g) Reconnection Charge. Pursuant to PUC 1203.13, a charge of fifty dollars ($50.00) during normal business hours and a charge of one hundred dollars ($100.00) during non-normal business hours will be made for reconnection of service discontinued by the company under PUC 1203.11 and 1203.12, payable in advance, in addition to all arrears under the customer's contract before service will be restored except when it has been necessary to dig up the service pipe or connection to effect discontinuance of service. In such cases, the reconnection charge shall be the cost of removal and restoration of service pipe or connection.

## II. TERMS AND CONDITIONS

### 16. CANCELLATION BY CUSTOMER

(a) Termination Notice. Pursuant to PUC 1203.10, customers who have fulfilled their contract term and wish to discontinue service must give at least four (4) business days written notice to that effect.

## II. TERMS AND CONDITIONS

### 17. COST OF GAS (This is included even though the Company will likely not have gas charges that differ seasonally.)

(a) Purpose. To permit the company to charge its customers with the cost of gas purchased or produced. A Cost of Gas Rate will be applied to all firm gas billed under this tariff as calculated on the appropriate pages.

(b) Application. A cost of gas rate will be calculated for the winter heating period, defined as the period from November 1 through April 30, and a cost of gas rate will be calculated for the summer period, defined as the period from May 1 through October 31.

The winter cost of gas rate will be applied to billings commencing with the first November revenue billing cycle; the summer cost of gas rate will be applied to billings commencing with the first May revenue billing cycle.

(c) Calculation. The amount of the cost of gas rate is the anticipated unit cost of gas sold.

At the conclusion of each winter and summer period the company will calculate the extent that cost of gas revenues are greater or less than actual unit costs of gas compared with the anticipated unit costs.

The calculated difference (actual gas sales volumes multiplied by the difference between actual and anticipated unit costs) will be carried forward into the computation of the cost of gas rate for the corresponding winter or summer period.

Any excess revenue collected, as determined above, will earn interest as specified by the P.U.C.

(d) Changes. The cost of gas rate may be adjusted without further Commission action based on the projected over-/under-collection of gas costs, the adjusted rate to be effective the first of the month. Any such rate adjustments may not exceed a maximum rate of 25 percent above the approved rate, but there is no limit on the amount of any rate reductions.

(e) Refunds. When refunds are made to the Company by its suppliers that are applicable to increased charges collected under this provision, the Company will make appropriate refunds to its customers and as the Commission may direct.

(f) Reporting. The Company shall submit to the New Hampshire Public Utilities Commission, at least 30 days prior to the effective date, the proposed winter and summer period cost of gas rate computation. Any monthly adjustments to the Cost of Gas rate must be filed five (5) business days prior to the first day of the subsequent month (the effective

## II. TERMS AND CONDITIONS

date of the new rate). The cost of gas rate shall be computed to the nearest one hundredth cent per therm and shown on customers' bills.

(g) Fixed Price Option Program. An alternative to the traditional winter period cost of gas rate mechanism may be elected by the customer, pursuant to the Company's Fixed Price Option (FPO) Program. The Company may offer up to 50% of its expected firm sales for the winter period under the FPO Program.

The cost of gas charge offered under the FPO Program will remain fixed for all winter period billings commencing November 1 and ending April 30 of the effective winter period.

Once elected, customers must remain on the FPO Program for the duration of the winter period unless service is terminated.

There are no maximum or minimum usage levels. Customers may enroll in this Program by contacting the Company between the October 1 and October 19 period immediately preceding the effective winter period.

## II. TERMS AND CONDITIONS

### 18. ATTACHMENT POLICY

Applications for new service will be conditioned upon credit worthiness and application of the 25% test set forth in Section 6.

## GENERAL RATE SCHEDULE

## RESIDENTIAL

The number of customer classes will be determined after a cost of service study is conducted in connection with Valley Green's rate case.

## GENERAL RATE SCHEDULE

## INDUSTRIAL, INSTITUTIONAL, AND COMMERCIAL

The number of customer classes will be determined after a cost of service study is conducted in connection with Valley Green's rate case.



Dated: January 1, 2016
Effective: January 1, 2016

Issued by: JAMES W. CAMPION, IV
Title: President

# SECTION G

DG 15-155
Valley Green Natural Gas, LLC
OCA Set 3 to Valley Green Natural Gas, LLC

Date Request Received: 08/17/15 Date of Response: 08/27/15; 12/7/15; 4/22/16
Request No. OCA 3-4 Witness: James W. Campion, IV

REQUEST: Given the presence of two potentially competing gas utilities to serve within Hanover and Lebanon, would Valley Green consider engaging in discussions about dividing up the territory so that more customers can get service sooner, compared to waiting for one start-up gas utility to expand its distribution system more slowly?

SUPPLEMENTAL RESPONSE: Valley Green has concerns about ~~is not interested in~~ "dividing up the territory." Valley Green does not agree that dividing up the territory necessarily results in serving residential customers sooner or better. Valley Green presumes the reference to "competing gas utilities" is to Liberty Utilities/EnergyNorth Natural Gas.

First, dividing a relatively small territory could make a natural gas pipeline franchise uneconomic for any company granted a franchise. To build a viable natural gas pipeline company, the company needs a critical mass of customers. Dividing the territory would remove customers needed to form that critical mass.

Second, meeting the needs of customers will involve non-regulated solutions such as trucking liquefied natural gas to remote locations.

Third, OCA 3-4 appears to presume that Valley Green and Liberty Utilities/EnergyNorth Natural Gas are in a similar position to start serving customers. Valley Green respectfully disagrees. Liberty Utilities/EnergyNorth Natural Gas' proposal to serve Hanover and Lebanon includes no property secured for a project, no permits, and no design. Valley Green is much further along with its local and state permit approvals and customer contacts than Liberty Utilities/EnergyNorth Natural Gas and will be in a position to serve customers much sooner than Liberty Utilities/EnergyNorth Natural Gas.

Fourth, furthermore, back in 2011 when prospective industrial and commercial customers were looking for natural gas service for Lebanon and Hanover, representatives of Liberty Utilities/EnergyNorth Natural Gas stated to Mr. Campion that it was not interested in serving the area. Because Liberty Utilities/EnergyNorth Natural Gas was not interested in serving Hanover and Lebanon back when customers were seeking a solution, Valley Green questions Liberty Utilities/EnergyNorth Natural Gas' commitment to serve the OCA's residential customers, especially since residential customers will not generate as much sales and business opportunity as industrial and commercial customers.

While dividing the territory is not a preferred result for the reasons set forth above, Valley Green could accept a division of territory that gives each of Liberty and Valley Green the area within a four-mile radius of its respective site, splitting the slight overlap between the two areas. The two sites are several miles apart, and each company is in a better position to serve the customers in its immediate area.

# SECTION H

DG 15-155

Valley Green Natural Gas, LLC

OCA Set 3 to Valley Green Natural Gas, LLC

Date Request Received: 08/17/15 Date of Response: 08/27/15

Request No. OCA 3-7 Witness: James W. Campion, IV

REQUEST: Please identify any contracts, letters of agreement, memoranda of understanding, or other forms of agreement between Valley Green and any potential customer(s).

RESPONSE: As part of Valley Green's discussions with potential commercial, industrial, and institutional customers, it circulated a draft letter of intent. (Attached) Valley Green's proposal was positively received by customers. While letters of intent have been reviewed and theoretical contract rates have been discussed with potential commercial, industrial, and institutional customers, Valley Green and the proposed customers understood that these now dated discussions would need to be revisited to reflect more accurate costs, such as gas pricing and overhead, after Valley Green received franchise approval. The letter includes reference to Valley Green's regulated and unregulated projects.

# *Valley Natural Green Gas, LLC*

April _, 2014

[redacted]

*Re: Letter of Intent ("LOI") to accept and purchase gas service*

Dear [redacted]

We are pleased to submit this Letter of Intent ("LOI") pursuant to which [redacted] would accept delivery of and purchase Natural Gas delivered by Valley Green Natural Gas, LLC ("Valley Green Gas" or "VGNG") (the "Transaction"). [redacted] and Valley Green Gas are referred to collectively as the "Parties".

This LOI describes our current thoughts on a transaction, and it does not constitute a binding proposal or agreement, except for the sections specifically identified below regarding exclusivity and confidentiality. Neither party makes any representation that it will enter into a final, binding agreement to consummate the Transaction.

NON-BINDING TRANSACTION OUTLINE

Recitals and Background

Valley Green Gas is developing a transportation and energy center including liquefied natural gas ("LNG") storage and vaporization facilities, compressed natural gas ("CNG") fueling facilities, and a natural gas distribution utility pipeline in Lebanon, New Hampshire (the "VGNG Facilities"). VGNG is in the process of permitting a site for the VGNG Facilities, and filing with the New Hampshire Public Utilities Commission permission to operate as a public utility.

[redacted] is a company that provides [redacted] and operates [redacted] NH [redacted] currently uses [redacted] as a fuel source for its boiler and wishes to obtain delivery of pipeline natural gas to [redacted] its facilities.

Therefore, the Parties would pursue a final, binding agreement for the delivery of natural gas via pipeline, based on the following transaction outline. Except for those terms detailed in sections 5 and 6 below, the terms of this letter of intent are not binding upon the Parties, and any agreement

is subject to, among other matters, completion of due diligence, the negotiation and execution of a final, binding agreement. The balance of this document sets forth general terms that will form the basis of negotiations between the Parties hereto.

1. **Development of VGNG Facilities.**

Valley Natural Green Gas and/or its affiliates are in the process of initial development of the VGNG Facilities at 135 Etna Road in Lebanon NH and are solely responsible for completing such development at their own expense, including but not limited to the following actions:

a) Secure all necessary permits.
b) Secure approval to operate as a public utility, and if applicable, approval of any tariff.
c) Secure gas delivery and distribution agreements with customers other than [redacted] in Lebanon and Hanover, New Hampshire.
d) Negotiate agreements for the supply of necessary equipment at the VGNG Facilities.
e) Select a general contractor for the installation of the VGNG Facilities.
f) Regularly inform [redacted] as to the development status of the VGNG Facilities.

2. **Development [redacted] Facilities.**

[redacted] is solely responsible for completing development of all facilities necessary to accept and utilize Natural Gas via pipeline at [redacted] locations [redacted] at its own expense, including but not limited to the following actions:

a) Secure all necessary permits.
b) Negotiate agreements for the supply of necessary equipment at the [redacted].
c) Select a general contractor for the installation of the [redacted].
d) Regularly inform VGNG as to the development status of the [redacted].

3. **Purchase of Pipeline Distributed Natural Gas.**

VGNG shall be responsible for purchasing Natural Gas from suppliers for all VGNG customers during the entire period of the delivery obligation discussed in section 4 below. VGNG shall contract such purchases for [redacted].

4. **Delivery of Natural Gas via Pipeline.**

VGNG shall deliver and [redacted] shall accept Natural Gas on the following terms:

a) VGNG will convert all LNG purchased under contract for [redacted] from vendors, into Natural Gas at appropriate pressure at the VGNG Facilities.

b) VGG will deliver to the [redacted] all Natural Gas so converted by VGNG, and [redacted] will accept such delivery.
c) The term of the conversion and delivery agreement will be [redacted].
d) [redacted] will pay VGNG for such conversion and delivery services [in accordance with a tariff a roved by the N HPUC] [as set forth in Exhibit Al.
e) VGNG shall invoice [redacted] [in accordance with a tariff approved by the NHPUC] [monthly, within fifteen days after the end of the billing month]. [redacted] shall pay such invoices [in accordance with a tariff approved by the NHPUC] [within fifteen days of receipt].
f) VGG shall remotely monitor gas levels at the VGNG Facility and schedule deliveries so that [redacted] is never out of fuel.
[redacted] VGNG shall be responsible for operating and maintaining the VGNG Facilities and [redacted] shall be responsible for operating and maintaining the [redacted]
h) VGNG shall have the right to terminate the agreement if [redacted] fails to pay any undisputed amount within thirty (30) days of its due date. [redacted] shall have the right to terminate the agreement if [failure of delivery obligation].
i) [Other customary terms and conditions].

**BINDING PROVISIONS**

**5. Exclusivity.**

In order to induce Valley Natural Green Gas to invest the necessary time and expense associated with developing the VGNG Facilities and pipeline, [redacted] and its affiliates, assigns, directors, officers, employees, representatives, and agents, agree and covenant that they will not, either directly or indirectly, solicit any indication of interest from or engage in any discussions with any party other than Valley Natural Green Gas or its affiliates regarding the purchase of natural gas in any form or any other fuel product other than short-term purchases of propane and pending negotiation of final terms under this LOI and development of the VGNG Facilities.

This exclusivity provision will continue for a minimum of [twenty-four (24) months] from the date of this LOI and for so long thereafter as VGNG continues to work in good faith with [redacted] or its assigns or successors on the VGNG Facilities. Notwithstanding the above, this exclusivity provision will terminate if the parties fail to enter final binding agreements implementing the terms set forth in sections 1 through 4 above within such [24-month] period. This exclusivity provision will also terminate if VGNG provides written notice to [redacted] that it has decided that it will not develop the VGNG Facilities.

**6. Confidentiality.**

The Parties agree that the contents of this LOI constitute Confidential Information and shall not be disclosed to any other parties without the express permission of the other Party.

Please indicate your acceptance of the above by signing and returning one copy of this

Agreement. We look forward to working with you on this Project.

Sincerely yours,

_____

Name: James E. Campion
Title: CEO
Valley Natural Green Gas, LLC

AGREED AND ACCEPTED BY:

_____

# EXHIBIT A

## PRICING

**[If not set forth in a tariff approved by the NHPUC, describe formula for compression an delivery services, probably in terms of$ /MMBTU (LHV).]**

# SECTION I

DG 15-155
Valley Green Natural Gas, LLC
City of Lebanon's Set 1 to Valley Green Natural Gas, LLC

Date Request Received: 08/24/15
Request No. City of Lebanon 1-1

Date of Response: 09/03/15; 12/17/15
Witnesses: Kenneth H. Stanley
Jonathan W. Carroll

REQUEST: Please describe ***all*** potential types of health or safety emergencies which could possibly arise in conjunction with the operation of facilities such as the type which Valley Green proposes to operate in Lebanon, regardless of how small the likelihood of such emergency arising is believed to be. For each such type of emergency, please also list the various potential origins, sources or ways in which such an emergency might possibly arise.

RESPONSE: The type of emergencies Valley Green will be required to address or respond to are defined in federal and state laws.

49 CFR §191.3, describes emergencies as "incidents" and they are defined as:

(1) An event that involves a release of gas from a pipeline, or of liquefied natural gas, liquefied petroleum gas, refrigerant gas, or gas from an LNG facility, and that results in one or more of the following consequences:

(i) A death, or personal injury necessitating in-patient hospitalization;

(ii) Estimated property damage of $50,000 or more, including loss to the operator and others, or both, but excluding cost of gas lost;

(iii) Unintentional estimated gas loss of three million cubic feet or more;

(2) An event that results in an emergency shutdown of an LNG facility. Activation of an emergency shutdown system for reasons other than an actual emergency does not constitute an incident.

(3) An event that is significant in the judgment of the operator, even though it did not meet the criteria of paragraphs (1) or (2) of this definition.

Federal regulations under 49 CFR part 191, part 192, part 193, and part 199 all, in some form, set standards for minimizing the occurrence of emergencies or set standards on how to respond to emergencies.

**Pipeline Safety Regulation – 49 CFR Parts 190 though 199**

The U.S. Department of Transportation's Pipeline and Hazardous Materials Administration (PHMSA) currently incorporates by reference into 49 CFR Parts 192, 193, and 195 all or parts of more than 60 standards and specifications developed and published by standard developing organizations (SDO's). In general, the SDOs update and revise their published standards every 3 to 5 years to reflect modern technology and best technical practices.

Specifically the following:

- **49 CFR part 191 - Transportation of Natural and Other Gas by Pipeline; Annual Reports, incident Reports, and Safety Related Conditions Reports**
- **49 CFR part 192 - Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards**
- **49 CFR part 193 - LIQUEFIED NATURAL GAS FACILITIES: FEDERAL SAFETY STANDARDS**
- **49 CFR 199 – Drug and Alcohol Testing**
- **And the other regulations and codes referenced there in**
- **49 CFR 178 – Impacts LNG Transportation Vehicles**

**National Codes**

- **NFPA 52 – Vehicular Gaseous Fuel Systems Code**
  - Scope.
  - Applicability. This code shall apply to the design, installation, operation, and maintenance of compressed natural gas (CNG) and liquefied natural gas (LNG) engine fuel systems on vehicles of all types and for fueling vehicle (dispensing) systems and associated storage, including the following:
    (1) Original equipment manufacturers (OEMs)
    (2) Final-stage vehicle integrator/manufacturer (FSVIM)
    (3) Vehicle fueling (dispensing) systems
  - This code shall apply to the design, installation, operation, and maintenance of liquefied natural gas (LNG) engine fuel systems on vehicles of all types, to their associated fueling (dispensing) facilities, and to LNG to CNG facilities with LNG storage in ASME containers of 70,000 gal (265 m3) or less.

- **NFPA 55 – Compressed Gases and Cryogenic Fluids Code**
  - Scope.
  - Applicability. This code shall apply to the installation, storage, use, and handling of compressed gases and cryogenic fluids in portable and stationary cylinders, containers, equipment, and tanks in all occupancies.

- **NFPA 59A: Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)**
  - Scope.
  - Applicability.
    This standard shall apply to the following:
    (1) Facilities that liquefy natural gas
    (2) Facilities that store, vaporize, transfer, and handle liquefied natural gas
    (3) The training of all personnel involved with LNG
    (4) The design, location, construction, maintenance, and operation of all LNG facilities
    1.1.2 This standard shall not apply to the following:
    (1) Frozen ground containers
    (2) Portable storage containers stored or used in buildings
    (3) All LNG vehicular applications, including fueling of LNG vehicles

- Purpose. The purpose of this standard is to provide minimum fire protection, safety, and related requirements for the location, design, construction, security, operation, and maintenance of LNG plants.

- **NFPA 70 – National Electric Code**
- **ASME B31.3 – Process Piping**
- **ASME B31.8 Gas Transmission & Distribution Piping Systems**

- Code for the design, operation, maintenance, and repair of natural gas distribution and transmission pipelines.

- Other Codes as required for Fire Safety, Life safety, etc.

In addition to the federal regulations, the Commission also sets standards intended to minimize or respond to emergencies such as the PUC's 500 & 800 rules also apply. PART 504, Quality of Gas Service, and requires pressure requirements, incident reporting, and emergency response. PART 506, Equipment and Facilities, requires compliance with the federal pipeline safety standards and sets standards for on-site storage. PART 508, Safety, Accident and Leakage Requirements, set forth safety practices, surveys, and inspections. All of these are intended to minimize the occurrence of emergencies.

For example, the PUC 504.05 (a) states:

The utility shall notify the safety division of the commission by telephone when any of the following events occur:

(1) A release of gas from a pipeline, release of LNG or LPG, or release of gas from a LNG or LPG facility that results in:

a. A death;

b. Personal injury necessitating same day professional medical treatment; or

c. Estimated property damage of $5,000 or more;

(2) A fire or an explosion at, or emergency shutdown of, a liquefied natural gas facility, or propane-air facility;

(3) An evacuation of a building conducted by a fire department, utility or other emergency personnel because of the presence of gas in the atmosphere or in, or in the immediate vicinity of, the building;

(4) An unplanned service interruption or gas outage that is expected to result in 50 or more customer outage hours;

(5) A single outage occurring at a state, federal, or municipal facility, hospital, school or other facility in which the public could be affected;

(6) A breach of security or other threat that jeopardizes the operation of a utility's major facilities;

(7) Any exceedance of maximum allowable operating pressure of any duration, including accidental over pressurizations, consistent with Puc 506.01(a);

(8) A gas facility-related event, that the utility is aware of or has reason to believe has been or will be reported in the news media, including, but not limited to, a shutdown of a major highway, arterial roadway or rail system, or where a person identified as a news reporter was present;

(9) When the utility confirms that levels of odorant do not meet the requirements of Puc 506.02(m); or

(10) An event which is significant in the judgment of the utility, even though it is not

described above.
In addition, per the requirements the New Hampshire Code of Administrative Rules, as enforced by the PUC, specifically Puc 500 and Puc 800 Rules, and the CFR regulations, Valley Green Natural Gas will be required to prepare and submit for review and approval, the following written plans:

1. Operations and Maintenance Manual
2. Emergency Response Plan
3. Security Plan
4. Integrity Management Plan (IMP)
5. Public Awareness Plan
6. Operator Qualifications Plan
7. Construction Quality Assurance Plan
8. Integrated Resource Plan

These plans will be prepared in compliance with these regulations and codes and VGNG will operate its facilities and systems in compliance with same. The enumeration of "***all*** potential types of health or safety emergencies" as requested will be addressed as required in the above noted Plans and through the review and approval process for same.

Valley Green intends to become a member of the Northeast Gas Association (NGA), of which both TRI-MONT Engineering, Inc. and Gulf Oil are already members, and will avail itself of the resources available through the NGA to ensure its plans meet or exceed all requirements.

Gulf Oil is a member of the NGA's LNG Steering Committee which coordinates annual LNG training programs and updates the regional LNG Trucking Emergency Plan. See attached sample table of contents and table of contents of terminal plan for topics typically covered. The committee also coordinates mock drills on a regular basis to test the New England LNG Emergency Response Plan. Additionally the NGA committee has a partnership with the Massachusetts Firefighting Academy and coordinates the most comprehensive LNG/LP safety and emergency response training program in the country in Stow, MA. The course is very thorough, combining classroom instruction and hands-on training. Plant operations personnel will be required to attend this course periodically. Gulf is willing to sponsor any local fire officials that would like to attend the course.

Gulf is also a member of the Public Awareness Committee of the NGA. The committee maintains the regional public awareness written plan and coordinates regional education, communication, and evaluation programs. The group develops pipeline safety surveys for the general public, excavators, public officials, and EMS officials. It also develops pipeline safety media campaigns, brochures, and mail inserts. Valley Green will have access to all of these resources.

Plant operations personnel would also be required to attend training courses offered at the Gas Technology Institute. GTI offers industry-recognized certification programs in the fields of Natural Gas Field Skills, Natural Gas Distribution, Natural Gas Transmission, and LNG Operator Training. Courses are specific to topics, such as: Fundamentals of Baseload LNG.

SUPPLEMENTAL RESPONSE: As detailed above, safety and emergency preparedness is heavily regulated. TRI-MONT and Gulf have ample expertise in designing and operating LNG facilities in compliance with these various regulations. In furtherance of its obligation to maintain a high degree of technical expertise, Valley Green has become a member of the Northeast Gas Association (NGA). The NGA is on the forefront of improving safety. Members of the NGA have access to continual training, in all aspects of gas supply and delivery, for safety and emergency preparedness.

In addition, The International Group of Liquefied Natural Gas Importers is another technical resource responsive to the City of Lebanon's inquiry about safety. Please also see the attached LNG Information Paper No. 7. The paper provides a summary of potential hazards of LNG and how those hazards compare favorably to gasoline and fuel oil hazards. It is a more readable overview of gas safety laws than the numerous technical regulations listed above.

# MANUAL OF SAFETY OPERATING PROCEDURES

## LNG PLANT

Volume I

Revised

LNG plans and procedures must be updated:
(1) When a component is changed significantly or a new component is installed; and
(2) At intervals not exceeding 27 months, but at least once every 2 calendar years.

TABLE OF CONTENTS

VOLUME 1


1. INTRODUCTION TO LIQUEFIED NATURAL GAS ..... 9
2. SAFETY WITH LNG ..... 13
3. INTRODUCTION TO LNG SATELLITE ..... 16
4. OPERATING PROCEDURES ..... 28
4. GENERAL DESCRIPTION ..... 28
4.2.1 TANK FILLING PROCEDURES ..... 30
4.2.2 PRECAUTIONS ..... 30
4.2.3 PROCEDURES –TANK FILL ..... 33
4.2.4 TANK FILLING (COLD TANK} ..... 35
4.2.5 TANK FILLING –PUMP TRANSFER. ..... 36
4.4 VAPORIZATION - STARTUP ..... 42
4.4.1 1 GENERAL INFORMATION ..... 42
4.4.2 PLANT INSPECTION ..... 42
4.4.3 SYSTEM START-UP ..... 46
4.4.4 SYSTEM SHUTDOWN ..... 48
5. OPERATING CONTROLS AND ENGINEERED SAFEGUARDS ..... 49
6. SECURITY AND SAFETY ..... 53
6.9.10 Abnormal Operating Procedures ..... 69
6.9.10.1 Operation of TWV-200 ..... 69
6.9.10.2 E-Stop Activation ..... 69
6.9.10.3 Power Failure ..... 70
6.9.10.4 Fire Alarm ..... 70
6.9.10.5 Gas Alarm ..... 71
6.9.10.6 Low Discharge Temperature ..... 71
7. FIRE PREVENTION ..... 74

VOLUME 2

8. MAINTENANCE ..... 10
8.1. SAFETY AND WORK PROCEDURES ..... 11
8.2. PROTECTIVE CLOTHING ..... 11
8.3. COMBUSTIBLE GAS DETECTOR ..... 12
8.4. HOTWORK PERMIT ..... 12
8.5. MAINTENANCE WHILE IN SERVICE ..... 15
8.6. LEAK REPAIR ..... 15
8.7. TOOLS & MATERIALS ..... 16
8.8. PURGING ..... 17
8.9. ISOLi\.TION ..... 17
8.10. EL
ECTRICAL ..... 17
8.11. W
ELDING &FABRICATION ..... 18
8.12. PA
INTING & SURFACE COATING ..... 20
8.13. PR
ESSURE TESTING ..... 21
8.14. CO
NTOUR & FOUNDATIONS ..... 22
8.15. EQ
UIPMENT, INSPECTION & MAINTENANCE LIST ..... 22
8.16. M
AINTENANCE PROCEDURES BY COMPONENT ..... 48
8.16.1 PROPERTY AND UTILITIES ..... 49
8.16.2 TANK ..... 51
8.16.3 HEAT EXCHANGERS ..... 57
8.16.4 BOILER AND WATER/GLYCOL SYSTEMS ..... 60
8.16.5 FIRE EQUIPMENT ..... 79
8.16.6 ODORIZER ..... 167
8.16.7 LNG PUMP ..... 205
8.16.8 VALVES ..... 231
8.16.9 CRYOGENIC TRANSFER HOSES ..... 389
8.16.10 PIPING - STRAINING ..... 391
8.16.11 COMBUSTIBLE GAS DETECTION SYSTEM ..... 393
8.16.12 FIRE DETECTORS ..... 426
8.16.13 GAS METERS ..... 429

9. CORROSION CONTROL (192.2625) ..... 522
10. DUTIES OF SUPERVISION ..... 524
11. CURRENT PERSONNEL & TITLES ..... 528

## LIST OF FIGURES

Figure 1 - LIQUEFACTION CYCLE COMBINING THE CASCADE AND EXPANDER CYCLES ..... 10
Figure 2 - LNG SATELLITE SYSTEM ..... 11
Figure 3 - TYPICAL VAPOR CLOUD COMPOSITION ..... 15
Figure 4 - UNLOADING SYSTEM ..... 17
Figure 5 - TYPICAL LNG STORAGE TANK ..... 21
Figure 6 - PRESSURE BUILDING SYSTEM ..... 22
Figure 7 - BOILOFF SYSTEM ..... 24
Figure 8 - VAPORIZATION SYSTEM ..... 25
Figure 9 - SENDOUT GAS ODORANT & METERING SYSTEM ..... 27

## LIST OF FORMS

### VOLUME 1

4.2.1.11 - LNG TRUCK OPERATIONS ..... 32
4.3.1.1.1 - CRITICAL VALVE OPERATION LOG ..... 40
4.4.5 - HOURLY LOG FORM ..... 49

### VOLUME 2

8.3.1 HOTWORK PERMIT ..... 15
8.14.1.3 WEEKLY INSPECTION CHECKLIST ..... 27
8.14.3 MONTHLY INSPECTION CHECKLISTS ..... 29
11.1 EMERGENCY CONTACTS ..... 534

Northeast
GAS ASSOCIATION

# LNG TRUCKING EMERGENCY RESPONSE PLAN

**December 31, 2010**

# TABLE OF CONTENTS


Section 1.0 - Purpose . . . . . 2

Section 2.0 - Organization . . . . . 2

Section 3.0 - Emergency Notification, Dispatch, and Response . . . . . 4

Section 4.0 - Plan Maintenance and Responsibility . . . . . 5

Section 5.0 - Training Requirements . . . . . 5

Appendix A - Zone Response Companies

Appendix B - Zone Coverage

Appendix C- Zone Emergency Response Sheets

Appendix D - Worksheets – Incident Questionnaire and Tool Kit

# LNG TRUCKING EMERGENCY RESPONSE PLAN

## I. PURPOSE

This "LNG (LIQUEFIED NATURAL GAS/METHANE REFRIGERATED LIQUID) Trucking Emergency Response Plan" (hereinafter referred to as the "Plan") has been developed by the LNG Steering Committee of The Northeast Gas Association (NGA) to provide for a quick and effective response to an LNG tank truck emergency.

The main objectives of the Plan are to:

- Provide initial information on the characteristics of LNG;
- Provide a means of contacting personnel trained in the safe handling of LNG and in the proper techniques of handling a damaged LNG tank truck;
- Identify technical resources available to local authorities responding to the scene of an LNG tank truck emergency;
- Provide a framework for "Responding Companies" as defined in the NGA LNG Trucking Emergency Mutual Assistance Plan; and
- Serve as the LNG Trucking Emergency Response Procedures referenced in the NGA LNG Trucking Emergency Mutual Assistance Plan.

## II. ORGANIZATION

The organization of the Plan incorporates the use of (A) a Zone Response Network, (B) CHEMTREC (Chemical Transportation Emergency Center) and (C) an Emergency Response Plan Committee.

GROUPE INTERNATIONAL DES IMPORTATEURS DE GAZ NATUREL LIQUÉFIÉ

THE INTERNATIONAL GROUP OF LIQUEFIED NATURAL GAS IMPORTERS

**LNG Information Paper No. 7**

# Questions and Answers (Q&A's)

GIIGNL's Technical Study Group has overseen the development of this Information Series of 7 papers to provide factual information about Liquefied Natural Gas (LNG). This paper attempts to capture and answer frequently-asked questions about LNG. These Questions and Answers (Q&A's) were developed through a collective effort of LNG importers and import-terminal owners. For more information on these topics, references and weblinks are provided at the end of this paper.

## Introduction

These Q&A's are organised around general topics related to LNG import terminals and the transportation modes which interface with them. An LNG import terminal consists of the berth or jetty(s) for the ship dockage and unloading (discharge), the LNG itself, the onshore LNG storage tank(s), pumps, vaporisers and other equipment to convert the LNG from a cold liquid back into natural gas. Distribution of the natural gas to consumers via pipeline is the norm; alternatively, LNG can be transported to customers in specially-designed road tank trucks and rail tank cars.

Another type of facility which may receive LNG by ship is known as a peak-shaving facility. These terminals, which may be operated by utilities, store LNG in bulk storage tanks until it is needed at times of peak demand. An LNG peak-shaving facility is normally connected to the gas supply system and the facility; these facilities can take gas from the network as feed for liquefaction and/or receive LNG by ship or road tank trucks. Peak-shaving facilities may include LNG liquefaction equipment to convert natural gas into LNG, LNG storage tank(s), pumps, vaporisers and other equipment to convert the LNG back from a cold liquid into natural gas before sending it back out through the pipeline distribution network to consumers.

The owners of LNG import and storage facilities consider the impact of their operations on the environment and wherever possible, minimise their burden on the environment.

In every part of the world, high environmental standards are demanded by local, national and supranational authorities who require extensive environmental assessments of design and operation before granting their approval to construct and operate.

Answers to the questions have been developed from a number of technical specialists and other sources; they are believed to be accurate based on industry and consultant review.

## LNG Basics

### What is LNG?

LNG stands for Liquefied Natural Gas. In French, Spanish, Portuguese, or Italian-speaking countries, the abbreviation GNL is used in place of LNG. Natural gas comes from deep in the earth and is extracted through specially-drilled wells. It comes to the surface either as gas or in association with oil. Natural gas at the well head is made up of many constituents including methane, propane, ethane, butane, pentanes, nitrogen, water, and other impurities. The gas is processed at a gas processing plant where most of the impurities and water are removed. Then the natural gas is sent to a liquefaction plant, where additional gas processing removes the rest of the water vapour, other impurities

such as mercury, sulphur compounds, and carbon dioxide from the gas. A refrigeration process turns the gas into a liquid. LNG is predominantly methane, with small amounts of ethane, propane and perhaps some butane. LNG appears as a colourless, odourless clear fluid, with about half the density of water. It is generally handled at slightly above atmospheric pressure in large bulk storage tanks and at around 4.5 bar when carried by truck. The temperature of LNG is typically -162°C (-259°F), which is a very low or cryogenic temperature. **Information Paper No. 1** provides additional information on LNG properties.

### Why liquefy natural gas?

The conversion to a liquid reduces the volume of natural gas by about 600 to 1, which means one LNG ship can transport enough LNG to equal 600 ships carrying natural gas at atmospheric pressure. Liquefying natural gas makes it feasible to transport natural gas in bulk and to store it in preparation for vaporisation and supply into pipelines. **Information Paper No. 2** describes the liquefaction process in greater detail.

### How do you liquefy natural gas?

Natural gas is cooled by a large refrigeration system. First, produced natural gas is processed to condition it for liquefaction by removing components which would freeze such as water vapour and carbon dioxide. In this processing step, other contaminants such as hydrogen sulphide and heavy metals are also removed. If commercially desired, heavier hydrocarbon liquids such as propane and butane are sometimes removed. The remaining natural gas, predominately methane with small amounts of ethane, propane and perhaps some butane, is then cooled by a refrigeration system working on the same basic principles as a refrigerator or an air conditioner. The main difference is the sheer scale of the plant used to produce LNG.

### Where does the LNG come from?

The LNG primarily comes from areas where large gas discoveries have been made, such as Algeria, Australia, Brunei, Egypt, Equatorial Guinea, Indonesia, Libya, Malaysia, Nigeria, Norway, Oman, Qatar, Trinidad, and the United Arab Emirates. Some LNG is produced in the US (Alaska) and Europe. For existing and potential import terminals, there is now an increasingly diverse choice of LNG supply sources.

In theory, LNG can be produced wherever natural gas is available. Domestically, pipeline natural gas is also liquefied and stored in peak-shaving facilities around the world (including the US, Europe, and Japan) as an alternative means of storing gas for future use, typically during periods of high, or peak, demand.

LNG import/export projects are based on the economics of surplus gas supplies at a low price at the source, reasonable transport distances at moderate costs, and demand at attractive prices at the destination. The resultant "gross margin" generated by this formula must be sufficient to provide a reasonable rate of return on the required capital investment. The gas surplus may be the result of a natural gas produced in conjunction with oil production (associated gas) or large "dry gas" discoveries (unassociated gas). In either case, the local market usually is too small to consume the production, and pipelines are uneconomical for delivering the gas to consuming regions. Thus the economic value is low or non-existent. For European countries and the US Atlantic Region, Algeria and Nigeria meet these criteria as major suppliers, as well as Trinidad for the US Gulf Coast Region. In the future, Angola, Peru, and other Middle East countries appear positioned to become potential suppliers. Depending on market prices, several existing exporters are available including Australia, Brunei, Indonesia, Malaysia, Oman, Qatar, Trinidad and the US, most of which supply LNG to Japan, Korea and Taiwan. New export projects are planned for Angola, Australia, Indonesia, Iran, Peru, Siberia, the US and Venezuela.

## LNG Transportation

### How is LNG transported by sea?

LNG is transported in large, specially-designed ships, known as LNG carriers. There are about 300 ships in the worldwide LNG fleet and about 100 more are on order. The cost of LNG ships today is between US$ 225-250 million for a 135,000 cubic metres ($m^3$) carrier up to about US$ 300 million for the larger ships. LNG Ships are discussed in **Information Paper No. 3**.

LNG ships have design features aimed at a high degree of safety. They are double-hulled and have ballast tanks separate from the cargo tanks. As the cargo is very cold, the cargo tanks are separated from the hull structure by thick insulation. There are from four to six separate cargo tanks. The two cargo tank designs commonly used are membrane tanks and spherical tanks.

The cross section of membrane tanks is essentially the same shape as the ship hull. The metal membrane inside the insulation provides the liquid containment, as does a redundant secondary barrier, should a failure occur to the primary barrier. The cargo hydrostatic and dynamic loads are carried by the insulation through to the hull structure external to the tank.

The spherical tank design incorporates freestanding insulated cargo tanks which are designed for liquid, vapour pressure (1.2 atmosphere absolute pressure or less), and dynamic loads. Spherical tanks are supported at the equator by cylindrical skirts to the hull. All LNG

ships carry their cargo at very low-pressure, usually less than 150 kPa (mbar) above atmosphere pressure.

As both designs have proved safe and reliable in service, the choice of cargo tank design is primarily based on economics, i.e., price, delivery schedule and shipyard idle capacity, rather than technical or performance criteria. Both major designs have evolved into a "standard" design with a capacity of 125,000 $m^3$ to 175,000 $m^3$ and a service speed of 18 to 20 knots. Typical dimensions are 270 to 290 metres (m) long and 40 to 49 m in width with a draft of about 11.5 m. Some new ships exceed 300 m in length and have a cargo capacity of up to about 267,000 $m^3$.

## What are the flags of registry for LNG ships?

Countries with more than one LNG ship in their registry include Algeria, Australia, The Bahamas, Bermuda, Brunei, France, Isle of Man, Italy, Japan, Korea, Liberia, Malaysia, Malta, the Marshall Islands, Norway, and the United Kingdom. No inference about safety or reliability can be drawn from a ship's flag of registry, the supplier of the cargo, or the nationality of the ship's crew to a particular characterisation of the importers.

The flag of registry is not particularly relevant in terms of rules and regulations and safety level available on LNG carriers since all flag states implement International Maritime Organisation (IMO) Conventions including, for instance, the International Gas Carrier Code (IGC Code), the International Safety Management (ISM) Code, and the International Convention on Standards of Training, Certification and Watching (STCW) Convention. The safety level is directly managed by the ship operator and ship manager. Safety policies for ships are also framed to consider the potential impacts of incidents which could involve the whole LNG chain, not only the tanker.

LNG ships must also be certified by marine Classification Societies during design and construction to ensure that standards are met. Classification inspections or "surveys" continue at regular intervals throughout the ship's working life. The main Class Societies operating internationally for LNG are Lloyd's Register (LR-UK), Bureau Veritas (BV-France), Det Norske Veritas (DNV-Norway), the American Bureau of Shipping (ABS-US) and Nippon Kaiji Kentai Kyokai (NKKK-Japan).

## How do those who employ LNG ships know that they are in good repair and working properly?

LNG ships must be designed to meet the requirements of the IGC Code, Classification Society Rules and flag state requirements, and be constructed under Class supervision. Throughout their service life, LNG ships are subjected to regular inspection and survey. The results of this process are recorded in the ship's certificates, which are available for inspection. Without valid certification, an LNG ship will not be accepted for work.

The terminal operators have a vested interest in making sure the LNG carriers unloading at their facility are in good repair and working properly. An accident on the ship while it is docked could significantly impact the operations of the import terminal. In Europe and Japan, the import terminal and/or the charterers carry out ship inspections to check the tanker's suitability to be chartered or to enter port. There occasionally have been incidents in which LNG ships have been turned away until rectification of deficiencies on the ship (which had resulted in its failure to meet the standard).

In the US, the US Coast Guard (USCG) also inspects the ships regularly and issues a new Letter of Compliance certificate every two years. The owners of the terminals may also have a financial interest in the ships. All parties in the LNG process chain are keenly aware of the potential impact to the Industry's safety reputation of even a minor incident or "near miss".

Several means are available to assess the ship conditions. The "Port State Controls" established by the Memorandum of Paris (1981) are recorded in the "Equasis" database available for worldwide access. Generally, operators perform ship inspections according to the Oil Companies International Marine Forum (OCIMF) standards or to their own standards to assess the ship conditions. Reports on the ship's technical and survey status are available through the OCIMF Ship Inspection and Report (SIRE) programme, via the ship's classification society, and through the ship owner. For additional information on the regulations, codes and standards which apply to LNG ships, please refer to Information Paper No. 3.

## For a new LNG Carrier arriving in an LNG terminal, how is the ability and training of the crew for performing manoeuvres checked?

The training of the crew must be in accordance with Standards of Training, Certification and Watchkeeping (STCW) Convention from the International Maritime Organisation (IMO). The training level required for the crew is given in the STCW IMO Convention, which requires a "dangerous cargo endorsement" and navigational experience. Certificates are checked by Port State Controls and deficiencies are recorded in the "Equasis" database.

The Society of International Tanker and Terminal Operators (SIGTTO) provides guidance to the industry on good practices and minimum competency standards. Training to meet the particular conditions of an import

terminal is managed by the terminal and organised around pre-transfer meetings and ship-to-shore procedures.

### Is LNG transported by road?

LNG is transported by road to consumers from import terminals and liquefaction facilities, including peak-shaving facilities, in specially designed LNG road tankers in some countries, including Australia, Belgium, China, Germany, Japan, Korea, Portugal, Spain, Turkey, the UK and the US. These LNG road tankers are double-skinned with insulation in between and contain up to 20 tonnes of LNG.

Transportation via trucks allows the distribution of energy to areas which are far from established gas distribution networks, e.g., areas which do not have pipeline access because of poor economics or difficult terrain. For example, parts of Scotland are supplied by LNG road tankers because the mountains prevent the cost effective laying of pipelines. A growing market is based on the use of LNG as fuel for trucks and large commercial vehicles. A fuel station infrastructure for these vehicles is growing rapidly and is supplied by LNG road tankers.

Economies of scale exist in the liquefaction process. In some areas it is economical to use LNG import facilities as a central "hub". Supplying multiple end-users via trucks has proven beneficial to all members of the energy supply chain.

### How many LNG tank trucks are in operation worldwide?

About 700 LNG tank trucks are in service worldwide. A recent industry report estimated to cover more than 70% of the overland transportation for LNG worldwide concluded the following:

- At least 284 LNG tank trucks transport approximately 1,900,000 tonnes of LNG annually;
- **In Europe**: 65,000 individual truck loads travelling more than 18,000,000 km delivering close to 1,200,000 tonnes of LNG;
- **In the Americas**: Just over 21,000 individual truck loads, travelling more than 3,000,000 km with almost 370,000 tonnes of LNG; and
- **In the Far East**: 56,000 truck loads, over 8,000,000 km carrying more than 350,000 tonnes of LNG.

### Is an LNG road tank truck like a petrol (gasoline) tank truck? Is it more explosive? Is it more harmful to the environment if it has a spill?

The main similarity between a petrol (gasoline) tank truck and an LNG tank truck is their comparable size. LNG tank trucks are double-skinned with insulation in between, and contain up to 20 tonnes of LNG. LNG if spilled will vaporise and the natural gas will dissipate. Both gasoline and LNG vapours are flammable.

## LNG Characteristics

### What are the hazards of LNG?

LNG is stored and transported at cryogenic or extremely low temperatures (-162°C; -259°F) which can cause cold injuries upon contact with live tissue. The cryogenic temperatures also can cause brittle fracture when in contact with many materials, e.g., rubber or steel. In a confined space, displacement of air by natural gas (vaporised LNG) can result in there being insufficient oxygen to support life.

LNG (natural gas in liquid form) is primarily used as a fuel; therefore the vapours are flammable and will burn once mixed with the proper amount of air to support combustion. LNG in its liquid state will not burn. Vapours form when LNG goes from a liquid to a gas. In all normal circumstances, LNG warms and begins to boil (and evaporate) as soon as it is released outside its storage container. Therefore, LNG facilities and equipment are designed with special features to assure containment of the LNG and its vapours. When natural gas vapours burn, the fires are very hot; the radiant heat of LNG fires is considered the primary hazard.

#### Fires

The fire hazards from LNG are broadly similar to other hydrocarbons such as LNG or gasoline. The main differences stem from its vaporisation and dispersion behaviour. If there is a release of LNG, a flammable mixture can develop as the vapours mix with the oxygen in air. Low temperature LNG vapours cause the air to be cooled so that any moisture in the air condenses to form a white cloud or fog. Thus the vapour/air mixture from an LNG release is usually visible. Specifically, it is the atmospheric moisture "fog" which is easily seen rather than the natural gas vapour. Under most conditions, the visible fog is a reasonable indication of the physical boundaries of the flammable mixture. The shape of the cloud is a good indication of the direction of the vapour dispersion.

Initially, the cold LNG vapours are heavier than air and will tend to stay close to the ground, but as the LNG-air vapour cloud warms, it will approach the density of the ambient air. This will limit the amount of sideways spreading of the cloud. When the cloud temperature warms to about -110°C/-166°F, it becomes positively buoyant. In such cases it can rise away from ignition sources at ground level, depending on the surrounding wind and atmospheric conditions.

Three elements must be present in the correct proportions for a fire to occur:

- Fuel (LNG vapour)
- Oxygen (Air)
- Ignition Source (Hot surface or spark)

A flammable mixture of fuel in air exists only between the upper flammable limit (UFL), where there is not enough oxygen, and the lower flammable limit (LFL), where there is not enough fuel. For LNG vapour/natural gas, the lower flammable limit is approximately 5% and the upper flammable limit is approximately 15%.

The risks from a LNG fire can be subdivided into two categories:

- *Fires where ignition does occur but is delayed.* When ignition is delayed, a vapour cloud will form and begin to spread. Computer calculations based on experimental data are used to estimate the size and flammability of the LNG vapour cloud and how it will disperse over time in a variety of weather conditions and terrain types. LNG facility designers and operators must demonstrate to regulators that these potential vapour releases and fires pose no hazard to the general public. In some countries, a thermal radiation exclusion zone, based on modelling, is required for sustained fire scenarios. Once ignited, the LNG vapour cloud may, in low wind conditions, burn back to the source of LNG/gas leak and will continue as the second type of fire.
- *Fires with immediate ignition in which a fire persists in burning for extended periods of time.* These fires occur at the point of the gas leak and burn only in the immediate vicinity. Thermal radiation calculations are performed to predict the impact of these fires on other equipment, plant personnel and the general public. LNG facility designers and operators must demonstrate to regulators that these fires pose no hazard to the general public.

### Other Hazards

Exposure to LNG liquid can cause freezing of the skin and is destructive to tissue, somewhat like a burn. Hence the expression "cryogenic burn". Exposure to low temperature LNG vapour is less likely to cause tissue damage because the low density and low heat transfer from the vapour means that an extended exposure time is required before damage occurs. Unless a person is incapacitated, exposure to cold LNG vapour should not be life- threatening.

Where LNG vapours have displaced oxygen, as in a confined space, decreased oxygen availability impairs human physical and mental functionality. At low oxygen concentrations (below 10%) unconsciousness and asphyxiation will occur. The hazard from a high concentration of LNG vapour (50% or greater) is the displacement of the oxygen in air rather than any toxic or chemical property of the LNG vapour. Methane is not toxic and is chemically inert.

## How does LNG compare in terms of safety hazards to other substances handled in ports, land-based facilities, on roadways and on railways?

LNG is not explosive in open air, toxic, carcinogenic or chemically reactive. It is flammable and will burn – which is its value as an energy source. If a leak or spill occurs, LNG vapours immediately begin absorbing heat from ambient air and soil, become lighter than air, rise and dissipate. If the vapours ignite, the flame speed of flammable vapours burning a cloud in the open air is relatively slow (about 4 metres per second).

Gasoline and fuel oil are more flammable and, in their liquid state and contain toxic components. If these hydrocarbons are spilled, unlike LNG, there will be an environmental impact. The extent and duration depend upon incident-specific conditions. LNG has comparatively fewer hazardous characteristics than some other common fuels, as shown in **Table 1**.

## What is that unpleasant odour in natural gas?

Odorants are deliberately added to natural gas used for industrial and residential purposes to provide an early warning sign of escape or leakage. LNG (the liquid) has no odour and the liquid is not normally odorised. Conventional odorants freeze at LNG temperatures and are not sufficiently volatile at low temperatures to create an odour in vapours from an LNG spill. Therefore, the gaseous form of LNG is odorised as required by state regulations after it has been regasified but before entering the pipelines for distribution.

Table 1. Characteristics of commonly used fuels (see notes on table)

| HAZARD | LNG | LPG | GASOLINE | FUEL OIL |
|---|---|---|---|---|
| **Toxic** | NO | NO | YES | YES |
| **Carcinogenic** | NO | NO | YES | YES |
| **Flammable** | YES | YES | YES | YES |
| **Asphyxiant** | YES, in confined spaces | YES, same as LNG, but higher density encourages accumulation | NO (unless in confined space) | NO (unless in confined space) |
| **Other Human Health Hazards** | Low temperature | NO | Eye Irritant, Narcosis, Nausea, others | Similar to Gasoline |
| **Flammable Limits in Air (%)** | 5 –15 | 2.1 – 9.5 | 1.3 - 6 | N/A |
| **Stored Pressure** | Ambient, except in some small containers | Pressurized | Ambient | Ambient |
| **Behaviour if Spilled** | Evaporates forming flammable visible cloud that disperses readily; keep away from ignition sources | Evaporates forming explosive vapour cloud that will hug the ground | Forms a flammable pool, environmental cleanup required | Environmental cleanup required; potentially long term depending upon specific oil type |

## Will LNG burn?

As noted above, LNG, which is a liquid, does not burn, because liquids do not contain enough oxygen to support combustion. However, LNG vapours are flammable in air, but only when they comprise between 5-15% of the air. If the fuel concentration is lower than 5% it cannot burn because of insufficient fuel. If the fuel concentration is higher than 15% it cannot burn because there is too much fuel relative to the oxygen. Therefore, the fire hazard of LNG is preconditioned on a combination of variables: the LNG being released, vaporising, then mixing with air in a very narrow gas to air ratio of 5-15%, and ultimately finding an ignition source.

## Is a BLEVE possible with an LNG road tanker?

The acronym BLEVE means Boiling Liquid Expanding Vapour Explosion, which is the sudden release of a large mass of pressurised flammable liquid to the atmosphere. A primary cause is if an external flame impinges on the shell of a pressurised tank above the liquid level, weakening the shell and resulting in sudden rupture. A BLEVE can only occur in a road tanker under specific circumstances:

- A fire is ignited beneath or impinging on the road tanker;
- The insulation around the vessel fails to prevent heat reaching the LNG;
- The fire burns sufficiently long that the LNG begins to boil;
- The LNG boils so vigorously that valves installed to relieve the increasing pressure are unable to cope, and pressure within the tank rapidly rises;
- The upper part of the shell not in contact with LNG becomes weakened by overheating
- The tanker may then rupture with an intense, localized overpressure and fire.

There are two types of LNG road tankers operating worldwide:

- Double-skinned tankers with insulation between the two metal layers. These tankers are mandatory in the US, and are also common in Europe and Asia. In the double-skinned road tankers the fire can not directly impinge on the inner tank which contains the LNG. Any failure of the inner tank therefore occurs at a pressure too low to cause a BLEVE.
- Single-skinned LNG tankers with external insulation are occasionally used in some European and Asian countries. In single-skinned tankers, the fire has the potential to directly impinge on a tank containing LNG and a BLEVE is possible.

An LNG road tanker left the road and crashed into a gorge at Catalunya in Spain in 2002. A fire began immediately (it remains unclear whether this was a diesel or LNG fire) and 20 minutes later a BLEVE occurred. The driver was killed in this accident.

# LNG Safety

## What safety codes and regulations govern the transport and handling of LNG?

Specific standards for terminals and ships have been developed and adopted in different parts of the world. For additional information on the regulations, codes and standards which apply to LNG ships, please refer to **Information Paper No. 3**. For additional information on the regulations, codes and industry standards which apply to LNG import terminals please refer to **Information Paper No. 4**.

In the US, the codes and regulations specific to LNG import facilities include:

- 49 CFR Part 193 - *Liquefied Natural Gas Facilities: Federal Safety Standards;*
- NFPA 59A - *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG);*
- 33 CFR Part 127 - *Waterfront Facilities Handling Liquefied Natural Gas and Liquefied Hazardous Gas.*

In Europe, the codes and regulations specific to LNG import facilities include:

- European Union (EU) Seveso II Council Directive 96/82/EC of 9 December 1996 - *Control of Major-Accident Hazards involving Dangerous Substances*;
- European Standard EN 1473 - *Installation and Equipment for Liquefied Natural Gas – Design of Onshore Installations;*
- EN 1532 Installation and Equipment for Liquefied natural gas – Ship to Shore Interface.

The following US standards may also be applied:

- NFPA 59A - *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG);*
- 33 CFR Part 127 - *Waterfront Facilities Handling Liquefied Natural Gas and Liquefied Hazardous Gas.*

The codes and regulations which apply internationally to LNG ships include:

- *International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk* (the "IGC Code");
- 46 CFR Parts 153, 154 and 157.

Various LNG operations are governed by different regulatory jurisdictions but all are covered by both regulations and codes. For example, in the US, a prime regulation governing the marine portion of an LNG import terminal is 33 CFR Part 127, *Waterfront Facilities Handling Liquefied Natural Gas and Liquefied Hazardous Gas.*

For marine operations, port authorities also have jurisdiction.

In the EU, the onshore terminals are under the jurisdiction of European Council. The main European regulation applicable to LNG import terminals and storage facilities is European Union Seveso II Council Directive 96/82/EC of 9 December 1996 on the *Control of Major-accident Hazards involving Dangerous Substances.*

Applying their own regulations derived from this Directive, national authorities of each European country have responsibility to issue a certificate to the facility and are the lead agency for review of environmental and safety concerns including public comment meetings and review procedures.

In Asia, specific standards have been developed for each area. The codes and regulations specific to LNG import facilities include:

- Gas Industry law, and
- Electricity Power Industry law.

## What is done to assure that LNG ships and land-based facilities are designed and built for safety of operation and to protect the public?

The public safety assurance is accomplished by:

- Safe siting, design and construction of the import terminal per codes;
- Safety studies complying with European Directive Seveso II 96/82/EC for European countries;
- Ship design and construction approval by a "classification society" such as Bureau Veritas, DNV, Lloyd's Register of Shipping, NKKK, RINA and the American Bureau of Shipping;
- Pre-arrival inspections of facilities and ships;
- Third-party safety and code compliance audits;
- Initial and ongoing training programs for all personnel;
- Integrated emergency response programs, including all resources.

## What ensures those dealing with LNG are capable of adequately performing their duties so as to protect the public?

LNG facilities are required to be designed and constructed by professionals who have demonstrated competence. This is assured, for example, by government regulations and oversight agencies which license engineers for the practice of engineering. Trained inspectors verify that the facilities are constructed correctly. Safeguard systems for LNG facilities are discussed in Information Paper No. 6.

Operations and maintenance personnel in LNG facilities are required to be trained, both initially and periodically thereafter, in:

- The hazards of LNG;
- The hazards of operation and maintenance activities;
- How to recognize breaches of security and execute security procedures;
- Understanding the potential causes, types, sizes and predictable consequences of fires and knowing and following fire prevention procedures;
- How to perform their assigned functions during both normal operations and emergencies;
- How to provide first aid; and
- Verification of compliance with these requirements is performed by each national dedicated Authority.

A key component of emergency planning is the training of all emergency responders, which incorporates coordination, communication, drills and exercises. Hazards and mitigation scenarios are identified and used to develop responses and role assignments. Simulated emergencies, both table-top and full-scale, are used to

validate and improve the effective application of knowledge, skills, and team interactions. Field exercises are used to assure hands-on expertise.

For the European Union all these operation and maintenance activities fall under the control of a Safety Management System required by Directive Seveso II 96/82/EC.

In the US, exercises are required under a variety of authorities, including the US Coast Guard and the Department of Transportation, among others.

## What standards and/or regulations define the required systems/methods to detect and notify the operator of a release of LNG from tankers and terminals?

Standards and codes require that combustible gas detectors and low temperature detectors are located at places where an LNG release might occur and where LNG or low temperature vapour might accumulate.

These detectors are continuously monitored. They also have alarms set just above the detection levels and automatic shutdowns at hazard levels.

For facilities on land, monitoring systems are required by EN 1473 in Europe, and 49 CFR Part 193 and NFPA 59A in the US. Onboard ship, monitoring systems are required by the IGC Code, the classification society's requirements and the USCG requirements of 46 CFR 153-154 and 33 CFR Parts 127, 160-169.

In addition to the code-required instrumentation specifically for leak detection, there is abundant normal process instrumentation that will alert an operator to an abnormal condition that may or may not be caused by leakage. Many areas are either covered by remote TV cameras or are visible to a plant operator or from a ship's control room. An LNG release of any size is easily recognized visually, because of the condensation of water vapour from the atmosphere within any resulting cloud.

## What safety features are there at the onshore facilities?

There are two types of safety features in an LNG facility: management systems and technology/ equipment systems. The subject of **Information Paper No. 6** is Industry Safeguard Systems which includes a discussion of safety features.

Management systems include studies during the design process that identify hazards and then review the design to ensure that these hazards can be mitigated or controlled. During the operational phases, procedures are written to ensure that safe working habits and procedures are encouraged, inspections and maintenance are carried out in a timely and appropriate manner and impact on the public and employees of any unexpected circumstance is minimised.

In the US, the regulations generally require that these worst-case spill hazards remain on the owner's property such that risk to the public is approaches zero.

In Europe, the Seveso II Directive requires a complete Safety Management System for the control of major-accident hazards. The System must include a safety study with a risk analysis and relevant measures for mitigation of consequences. The final risk level must be acceptable to the authorities.

Emergency procedures and response plans also must be developed. These plans will be discussed with the local, fire, police and medical services. Most facilities have regular simulations of these plans and exercises with the local authorities.

With regard to safety technology and equipment, LNG facilities have multiple levels of hazard detection, mitigation and intervention systems. There are two types of systems: passive technology systems, which work without interaction, and active systems, in which an operator is prompted to take action or which may be automatically deployed.

Passive systems incorporated during the design phase ensure that the correct materials are employed to handle cryogenic temperatures and process pressures; that equipment is correctly sited to prevent any hazard spreading (escalating); and that access is restricted to certain areas. Passive systems also can safely dispose of any gas/LNG during an accidental release. Concrete coatings and protective reinforcement of control rooms are other examples of passive systems. Restricted zones are established around equipment and vessels containing fuel to strictly control or eliminate possible ignition sources.

Active systems include detection equipment for finding leaks such as methane detectors, emergency shutdown devices (ESDs), emergency venting systems, Ultraviolet or Infrared (UV/IR) fire detectors, closed circuit TV; staff monitoring of the facility by regular inspections; training of personnel; specifically-designed systems to mitigate hazards, for example, earthquake protection of LNG storage tanks; and emergency fire-fighting systems.

For additional information, please see **Information Paper No. 6** on Industry Safeguard Systems.

## What safety features are there onboard the ships?

Safety features for ships are broadly divided into two categories: ship navigation and cargo handling.

In the area of ship navigation, IMO has established international "Collision Regulations" which applies to all

vessels in coastal and international trade. Ships are now equipped with radar which incorporates ARPA (Automatic Radar Plotting Aid). ARPA not only identifies the presence of another ship or other hazard, but also indicates its relative speed and direction. This feature is especially useful for determining a safe course in high traffic areas. Ships are also equipped with GPS (Global Position System), which can pinpoint the exact location of the ship (within a few metres) anywhere in the world. Many of the world's major ports, including most LNG ports, have VTS (Vessel Traffic Services), which are best described as "air traffic control" for ships.

All ships are equipped with GMDSS (Global Maritime Distress and Safety System). GMDSS has replaced the radio operator and Morse Code. The GMDSS system is located on the bridge and can be easily accessed by the bridge watch-standers. In the event of an emergency, a watch-stander can push a distress button, which will automatically send a signal with the ships name and location. The watch can add additional information to the automatic message, such as the type of emergency (fire, sinking, etc.). This message will be forwarded automatically to all ships in the area, so they can render assistance. Included as part of the GMDSS system is an array of lifesaving signal equipment, such as radio beacons and search and rescue transponders. The law requires a minimum number of officers on each ship to be licensed to operate GMDSS.

The cargo system is designed with many features to maintain operation in a safe manner and, if it deviates outside of predetermined parameters, actions will be taken to assure safety. Pressures, levels, and temperatures are monitored automatically. If a problem is identified by the monitoring system, an alarm will sound and equipment will be secured, as necessary, to return the cargo system to a safe condition. Most of the alarms and trips have some form of redundancy to ensure problems are identified and corrected in a timely manner. For example, under the International Gas Code, all LNG ships must have two means of safely disposing of excess gas, thereby controlling the pressure in the LNG tanks.

All vessels are equipped with a gas detection system that senses the atmosphere in specific locations which are subject to potential gas leaks. Such spaces include the insulation space around the cargo tanks, compressor room, control room, and any other spaces where gas can accumulate. Fire and/or smoke detection systems may be available for spaces that contain flammable materials, such as the paint locker.

The navigation bridge is manned twenty-four hours a day at sea and has cargo system monitoring equipment that sounds an alarm whenever a non-standard condition is identified in the cargo system. The cargo control room is manned continuously during periods of cargo transfer to/from the ship.

Smoking is banned except in one or two specific locations within the ship's accommodation area.

## Does every body of water have the same rules for LNG carrier safety?

Not every port or import terminal has identical safety rules, but all follow the same guiding principles.

The rules at a specific port for LNG ships are established by the Captain of the Port/Harbour Master. A key reference document for establishing port-specific rules is the International Safety Guide for Oil Tankers and Terminals (ISGOTT). The Terminal Safety Rules are generally gathered in a Terminal Safety and Port Instruction Handbook including a Ship Shore Safety plan with which the vessel shall comply.

The Society of International Tanker and Terminal Operators (SIGTTO) provides guidance to the industry on best practices for ships at sea and at berth. Many port authorities consult widely with their peers prior to determining or changing their operational rules.

Port manoeuvring and departure safety rules vary depending on the port configuration (river, open sea, tide, weather, other traffic). However, many common features exist such as the need for tugs and defined weather limits, tide and visibility restrictions.

## What safety features are there on LNG tank trucks?

LNG tank trucks have safety devices to prevent over-filling and over-pressurisation, as well as safety systems to prevent the LNG road tanker from driving away while still connected to the loading facilities. LNG road tankers must comply with country-specific codes for design and operation.

## What safety measures are in place at the unloading facilities?

The unloading berth has the same hazards prevention and detection systems as the rest of the import terminal, including closed-circuit TV, emergency shut-down (ESD) systems, fire detection systems and vapour detection. Most also have emergency release couplings on the unloading lines which minimise the spillage of LNG should a ship have to leave the berth unexpectedly, e.g. during extreme wave conditions. The LNG unloading process systems incorporate monitoring and control devices to detect deviation from acceptable parameters, thereby enabling corrective action to prevent unsafe conditions. Closed-circuit TV is used for monitoring the unloading area and as a secondary visual system to the combustible gas detectors and UV/IR fire detectors. There are

emergency shut-down buttons at the pier, the control room, and on board the LNG ship which, when activated, will bring the ship and the import terminal to a safe shut-down. This shut-down generally shuts off all pumps and closes off all piping so that the LNG stays either on the ship or in the storage tank.

### Who verifies that safety measures are applied and what is the frequency of these inspections?

**European area**: The Safety Management System, required by the European Directive Seveso II and implemented by the owner, includes internal control loops for every safety activity. In addition, some verifications are made by oversight agencies and inspections are performed by Local Authorities. The frequency of these inspections is variable for each facility. The Seveso II consent must be renewed every 3 years.

**US area**: Safety activities fall under the jurisdiction of OHSA (Occupational Health and Safety Administration), DOT (Department of Transportation), or Dept. of Homeland Security/US Coast Guard. Each agency will verify the safety activities that fall under its jurisdiction through inspections. The inspection rate is chosen by the responsible agency and will vary by facility. The Federal Energy Regulatory Commission (FERC) requires quarterly reports from the import terminal operators and typically also makes annual inspections.

**Other areas**: Similar procedures are implemented by government agencies in Asia and wherever a new LNG terminal is constructed.

## Security

### What measures are in place to assure the security of LNG ships and terminals?

Following the attacks on the US on September 11, 2001, the International Maritime Organisation (IMO) implemented a comprehensive security regime for international shipping which entered into force on July 1, 2004. The mandatory security measures, adopted in December 2002, include a number of amendments to the 1974 Safety of Life at Sea Convention (SOLAS), the most far-reaching of which implements the new International Ship and Port Facility Security Code (ISPS Code), which covers the whole port including any LNG facility therein. The ISPS Code contains detailed security-related requirements for Governments, port authorities and shipping companies in a mandatory section (Part A), together with a series of guidelines about how to meet these requirements in a second, non-mandatory section (Part B).

In addition to addressing security threats from terrorism, IMO is implementing an anti-piracy project, a long-term project which began in 1998. IMO's aim has been to foster the development of regional agreements on the implementation of counter piracy measures. The Regional Cooperation Agreement on Combating Piracy and Armed Robbery against ships in Asia (RECAAP), which was concluded in November, 2004 by 16 countries in Asia, includes the RECAAP Information Sharing Centre (ISC) for facilitating the sharing of piracy-related information. In January, 2009, an important regional agreement was adopted in Djibouti by States in the region, at a high-level meeting convened by IMO. The Code of Conduct concerning the Repression of Piracy and Armed Robbery against Ships in the Western Indian Ocean and the Gulf of Aden recognizes the extent of the problem of piracy and armed robbery against ships in the region and, in it, the signatories declare their intention to co-operate to the fullest possible extent, and in a manner consistent with international law, in the repression of piracy and armed robbery against ships.

Assuring the security of maritime and other critical infrastructure assets has been addressed in country-specific laws and regional agreements. For example, the US passed the Maritime Transportation Security Act (MTSA) in 2002. MTSA applies to vessels operating in U.S. waters (regardless of flag), marine terminals and, in addition to US domestic ports, foreign ports that receive vessels intending to travel to US port facilities. MTSA is similar to the ISPS, except that all parts of MTSA are mandatory. Security vulnerability assessments and security plans are required to be reviewed and approved by the US Coast Guard. The MTSA also introduces the requirement for a USCG-issued Transportation Worker Identification Card (TWIC) for anyone having to enter a secure area of a marine terminal and vessels while in US waters. This includes members of the crew and is required regardless of flag of ship or nationality of the crew.

LNG terminals include a range of layered and multiply-redundant security measures and systems. The specific measures and systems are selected from a wide range of possibilities by risk assessment, usually in conjunction with government security organisations and are deployed according to national alertness criteria.

### What would happen if a bomb, missile or plane hit the LNG storage tank at the import terminal?

Security experts do not consider LNG facilities to be a priority terrorist target. Also, if a terminal became a target, the post-9/11/2001 air traffic controls would make it exceedingly difficult to execute the attack. These facilities

are indentified as part of a country's critical infrastructure and enhanced security measures have been implemented. Also, research and sophisticated modelling have compared the structural integrity of storage tanks against likely attack parameters. The results show that penetration of the tanks by these modes of attack would be very unlikely. All plant safety and security vulnerability assessments consider this type of scenario as a design case andplant designs provide for spill impoundment for credible accidents. Currently, an evaluation of the consequences has determined some underlying factors which place some boundaries on the risks. These are:

- If an aircraft impact is severe enough to cause a release of LNG, there will be an immediate fire (aircraft fuel and LNG), which precludes the development of a flammable vapour cloud.
- The structure of an aircraft is relatively "soft" except for the engines that are "hard" with considerable mass and penetrating potential.
- The combined structural strength, flexibility and mass of the LNG tank probably preclude a catastrophic failure but may not preclude penetration by the engines.

### What would happen if a bomb were attached to an LNG road tanker and then exploded?

The LNG road tanker trailer contains a relatively small amount of LNG. It is double-skinned with insulation between and is therefore highly resistant to damage. If liquid were to be spilled, the result will be a fire and some possibility of LNG entering the road drains.

### What would happen if a bomb, missile or plane hit the LNG ship?

This issue has been the concern of government agencies and the LNG industry. The research conducted by the US Dept. of Energy Sandia National Laboratories scientifically addressed the effect of a terrorist attack on LNG carriers, and included the intelligence community in defining scenarios and study parameters. The details of the scenarios are classified information.

Some parallels could be drawn from the experience of the Gaz Fountain, a refrigerated LPG carrier hit by rocket fire in the Persian Gulf in 1984. Three air-to-ground armour-piercing rockets hit the ship. Only one of these caused a rupture of one of the ship's tanks, causing a large fire. Ultimately, the fire was brought under control, a significant portion of the cargo in the other tanks was off-loaded to another vessel and the ship was made safe for removal from the area.

### How vulnerable are the ships?

With their double-hull construction, robust cargo tanks with multiple layers of insulation, implementation of maritime security measures following 9/11/2001, scrutiny from regulators, transit risk mitigation measures, and the training required for the crew, LNG ships are inherently less desirable than all other possible terrorism targets.

### Is it fair to characterise an LNG tanker as a floating bomb?

No. An explosive delivers a large amount of energy over a very short time period. Explosives have the reactants inherently contained in the explosive material. The energy release is concentrated and nearly instantaneous. The gases created expand at very high speed, far greater than the speed of sound, thereby causing a "bang".

Although the tankers carry a large amount of LNG, equal to a large amount of stored energy, the physical characteristics of the cryogenic liquid mean that it takes a considerable time to convert this energy into a flammable or explosive state.

A similar comparison would be a warehouse full of wood. This has the stored energy of a bomb but would not be considered dangerous as the related energy would be released only slowly in the event of a fire.

For LNG, the liquid first needs to vaporise and be mixed in the correct proportions with air to become flammable. The flame speed for methane is relatively low (approximately 4 m/s). Unless confined within a building or industrial space, it does not explode. If the cargo tanks were breached by an intentional attack, flammable vapours would form and a fire would likely occur. The aforementioned Sandia research modelled and predicted the radiant heat from the fire from a cargo tank at various distances from the ship.

### Have there ever been any attacks or verified terrorist threats against an LNG facility?

None known.

## LNG Spills

### Is an LNG spill detectable?

LNG's low temperature will typically cause condensation of water vapour in the air and form a visible white cloud which would be readily apparent and small amounts of white (hydrate) material would accumulate on surfaces, much like ice or snow. The air around the release would

feel quite cold. LNG vapours have no odour or colour, as many other substances do, to indicate a release.

Flammable vapours are detectable with specialized equipment. Within an LNG facility or onboard a ship, various types of hazard detectors are used to alert personnel to a leak or spill. These could include detection for the presence of gas, flame, smoke, high temperatures or low temperatures. These detection systems are discussed in greater detail in **Information Paper No. 6**.

## What is the environmental impact of LNG spills?

If spilled on land or water, LNG will vaporise and the natural gas will dissipate. The environmental impact of LNG spills is minimal because the components of LNG are non-toxic and insoluble in water. Therefore, if there is an LNG release on water or on land, the LNG will completely evaporate with no residue. However, freezing of the ground and organic tissue will occur upon contact with the cryogenic liquid.

## What happens when LNG is spilled on land?

Most simply, an LNG spill on land will result in vaporisation of the liquid to form a vapour cloud, predominantly of methane vapours. The vapour cloud will become buoyant when its temperature reaches approximately -110°C/-166°F, depending on the actual LNG composition and ambient weather conditions. If ignition sources are not present when the cloud is within flammable limits (5-15% natural gas in air), no fire will occur.

Initially, there is a large temperature difference between the spilled LNG and ambient, warmer surfaces. The initial evaporation rate of LNG is quite rapid but will decrease if a pool of spilled LNG accumulates. As time progresses and a pool accumulates, and/or the leak continues, the ground temperature drops which results in a slower evaporation rate. The pool of LNG would continue to evaporate until it completely vaporises.

The evaporation rate can be controlled by restricting the land surface area available for evaporation through dikes or walls to create spill basins or sumps. Insulation of the ground surface using special concrete also helps reduce the initial vaporisation rate. The vapour evaporation rate eventually depends on the size of the pool surface in contact with the air and the strength of the wind, rather than the contact with the ground. Managing the evaporation rate from this point depends on the response objective – whether it's better to slow down or speed up vapour cloud formation. Terminal personnel are knowledgeable about how to implement strategies to achieve response objectives. For example, high-expansion foam can blanket the surface of contained spills to reduce vaporisation rate and therefore control the rate at which the vapour cloud can form.

## What happens when LNG is spilled on water?

A spill of LNG on water evaporates about five times faster than on land because of the higher heat transfer rates associated with the water and a tendency for the water not to completely freeze. The high heat capacity and the circulation of the water at the surface usually inhibits significant ice formation. Depending upon the quantity spilled and the conditions, LNG has a tendency to spread and form a pool on the water surface because it is insoluble. This pool of LNG will evaporate and create a vapour cloud which expands, begins to dilute, and moves with the ambient wind conditions. The actual size, rate of expansion, movement of a vapour cloud depends upon incident-specific conditions. A first approximation is that the size of the LNG pool will increase until the vapour generation rate equals the LNG release rate. If ignition sources are not present when the part of the vapour cloud that is within flammable limits (5-15% natural gas in air), then no fire will occur.

Some LNG spills on water may have a Rapid Phase Transition (RPT). This is essentially a flameless overpressure caused by the very high transient rates of heat transfer from the water to the LNG. This causes the LNG to change from the liquid to the gas phase so quickly that a rapidly expanding vapour cloud is generated. The cloud can expand so quickly that a sonic boom and localized overpressure is created.

The RPT "explosion" phenomenon for LNG on water has been observed in a number of situations and has been studied extensively in both laboratory and large-scale tests. While this phenomenon is spectacular to observe at large-scales tests, the actual energy release is modest. An RPT is a very unpredictable phenomenon and the exact circumstances of its formation remain unclear. The temperature of the water and the actual composition of the LNG are important factors in predicting whether or not an RPT will take place. Work has also been performed to examine the impact of an RPT on the LNG ship and pier structure. Measured overpressures are insufficient to cause more than minor damage either to the ship or pier.

## What happens when LNG is spilled on a ship?

Small spills of LNG have occurred onto the decks of LNG carriers during the loading and unloading process. The cold of the LNG has caused the carbon steel deck plates to crack in some cases. Fire hoses and deck water

sprays are used to warm the spill area and increase the evaporation rate of the LNG.

Unlike deck plates, LNG tanks within a ship are made of metals which do not crack or become brittle in the presence of cryogenic temperatures. All LNG ships have two systems to prevent leakage from the LNG tanks. If one tank fails for whatever reason, the LNG is held safely by the secondary protection system. LNG tank types are designed to leak before failure, thereby allowing the crew to empty the affected tanks before significant damage can take place.

The LNG tanks and insulation spaces are kept free of air to prevent any leak from creating a flammable mixture. The tanks themselves always contain liquid LNG and some LNG vapour above the liquid.

The insulation spaces on membrane ships are filled with nitrogen (an inert gas) and monitored continuously for the presence of methane (flammable vapour).

### What is the risk from an LNG vapour cloud?

The main risk from a natural gas vapour cloud (mostly methane) is the potential for a fire. Risk analyses require all credible and possible release scenarios to be determined and evaluated. For the identified scenarios, codes and mathematical models are used to calculate the maximum excursion of the flammable mixture under adverse conditions.

If ignition of a vapour cloud does occur, the flame will burn slowly (3-4 m/s) back through the vapours to the point of release. If, at the time of the spill, the wind speed is more than a few metres per second, the flame will not propagate back to the source; it will burn out down wind from the ignition point. It will continue to burn until extinguished or until all the leaking LNG/fuel is consumed. Thus, the hazard area is limited to the path between the point of ignition and the point of release.

**Unconfined** methane vapour clouds cannot explode. If ignited, the cloud will deflagrate: the flame front will progress through the flammable portion of the cloud at the rate of a few metres per second. Once the vapour cloud is diluted below the lower flammable limit, it can no longer be ignited, nor will it burn.

A **confined** methane vapour cloud can explode and a cloud that enters a congested region can produce an explosion, if the amount of congestion is sufficient to accelerate the flame sufficiently. There is no evidence from any of the experimental programs or incident history that an LNG vapour cloud is capable of undergoing a transition to a sustained detonation, as has been observed with other more reactive hydrocarbon gases. (It should be noted that detonation occurs when the blast front progresses through the flammable cloud at sonic velocity, i.e., some 300 m/s. Normally, in an unconfined LNG vapour cloud, the flame front velocity is about 3-4 m/s, and shows no tendency to accelerate).

## LNG Incidents

### Have there ever been any major LNG accidents at import terminals worldwide?

The only incident at an import terminal which can be considered major was in 1979 at Cove Point, Maryland, US. An explosion occurred in an electrical switch room. LNG leaked through the electrical gland of an LNG pump, and travelled through 60 m of electrical duct and entered an electric substation. Since natural gas was not supposed to be in this part of the facility, there were no gas detectors. An electrical arc ignited the mixture of natural gas and air, causing a confined explosion of natural gas. One operator was killed and another one seriously injured.

Incidents involving other kinds of LNG facilities have happened, and they must neither be forgotten nor ignored. (NOTE: A Chronological Summary of Incidents Involving Land-Based LNG Facilities is presented in the CH-IV report, 2006). For instance, at the peak-shaving plant in Cleveland, Ohio, US, in 1944, many people died, as the result of LNG's worst accident. However, it occurred more than 60 years ago, at the beginning of the industrial application of LNG and long before the introduction of the stringent LNG safety standards which exist today. Moreover, it is the only incident involving public safety issues (meaning either public injuries or damage to businesses external to the LNG site). Indeed, since then, there have been no fatalities or injuries to the public due to incidents in LNG terminals.

Additionally, there have been few incidents involving LNG, as the industry has been making huge efforts in this regard and has developed a very conservative approach to the safe design, construction, and operation of LNG facilities. The industry continues to improve its record of reliability and safety. Like many industries involving complex infrastructures and intricate industrial processes, the LNG industry (LNG export and import terminals, LNG peak-shaving plants and transportation systems) has the potential for hazards to occur. The LNG industry has learned from past incidents, and it continues to improve technology, thanks to the benefits of the experience acquired from the handling of the same product over several decades.

The changes which have been made are the expression of these efforts: the incidents which occurred led to significant changes, not only in codes, standards, and safety rules, but also in staff training, storage tank design and construction, plant and equipment technologies, and many other fields. As a result, the study of safety

performance indicators highlights the LNG industry's admirable safety record when compared to that of the overall Oil and Gas industry.

## What caused the tragic incident in Cleveland, Ohio in 1944?

Mr. Ted Lemoff of the US NFPA (National Fire Protection Association) recently analysed the Cleveland incident in detail and presented a paper at GASTECH 2008, one of the industry's global conferences. Excerpts from this paper are included in this answer.

### Background

In an effort to assess ways in which to commercialise LNG, a pilot plant was constructed in Cornwell, W.V., US in 1940. A primary objective of the pilot plant was to address several technical issues, such as investigating what construction and insulation materials would be suitable for LNG storage. The pilot plant ran for 4 months and the operators learned that steel with less than 3.5% nickel and less than 0.09% carbon is brittle below –45ºC (-50ºF). Papers were presented at natural gas conferences and in technical magazines to make engineers aware of the new technology.

The winter of 1939-40 was an unusually cold winter in the US Northeast, and there were gas shortages. In that era, it was normal for industrial gas customers to stop using natural gas during periods of heavy demand, to assure a sufficient natural gas supply for heating of homes and for cooking. The East Ohio Gas Company (EOGC), a natural gas utility company serving Cleveland and surrounding areas, constructed the first commercial LNG storage tanks designed to have additional supplies of natural gas for cold winters. The "Number 2 Works" in East Cleveland was selected because it was the central point of the city gas distribution network and natural gas could easily be introduced into the system. The site had been in use for 50 years and it contained shops and buildings in the natural gas business. Recognizing the importance of the Charpy Impact Test (a procedure used to evaluate the brittleness of metals), three spherical tanks were constructed using 3.5% nickel steel in 1941. The need for additional storage capacity resulted in the new construction of a fourth tank, a semi-toroidal design. This design, although smaller and more expensive than spherical tanks, was selected because the design made for a stronger vessel. When the centre dish of the semi-toroidal tank was filled, the liquid overflowed and a crack developed; it was repaired. Extensive testing occurred on all the tanks when they were constructed. Dams were constructed around the 4 tanks to contain small spills, and an overflow tank was constructed. A tank designer objected to the dams because they would confine the air in the space beneath the tanks, interfering with air circulation. The tanks were designed assuming the outside of the insulating jacket would be at room temperature.

### The Incident

According to operating records, on October 20, 1944, the 4 LNG tanks had been filled and Sphere #1 was being topped off. At 2:40PM tank #4 failed (the toroidal tank). Plant employees testified that they heard a low rumbling. The 3,800 $m^3$ stored in tank #4 flowed over a large area and began vaporising immediately, forming a white cloud. A fire started shortly thereafter. About 20 minutes after #4 tank failed, the #3 tank failed (1,900 $m^3$), probably as a result of its support columns failing either from fire damage or from damage suffered from fragments of tank #4. Some of the liquid entered the sewers, which later ignited and exploded. The fires were brought under control early the following day. Tanks #1 and #2 survived the fire without leakage. The radiant heat from the LNG fires was intense. The fire resulted in 128 fatalities (the largest number were plant employees), over 200 injuries, and significant damage to the plant and wood buildings within 400 m.

### Investigation and Conclusion

Investigations were conducted by the Bureau of Mines, Case Western Reserve University, the coroner, and the National Board of Fire Underwriters. Metal fragments collected within 91 m of tank #4 indicated a pressure explosion from ammonia cylinders which were used in the liquefaction process. Fragments of tank #4 showed fractures consistent with low-temperature embrittlement. Investigators analyzed at least 7 possible causes for the tank failure but in the end were unable to reach a definitive conclusion. Their report listed possible contributing factors to the incident, including improper design (wood support of the inner tank), and the use of steel subject to brittle fracture.

### Recommendations

The Bureau of Mines report made the following recommendations (among others):

- LNG Plants should be isolated from other activities. They recommended a separation distance of at least 800m.
- Dikes to contain any LNG spill must be provided.
- Low temperature properties of metals should be investigated and published.
- Cryogenic liquids storage should not be made of 3.5% nickel steel unless brittle failure is determined not to be the cause of #4 tank failure.

- All cryogenic pipe joints should be bolted.
- Extreme caution should be taken to prevent spilled LNG from entering sewers.
- The appearance of frost spots on the outer shell of storage tanks should be investigated by emptying the tank.
- Efforts should be made to prevent wide variation in temperature in LNG storage tanks when they are first filled.
- Remote closing valves should be provided.
- All nearby sources of electrical ignition should be eliminated.
- Means for rapid egress should be provided for plant employees.

Where appropriate these recommendations have subsequently been incorporated into the various standards, codes, regulations and best practices discussed in **Information Paper No. 4**.

## Have there ever been any incidents involving LNG ships at import terminals?

There have been five incidents reportedat import terminals where small amounts of LNG have been spilled during unloading, which caused minor cracks on the ships' deck plate. (NOTE: A Chronological Summary of Incidents Involving LNG Ships is presented in the CH-IV report, 2006). Also, LNG ships are reported to have bumped a jetty, or berth, while docking on two occasions.

### *SPILLS DURING UNLOADING*

| DATE | VESSEL | DESCRIPTION |
|---|---|---|
| May 1965 | ***Methane Princess*** 27,400 $m^3$ Conch tanks | LNG leaked during disconnection of the loading arms. Small crack on ship deck. |
| April 1966 | ***Methane Princess*** 27,400 $m^3$ Conch tanks | Cargo leakage; no details |
| April 1979 | ***Mostefa Ben Boulaid*** 125,000 $m^3$ Membrane tanks | Equipment failed while unloading at Cove Point, US, spilling small amount of LNG on deck plate which cracked |
| April 1979 | ***Pollenger*** 87,600 $m^3$ Spherical tanks | Equipment failed while unloading at Boston, US, spilling small amount of LNG on tank weather cover plate, which cracked |
| 1985 | ***Isabella*** 35,500 $m^3$ | LNG tank overflowed while vessel was being unloaded, causing a crack to the deck plate. |

***COLLISIONS WITH JETTIES***

| DATE | VESSEL | DESCRIPTION |
|---|---|---|
| October 1997 | ***LNG Capricorn*** 125,000 $m^3$ Spherical tanks | Collided with a dolphin while docking near Osaka, Japan. Ship was pushed into the dock by high winds and sustained minor damage on the aft quarter. No cargo was released. |
| September 1999 | ***Methane Polar*** 71,500 $m^3$ Membrane tanks | Engine failure while docking at Trinidad and Tobago. Vessel struck and damaged an adjacent pier. No cargo was released. |

## LNG Benefits and Economic Considerations

### How is LNG ultimately beneficial to citizens around the world?

LNG supplements the natural gas supply, which is a key component of the energy mix. In the **World**, LNG is 5.3 % of consumed gas (in **Europe** LNG is 7.3% of consumed gas; in the **US** LNG is about 2.5% of consumed gas; in **Japan**, **Korea** and **Taiwan** LNG imports comprise more than 90% of their consumption of gas). Natural gas is used in residential homes for cooking, to provide heat and hot water, and in industry. The unique properties of LNG provide compelling reasons for its use in some circumstances. The ability to store LNG (mainly for short term or seasonal use) enables energy companies to meet fluctuations in demand, be it from day to night or from summer to the coldest day in the winter. In the long term, many countries need to diversify their gas supply and LNG imports are part of the answer.

Some countries may have gas reserves or pipeline supplies, but there are several additional factors that result in the need for LNG importation. Some of these factors are economic and some are strategic. Gas reserves are large but not infinite. The portion of the total natural gas supply that can be derived from imported LNG must be evaluated by area, pipeline transportation cost and capacity and load fluctuations. However, the demand for natural gas is increasing primarily because many new power plants are fuelled by natural gas for environmental reasons and the high purity of LNG can be an additional advantage. Worldwide, it is expected that the portion of energy supply from LNG will increase with time.

For example, the European natural gas market is expected to grow from 23% to 28% of total energy consumption in 2020 (i.e., within the next 10 years). In order to meet that growing demand, LNG must play an increasingly larger role in the Europe's energy mix.

In the US, natural gas is used in residential homes for cooking, to provide heat and hot water. In order to meet growing demand, LNG must play an increasingly larger role in the country's energy mix. Currently, only a very small percentage of the overall natural gas supply is served by LNG (about 2.5% in year 2007). New England, in the coldest weather, has derived as much as 40% of their natural gas use from LNG. It is expected that the portion of US energy supply from LNG will also increase in the future.

Although new natural gas reserves will be used in the future, the costs to deliver to market will be greater, as will the costs of deepwater production from the North Sea, the Gulf of Mexico and from other places in the world. In contrast, LNG project costs are stable and the number of sources is increasing. Thus, the portions of supplies from LNG will be primarily dictated by the cost of production and transmission of domestic natural gas, as well as the cost of natural gas from the areas which produce and export LNG.

The natural gas prices are sensitive to imbalances, even small ones, in supply and demand. Along with various natural gas imports by pipeline, diversification of sources through LNG imports will work toward a more stable balance and offset the upward price pressure during periods of tight supply.

### What would be the economic impact of losing an LNG import terminal?

The loss of an LNG import terminal would result in an important decline in natural gas supply to the subject country as a whole, as well as having an adverse effect on the local area. The severity of these impacts would depend upon the pipeline capacity in the area, but the loss of an import terminal is the equivalent to two major offshore supply areas being unavailable. There would also be a ripple effect. If natural gas is scarce, in tight supply, there will be more demand for oil resulting in its price increase. This in turn would increase the price of energy in general and electricity, gasoline, and chemicals in particular.

### What would be the economic impact of losing an LNG peak-shaving facility?

The loss of an LNG peak-shaving facility would mean an important loss of natural gas supply to the local or regional area, or even the entire supply chain in the country, depending upon the design of the distribution system and relative size of the country. The severity of the economic impact would depend upon the quantity stored in the facility's LNG tank(s), the time of year of the loss, and the relative importance of the facility in the economy of the region or area.

## What would be the economic impact of discontinuing LNG imports?

The short-term economic impact would be an increase in domestic natural gas prices, intermittent curtailment during peak demand periods and a reversal of the trend to use natural gas for power plants instead of oil and coal. The long term economic impact would be an increase in natural gas prices due to higher cost of exploration and production, higher transmission costs due to new, longer pipelines, higher prices due to scarcity and a switch to less environmentally friendly fuels.

## Key Points and Conclusions

In closing, the reader should remember the following key points of this Information Paper. In addition, most of these points apply to the entire Information Series about the LNG industry.

1. In a world where economic, political and sociological pressures have combined to create far-reaching global strife in the simple search for energy, LNG deserves serious consideration as an attractive source of reliable and secure energy supply for many years to come.
2. Like every other member of the family of energy industries, the LNG industry has some inherent hazards and risks.
3. While the LNG industry has been in world-wide existence for well over sixty years, there have been relatively few accidents, incidents, injuries or deaths in any facet of the entire industry, despite the presence of ships and trucks travelling the oceans, seas and roadways of this diverse and vast planet. No injuries to the public have occurred at a LNG facility since the tragic accident in Cleveland, Ohio, US over 60 years ago, when LNG first became commercially viable.
4. Like other members of this energy family, the safety hazards and risks of LNG can be effectively and efficiently managed through the multiple layers of codes, standards, best practices, measures, and contingency planning applied throughout the industry.
5. Historically, the members of the LNG industry have demonstrated their commitment to manage these risks in a most comprehensive, complete and responsive way. A graphic illustration of this framework and commitment is reflected in the "Multiple Safety Layers" figure on the last page. These layers are firmly based on a foundation of solid Industry Standards, Regulatory Compliance mandates and Codes. These "safety layers" include several key components of this overall Risk Management System. Included among them are Primary and Secondary Containment, Control Systems incorporating Knowledge and Experience (which are reinforced by comprehensive and ongoing training). A protective umbrella of Safeguard Systems, Separation Distances, and Contingency Planning further enhances the safe management of LNG.

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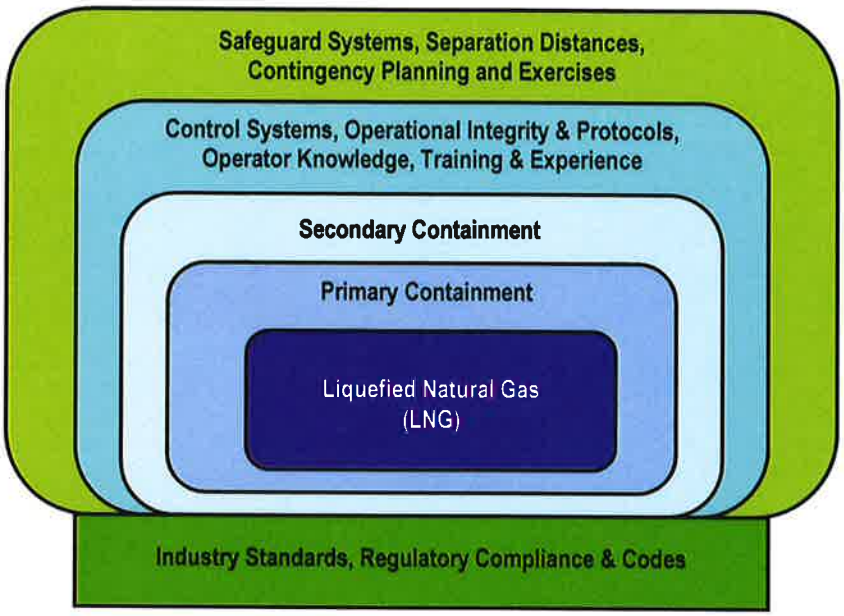
# Multiple Safety Layers Manage LNG Risk




The GIIGNL Technical Study Group has developed this 7-paper series to provide public readers with factual information about the LNG industry's multiple layers of safety, as illustrated in the figure to the left.

The GIIGNL Information Papers include:

- No. 1 – Basic Properties of LNG
- No. 2 – The LNG Process Chain
- No. 3 – LNG Ships
- No. 4 – Managing LNG Risks – Operational Integrity, Regulations, Codes, and Industry Organisations
- No. 5 – Managing LNG Risks – Containment
- No. 6 – Managing LNG Risks – Industry Safeguard Systems
- No. 7 – Questions and Answers (Q&A's)

For more information about these and other topics, or to obtain copies of this report series contact:

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# SECTION J

DG 15-155
Valley Green Natural Gas, LLC
City of Lebanon's Set 1 to Valley Green Natural Gas, LLC

Date Request Received: 08/24/15
Request No. City of Lebanon 1-3

Date of Response: 09/03/15; 12/17/15
Witnesses: Kenneth H. Stanley
Jonathan W. Carroll

REQUEST: For each of the type of emergency, and/or potential source or origin of such emergency listed in the response to Requests #1 or #2 above, please describe the type of emergency response – by either private or public personnel or both – with would be required, or would otherwise be desirable, in the event such an emergency were to occur, in order to control, prevent or reduce the threat or adverse impacts on public health and safety. For each type of emergency response discussed, please state the source of the information used in the answer.

RESPONSE: The types of emergency responses will depend on the type of emergency and the applicable regulatory standards. The written plans as identified in the response to City of Lebanon 1-1 will provide information regarding the expected response to emergencies, who would be involved, and how coordination would be addressed

SUPPLEMENTAL RESPONSE: See attached *Managing LNG risks – Industry Safeguard Systems* – LNG Information Paper No. 6, published by The International Group of Liquefied Natural Gas Importers. This publication provides an overview of laws, operational safeguards, and standard practices for the detection, control, and mitigation of effects from releases of LNG. It is offered as a more easily readable overview than the regulations listed in Lebanon 1-1.

GROUPE INTERNATIONAL DES IMPORTATEURS DE GAZ NATUREL LIQUÉFIÉ

THE INTERNATIONAL GROUP OF LIQUEFIED NATURAL GAS IMPORTERS

## LNG Information Paper No. 6

# Managing LNG Risks – Industry Safeguard Systems

GIIGNL's Technical Study Group has overseen the development of this Information Series of 7 papers to provide factual information about Liquefied Natural Gas (LNG). In French, Spanish, Portuguese, or Italian speaking countries, the abbreviation GNL is used in place of LNG. This paper describes the operational safeguards which the industry implements as standard practices to detect, control and minimize potential effects from a release of LNG. For more information on these topics, additional references and weblinks are provided at the end of this paper.

## Safety Safeguards in Many Layers

The safety of LNG world-wide is the result of high industry standards, effective regulations, and a fervent industry commitment to rigorous risk management. Regardless of the type of LNG facility, there are multiple layers of protection implemented to minimise the likelihood of an LNG release. **Information Papers No. 4 and 5** describe ways in which the industry maintains operational integrity through regulations, codes, standards and best practices, and how the LNG is contained in various types of storage tanks. This paper describes industry safeguard systems designed to immediately detect, control and mitigate the consequences if a release of LNG were to occur in the import terminal.

There are two types of safety features in an LNG facility: management systems and equipment/technology systems. Management systems include studies during the design process which first identify hazards and then review the design to ensure that these hazards can be controlled or mitigated. During the operational phases, procedures are written to ensure that safe working practices are encouraged, inspections and maintenance are conducted in an appropriate and timely manner and that the impact on the public and employees of any unexpected circumstance is minimised.

With regard to safety equipment and technology, LNG facilities have multiple levels of hazard detection, mitigation and intervention systems. There are two types of intervention systems: those based on passive technology, which require no interaction, and active systems, where action is either automatic or an operator is prompted to take action.

## Prevention

LNG facilities and LNG carriers are viewed in the industry as the "top of the line". This view is justly predicated on their high quality, robust safety systems and overall attention to detail in design, solid construction and stringent operational practices. All of these factors collectively serve to prevent accidents, incidents and product releases of any kind. The excellent safety record of the industry is substantive evidence of this commitment. There was a (single) major tank failure incident, which occurred in Cleveland, Ohio, US in 1944 at the beginning of the LNG industry, resulting in a fire and a number of fatalities. This incident is discussed in detail in **Information Paper No. 7.** At the time of the Cleveland incident, the safe storage practices required for cryogenic liquids were not fully understood. Since then, the LNG

industry has implemented safety improvements to prevent situations which could lead to or cause such incidents.

Examples of standard practices which are now established around the world to prevent leaks and their escalation include the following:

- Compliance with known and proven codes and standards for designing and siting new facilities;
- Siting new facilities a safe distance from adjacent populations based on risk assessments;
- Construction of special materials and inclusion of systems designed to safely insulate and store LNG at temperatures of -162°C (-259 °F);
- Various codes and standards for maintenance and inspection of equipment in LNG service;
- Overpressure protection (pressure controllers and relief valves);
- Leakage detection and spill control through temperature probes;
- Ignition source control;
- Fire zoning;
- Emergency depressurising;
- Passive fire protection, e.g., fireproofing, fire resistant barriers and coatings; and
- Active fire protection.

Additional standard devices and practices specifically for tanks include:

- Cool-down temperature sensors on the tank wall and base;
- Leak detection equipment, e.g., temperature sensors, and low temperature alarms, located in the annular space;
- LNG tank gauging systems to provide remote readings, with high/low level alarms which trigger emergency shut down systems; and
- Combined temperature and density sensors to detect rollover potential.

In Europe, the Seveso II Directive requires a complete Safety Management System for the control of major-accident hazards. This System must include a safety study with a risk analysis and relevant measures for the mitigation of consequences. The final risk level must be acceptable to the authorities. In the US, the regulations generally require that these worst-case spill hazards are contained within the perimeter of the owner's property such that risk to the public is near zero.

Locating LNG facilities and vessels a safe distance away from adjacent industry, communities and other public areas provides the assurance of protecting citizens from potential hazards in case a serious incident occurs. In the current environment, where there is a threat of terrorism, the public is understandably concerned that bulk storage of a flammable energy source represents a risk. Separation of LNG from the public can take the form of exclusion zones for facility-siting or safety zones around LNG ships while underway. The separation distances used in codes, standards, and regulations are based on risk assessments and scientific analyses.

In addition to industry best practices and governmental requirements, financial institutions specify guidelines to assure that LNG facilities are safe and worthy of financing and insurance. The World Bank Group states in its guidelines that the layout of an LNG facility (and the separation distance between the facility and the public and/or neighbouring facilities outside the LNG plant boundary) should be based on an assessment of risk from LNG fire (entitled a "thermal radiation profile prediction"), vapour cloud ("flammable vapour cloud dispersion characteristic prediction"), or other major hazards. The results of such risk assessments define the recommended separation distance for a proposed facility. Generally in Europe, depending upon the design and storage capacity of the subject facility, risk assessments recommend a separation distance from residential, recreation areas, or other public built-up areas. In simple terms, separation distances ensure that the surrounding public is protected from the consequences of any credible LNG release at a terminal.

The industry standards and regulations described in **Information Paper No. 4** reduce the likelihood of a release. If a release were to occur, the consequence is minimised through the use of secondary containment and active safety mitigation systems described in this paper.

**Figure 1** illustrates multiple layers of protective measures, for instance, to prevent the escalation of an LNG leak into a pool fire and to minimize the consequences of such an incident. The occurrence of a hazardous event, in this case, a pool fire, would require the simultaneous and very unlikely failure of several, independent layers of protection.

The layers of protection implemented at terminals include risk mitigation measures such as the following:

- **Spacing and design of pipes, equipment and storage tanks**: they must be made of specific materials in order to resist cryogenic temperatures and avoid LNG leaks. LNG tanks are equipped with integral impoundment.
- **Detectors**: Facilities are constructed with a variety of leak detection devices, including cameras, temperature sensors and various kinds of very specific detectors (for discovering fire, flame, gas, smoke or tank overfill). This detection equipment communicates to the control centre

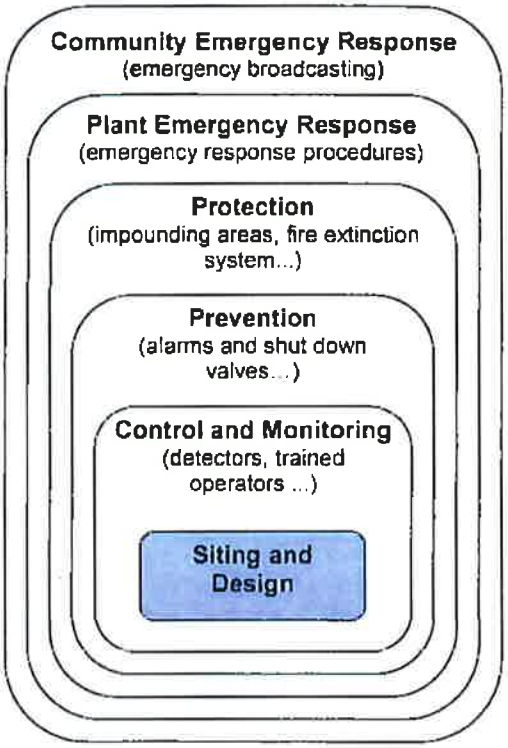


Figure 1: Layers of protective measures to prevent escalation of an LNG leak into a pool fire (Source: BV 2009)

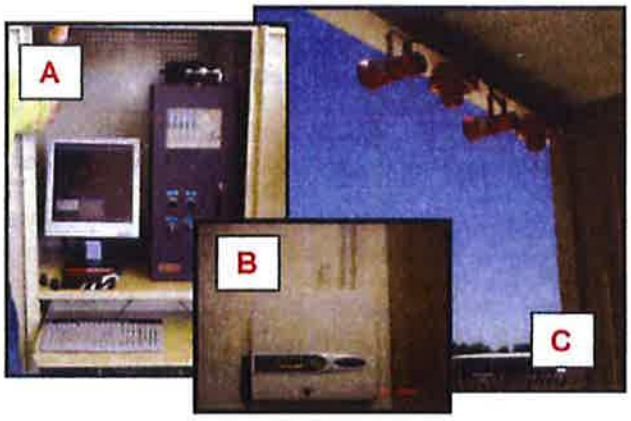


Figure 2. Detection and warning devices for LNG terminals: A) flame detection monitoring in a control room, B) aspirating smoke detector, and C) audible alarms (Photos provided by A.H. Walker)

and can automatically trigger emergency shut-down systems (some examples are shown in Figure 2).

- **Emergency shut-down (ESD) valves**: In case of fault detection, ESD valves are automatically closed to prevent the further loss of LNG.
- **Impounding areas**: In the event of an LNG leak, the spill is contained in these areas to control its spread, vaporisation rate and, if a pool fire occurs, to minimise the consequence outside the terminal.
- **Fire control systems**: LNG fires can be mitigated with fire-fighting systems available throughout the terminal.
- **Vapour reduction systems**: if an LNG pool has formed, foam generators can be used to reduce the rate of vapour formation and movement.
- **Trained operators**: operators are always present in the terminal to control operations and ensure rapid response to any emergency condition, including making emergency notifications to agencies and responders, as well as an emergency broadcast to the community.

Operations and maintenance personnel in LNG facilities are required to be trained, both initially and periodically thereafter, in:

- The hazards of LNG;
- The hazards of operation and maintenance activities;
- How to recognise breaches of security and execute security procedures;
- Understanding the potential causes, types, sizes and predictable consequences of fires and knowing and following fire prevention procedures;
- How to perform their assigned functions during both normal operations and emergencies; and
- How to provide first aid.

Verification of compliance with these requirements is performed by each national dedicated Authority.

## Detection

Several systems incorporate monitoring and control devices to detect deviation from acceptable parameters, thereby enabling corrective action to prevent unsafe conditions. Standards and codes require that combustible gas detectors and low temperature detectors are located at places where an LNG release might occur and where LNG or low temperature vapour might accumulate. In Europe, the codes are: EN 1473. In the US, they are: NFPA 59A 49 CFR Part 193.2507, Subpart I and 49 CFR Part 127.201-3. These detectors are continuously

monitored. They also have alarms set just above the detection levels and automatic shutdowns at hazard levels.

For facilities on land, monitoring systems are required by EN 1473 in Europe, and 49 CFR Part 193 and NFPA 59A in the US. Onboard ship, monitoring systems are required by the International Gas Carrier Code, the classification society's requirements and the USCG requirements of 46 CFR 153-154 and 33 CFR Parts 127, 160-169.

In addition to the code-required instrumentation specifically for leak detection, there is abundant normal process instrumentation which will alert an operator to an abnormal condition which may or may not be caused by leakage. Many areas are either covered by remote TV cameras or are visible to a plant operator or to a crew member from a ship's control room. An LNG release of any size is easily recognised visually, because of the condensation of water vapour from the atmosphere within any resulting cloud.

All LNG facilities have equipment to detect an LNG release and to initiate immediate notification so as to control the leak or spill. Vapour and liquid detection equipment is used to detect problems, set off alarms and monitor flammable vapours. Remote monitoring screens, e.g., in a control room, provide a means to instantaneously see the situation and manage the overall facility. Closed-circuit TV is used to monitor operational areas in the terminal and serve as a secondary visual system for the gas, flame, and fire detectors. Detection and initial response equipment includes:

- Cryogenic liquid detection.
- Leak detectors designed to detect low temperatures,
- Gas or vapour detection,
- Smoke detectors,
- Flame detectors,
- Safety alarms,
- Emergency shut down valves to limit the quantity of LNG released, and
- Secondary containment designed to mitigate the consequences of release.

Continuous improvements are made in detection systems.

## Control and Mitigation

A hazardous event (e.g., a pool fire) could only occur due to simultaneous failure of several independent layers of protection.

If a liquid spill is detected, emergency shut-down valves may be automatically activated depending upon the situation, e.g., size of the spill and the location. They can also be activated manually by push buttons at the jetty, control room, around the terminal and on the LNG ship (when it is at the jetty). The emergency shut-down system stops all pumps and closes off all piping so that the LNG stays either in the storage tanks or on the ship if there is a ship offloading. In manyterminals, emergency-release couplings on the unloading arms, used to transfer LNG between the ship and the shore, are quick break-away lines that shut the unloading system down and allow the ship to move away from the jetty.

If a leak is detected, actions are taken to:

- Prevent fire by securing the leak and the area, eliminating ignition sources, and monitoring vapours until no flammable vapours remain;
- Warn and shelter facility workers and notify authorities as required or appropriate;
- Control vapour dispersion with foam and/or water curtains;
- Use water spray to increase the vaporisation rate of the LNG (rapidly warm it), which will facilitate a more rapid mixing and dilution of LNG vapours to outside flammable limits, and help them warm more quickly to the temperature at which they will become buoyant and rise away from ignition sources and people on the ground (**see Information Paper No. 1**); and
- Control and manage/mitigate incidents if vapours are ignited, using dry chemical powder or foam, and applying water to plant equipment (not the LNG fire) to cool it down.

High-expansion foam and water-spray curtains help control LNG vapours in a proactive manner. The application of foam to LNG spills on land, or water spills that are contained, e.g., in a storm drain or small pond, is an effective hazard control technique. Applying and maintaining a "blanket cover" of high-expansion foam can help to minimise ignition risk and/or to manage vaporisation rates and vapour dispersion, when either of these actions is appropriate for the specific situation. The use of water curtain sprays to form water barriers between LNG vapours and potential ignition sources can also be an effective risk mitigation technique for a liquid spill. Dry chemicals can be applied to extinguish flames if the vapours in a contained area ignite. High-expansion foam has proven effective in reducing flame height and radiant heat.

In the event of a leak or spill, responders wear personal protective equipment (PPE) while undertaking control and mitigation actions. Common PPE equipment in industrial operations includes safety goggles, steel-toed boots, gloves, and hard hats. In an LNG facility, PPE for protection from cold liquids and vapours, e.g., face shields suitable for contact with cryogenic materials, are also standard. During an LNG incident, additional personal

protective equipment might include a breathing apparatus (depending upon the magnitude of any gas release), since LNG vapours can displace oxygen and lead to asphyxiation, along with fire protection gear such as:

- Full protective clothing (coat and trousers),
- Anti-flash hood,
- Fire helmet with visor,
- Fire gloves, and
- Fire boots.

## Inspections

Government agencies routinely inspect LNG facilities and ships to verify that safety measures have been correctly applied and maintained. Inspections vary among countries, or regions. For example:

- Europe. The Safety Management System, required by the European Directive Seveso II and implemented by the operator, includes internal control loops for every safety activity. In addition, verification of compliance is made by oversight agencies and inspections are performed by local authorities.
- US. Safety activities and inspections are under the jurisdiction of several agencies: the US Coast Guard, the Pipeline and Hazardous Materials Safety Administration (PHMSA) of the US Department of Transportation, and the Federal Energy Regulatory Commission (FERC). All of these agencies inspect terminal operations after start-up. Each agency will verify safety compliance with their respective jurisdictions through inspections. The inspection rate is chosen by the responsible agency and will vary by facility.
- Asia. In Japan, the Ministry of International, Trade and Industry (MITI) prescribes inspection frequencies.

## Emergency Response Plans

Being prepared for any emergency is an essential activity for LNG terminals and ships. A set of preparedness activities conducted before an incident helps assure that any incidents that do occur are well managed and mitigated. To be most effective, preparedness activities are conducted in a sequence, where the results of one activity leads into another, with the end result being that overall preparedness is constantly improving. This is referred to as the Preparedness Cycle (**Figure 3**). Preparedness is achieved and maintained through a continuous cycle of planning, organising, training, equipping, exercising, evaluating, and taking corrective action. Ongoing preparedness efforts among all those involved in emergency management and incident response activities ensure coordination during times of crisis.


Figure 3. Preparedness cycle (Source: US FEMA)

A good emergency response plan helps assure that responders have optimal control over an incident. Beginning to plan response actions at the time of an incident is an extra but avoidable challenge. For this reason, LNG facilities prepare and maintain emergency response plans which identify potential credible incident scenarios and then develop specific actions to mitigate the consequences of such incidents.

The regulations of countries, including the US and Europe, and companies, specify the content of these plans. For example, emergency response plans for import terminals, which in the US are required by FERC and must be approved before the terminal even begins operations, must include scalable procedures for responding to:

- Emergencies within the LNG terminal;
- Emergencies that could affect the public near an LNG terminal;
- Emergencies that could affect the public along an LNG vessel transit route;
- Methods for notifying agencies and the public; and
- Training and exercises using the plan.

It is important to involve all response stakeholders (including adjacent facilities) in the planning process to develop the plan. The facility emergency response plan is prepared in consultation with appropriate local and national governmental agency representatives, including first responder representatives. The valuable benefit of a

plan is the planning process of working through incident management issues.

Another key component of emergency planning is the training of all emergency responders, which incorporates coordination, communication, drills and exercises. Hazards and mitigation scenarios are identified and used to develop responses and role assignments. Simulated emergencies, both table-top and full-scale, are used to validate the effectiveness and efficiency of both individual responders and responding organisations. Field exercises provide an opportunity to practice hands-on skills and cultivate expertise.

Participating in such training and exercises helps assure that the emergency response plan will be well understood by the organisations with responsibilities during an incident and that they are ready to respond effectively in the unlikely event of an emergency.

## Key Points and Conclusions

In closing, the reader should remember the key points of this information paper:

1. Industry safeguard systems are designed to immediately detect, control and mitigate the consequences of any LNG release in an import terminal.

2. There are two types of safety features in an LNG facility: equipment/technology systems and management systems. The former include multiple levels of hazard detection, mitigation and intervention systems. The subject intervention systems may be active systems, requiring an operator to act or being automatically started, or passive systems, requiring no interaction.

   Management systems, include, among other things, studies during the design process which first identify the hazards and then review the design to incorporate steps which eliminate or control/mitigate the hazards. They also include, for example, the drafting, refinement and implementation/dissemination of sound operating procedures and safe working practices.

3. Safety design of facilities, systems, and equipment in the LNG industry are generally viewed as "top of the line", largely due to their high quality, robustness and implicit attention to detail.

4. The tragic accident in Cleveland, Ohio, US over 60 years ago, when LNG first became commercially viable, resulted in a fire and a number of worker and public fatalities. As a result of the exhaustive subsequent investigation, a comprehensive number of safety precautions have been implemented and are in effect throughout the industry.

5. Typical layers of protection implemented in modern LNG terminals are graphically illustrated in **Figure 1**. These layers begin, in a sense, with the Siting and Design of the terminal. The next layer reflects the Control and Monitoring features (including, for example, detectors and trained operators). Prevention components include alarms, shut-down valves, etc. Protection is provided by elements such as impounding areas and fire extinction systems. Company management of the incident is provided by implementing the Plant Emergency Response procedures. In addition, Community Emergency Response begins with notification about the leak or other incident, which activates governmental oversight, mobilises additional response resources to reinforce the facility's response, and thereby protects the public and adjacent properties.

The goal of this 7-paper series has been to identify and describe the many components which comprise LNG safety along with providing a global sense of LNG risk management. The figure on the last page graphically illustrates a comprehensive framework for LNG safety through "Multiple Safety Layers", which are all firmly based on a foundation of solid Industry Standards, Regulatory Compliance and Codes. These "safety layers" include: Primary and Secondary Containment, Control Systems which promote Operational Integrity, and Protocols, Operator Knowledge and Experience (which are reinforced by comprehensive and ongoing training). As demonstrated in this paper, a protective umbrella of Safeguard Systems, Separation Distances, and Contingency Planning further enhances the safe management of LNG.

The final paper in the series, **Information Paper No. 7**, presents commonly-asked questions and answers about concerning LNG import terminals.

## References and Additional Resources

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California Energy Commission - www.energy.ca.gov/lng/safety.html

Center for LNG - www.lngfacts.org

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Lemoff , T.C., PE. 2008. "LNG Incident, Cleveland, October 20, 1944" GASTECH 2008: Bangkok, Thailand from 10-13 March 2008.

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SIGTTO - www.sigtto.org

Texas Engineering Extension Service and Resources Protection International, LNG Live Fire Training Workshop. Student Manual. 2005 Texas A&M, Brayton Fire Training Field, College Station Texas, USA.

US Department of Energy - http://www.fe.doe.gov/programs/oilgas/storage/lng/LNG_Forum_Abstracts.html

http://fossil.energy.gov/programs/oilgas/storage/index.html

U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) – www.phmsa.dot.gov

U.S. Federal Emergency Management Agency. http://www.fema.gov/emergency/nims/Preparedness.shtm)

U.S. Federal Energy Regulatory Commission – www.ferc.gov

World Bank Group – www.worldbank.org

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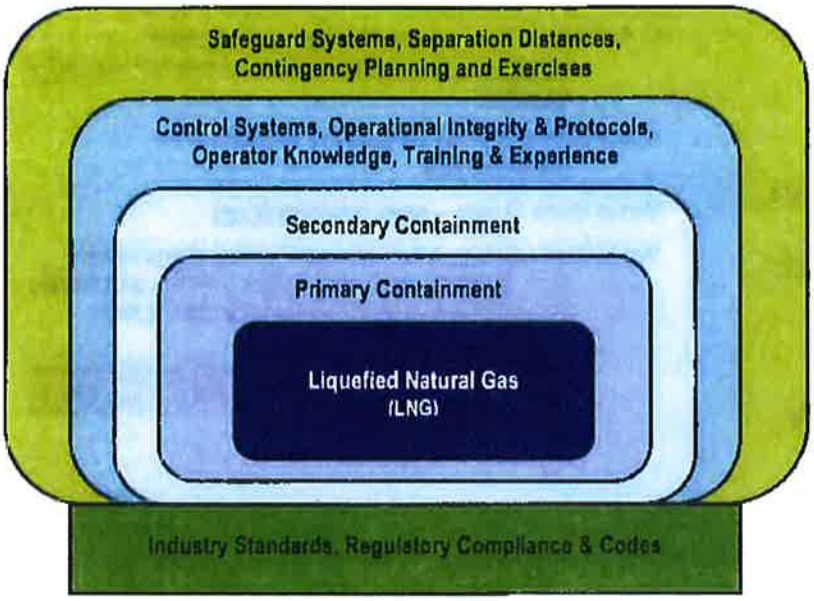
# Multiple Safety Layers Manage LNG Risk




The GIIGNL Technical Study Group has developed this 7-paper series to provide public readers with factual information about the LNG industry's multiple layers of safety, as illustrated in the figure to the left.

The GIIGNL Information Papers include:

- No. 1 – Basic Properties of LNG
- No. 2 – The LNG Process Chain
- No. 3 – LNG Ships
- No. 4 – Managing LNG Risks – Operational Integrity, Regulations, Codes, and Industry Organisations
- No. 5 – Managing LNG Risks – Containment
- No. 6 – Managing LNG Risks – Industry Safeguard Systems
- No. 7 – Questions and Answers (Q&A's)

For more information about these and other topics, or to obtain copies of this report series contact:

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# SECTION K

DG 15-155
Valley Green Natural Gas, LLC
EnergyNorth Set 1 to Valley Green Natural Gas, LLC

Date Request Received: 08/24/15 Date of Response: 09/03/15; 12/7/15; 4/22/16
Request No. EnergyNorth 1-1 Witness: James W. Campion, IV

REQUEST: Reference Petition, page 5, paragraph 10. Please identify all federal, state and local permits, approvals and authorizations determined by Valley Green to be required for construction and operation of the proposed project, including the LNG facility, distribution system and refueling facility, stating the basis for applicability determinations with regard to each, and identifying the specific offices from which those permits are being sought, the status of each of those permits, and the expected timetable for securing each of the permits.

RESPONSE: See table below. Final list of permits depends on final design.

SUPPLEMENTAL RESPONSE: Edits below are due to the delay in obtaining regulatory approval from the NH Public Utilities Commission.

| **Permitting Agency** | **Permit Needed** | **Statutory Authority** | **Status/Timetable** |
|---|---|---|---|
| NH Public Utilities Commission | Franchise Approval | RSA 374 | Filed May 15, 2015 |
| | Approval of Special Contract(s) | RSA 378:18 | File when applicable |
| | Rate Case | RSA 378 | File in 2016 |
| | Financing Approval | RSA 369 | File if/when debt financing is sought |
| | License to Construct and Maintain Gas Pipeline over Public Waterway | RSA 371:17 | File if applicable |
| | Approval of Affiliate Contracts | RSA 366 | File if applicable in 2016 |
| NH Site Evaluation Committee | Exemption from Certificate of Site and Facility | RSA 162-H | File in ~~early~~ 2016 |
| NH Department of Environmental Services | Alteration of Terrain Wetlands Permit | RSA 483-B | Applied for permit in February 2014. Process will continue with updated design, and may include (NPDES) storm water discharge approval. Awaiting final approval of completed wetlands improvements. |
| | Air Permit | RSA 125-C | File in ~~early~~ 2016 |
| | Above-ground tank registration | RSA 146-A | File in ~~early~~ 2016 |
| | Hazardous Waste Identification, etc. | Federal/state | File in ~~early~~ 2016 |
| NH State | Cultural/historical clearance | RSA 227-C | File if earlier clearance not sufficient. |

| | | | |
|---|---|---|---|
| Historic and Preservation Office | | | |
| DRED-NH Natural Heritage Bureau. | Wildlife clearance | RSA 217-A | File if applicable. |
| NH State Department of Transportation | Permit to excavate in or disturb state-maintained highway. (See also response to EnergyNorth 1-10 for list of federal pipeline safety regulations.) | RSA 231 | File ~~early~~ 2016 |

| | | | |
|---|---|---|---|
| City of Lebanon | Variance from Zoning Board of Adjustment | City of Lebanon Codes | In April 2014, the City of Lebanon Zoning Board of Adjustment approved the LNG fuel storage project for up to 4,500 cubic meters (or up to 1.19 million gallons). Extended by vote of Lebanon ZBA on March 21, 2016. |
| | Site Plan Review by Planning Board with input from Conservation Commission | | Filed for initial site plan review. Final site plan review is expected in ~~early~~ 2016. |
| | Subdivision Approval from Planning Board | | File in ~~early~~ 2016 |
| | Commercial water, sewer connections from Public Works | | File in ~~early~~ 2016 |
| | Pole/conduit license | | File in ~~early~~ 2016 |
| | Fire department approval or permit | | File ~~or~~ in ~~early~~ 2016 |
| | Building and/or excavation permit | Chapter 36 | In ~~early~~ 2016 |
| | License to run pipeline under/along city roads | | File in ~~early~~ 2016 |
| Town of Hanover | License to run pipeline under/along town roads | | File in ~~early~~ 2016 |
| | Special exemption for installation of gas pipelines | | File in ~~early~~ 2016 |

# SECTION L

DG 15-155
Valley Green Natural Gas, LLC
EnergyNorth Set 1 to Valley Green Natural Gas, LLC

Date Request Received: 08/24/15 Date of Response: 09/03/15
Request No. EnergyNorth 1-3 Witness: James W. Campion, IV

REQUEST: Reference Campion testimony, page 4, lines 9-16. Please describe the process by which Valley Green selected the Lebanon site for the location of the storage and regasification facility, including a description of the factors and identification of alternative sites considered.

RESPONSE: Location was the most important factor in selecting the Lebanon site. The factors favoring the Lebanon site included:

1. In an industrial zone
2. On existing infrastructure
3. Distant from residential areas
4. Proximate to very high percentage of demand
5. Proximate to interstate exit
6. Large enough for set-backs and Life Safety 59A regulations
7. Large enough for adding sustainable renewables
8. Large enough for vehicle refueling
9. Proximate to vehicle refueling customers
10. Out of site from the general public

# SECTION M

DG 15-155
Valley Green Natural Gas, LLC
EnergyNorth Set 1 to Valley Green Natural Gas, LLC

Date Request Received: 08/24/15 Date of Response: 09/03/15
Request No. EnergyNorth 1-10 Witness: Jonathan W. Carroll

REQUEST: Reference Campion testimony, page 6, lines 10-11 and Carroll testimony, page 1, line 19 through page 2, line 9. Please identify and provide details of Gulf's experience with regulated utility operations, including experience related to safety and inspection functions of regasification and other regulated facilities.

RESPONSE: Gulf does not currently operate and maintain a regulated natural gas utility system such as the one contemplated for Lebanon and Hanover. In fact, there are only a few communities in North America like it. However, Gulf plans to pull from its relative experience with: 1) terminal operations, 2) developing a liquefaction facility of its own in Pennsylvania, 3) operating and maintaining a fleet of LNG vehicles and associated fueling stations, 4) delivering to regulated LDC peak shaving facilities, 5) operating portable pipeline systems, and 6) designing satellite LNG storage and regasification systems for fuel oil customers. Furthermore, Gulf has hired an advisor, Kenneth Paul, who has over 40 years of experience in the LNG industry and is a senior member of the National Fire Protection Association (NFPA) 59A committee to help guide the Valley Green operations team. Ken has been involved in two projects similar to Valley Green in West Yellowstone, Wyoming and Fairbanks, Alaska. Ken has also served as a member of the Board of Directors for Essex Gas Company for 21 years, the Compressed Gas Association, and the American Gas Association's LNG Committee.

Gulf's strength is in logistics and terminal management with operational expertise in handling hazardous, flammable, and combustible refined petroleum products. Gulf owns and operates twelve oil terminals with 5 million barrels of storage, distributes over 3 billion gallons of fuel each year, and operates a fleet of bulk transport carriers. Gulf is a member of the International Liquid Terminals Association (ILTA), which develops industry best practices for safety and environmental excellence. The company has an impressive track record with zero OSHA related incidents over the past year.

Gulf's planned liquefaction facility in Great Bend, Pennsylvania will have operating procedures similar to that of Valley Green's facility. As such, supervisory, operating and maintenance personnel shall be qualified by training and experience to operate and maintain the plant. In addition to any local and state requirements the following Federal Safety Standards will guide development of operations and maintenance plans:

| Safety Standards, 49CFR, Part 193 & NFPA 59A | |
|---|---|
| 193.2503 | (a) Monitoring Components |
| | (b) Startup & Shutdown |
| | (c) Abnormal Operating Conditions |
| | (d) Purging & Inerting Components |

| | |
|---|---|
| | (e) Vaporization |
| | (f) Liquefaction |
| | (g) Cooldown |
| | (h) Compliance with 193.2805 (b) |
| 193.2505 | Cooldown |
| 193.2507 | Monitoring Operations |
| 193.2509 | Emergency Procedures |
| | (b)(1) Controllable Emergencies |
| | (b)(2) Uncontrollable Emergencies |
| 193.2511 | Personnel Safety |
| 193.2513 | Transfer Procedures |
| | (a) Transfer of LNG |
| | (b) Transfer |
| | (c) Action Required 193.2515 |
| 193.2515 | Investigation of Failures |
| 193.2517 | Purging |
| 193.2519 | Communication Systems |
| 193.2521 | Operating Records |
| 193.2603 | General |
| 193.2605 | Maintenance Plan |
| 193.2607 | Foreign Material |
| | (a) Contaminants and ice |
| | (b) Rubbish and fire hazards |
| 193.2609 | Supports |
| 193.2611 | Fire Protection |
| | (a) Maintenance Manual |
| | (b) Action |
| 193.2613 | Auxiliary Power |
| 193.2615 | Purging & Isolation |
| 193.2619 | Control Systems |
| | (a-d) Instrumentation |
| | (e) Relief Valves |
| 193.2621 | Transfer Hoses |
| 193.2623 | Tank |
| 193.2625 | Corrosion Protection |
| 193.2627 | Corrosion Atmospheric Corrosion Control |
| 193.2629 | External Buried Corrosion |
| 193.2631 | Internal Corrosion |
| 193.2633 | Interference Currents |
| 193.2635 | (a-c) Monitoring Corrosion |
| | (d) Atmospheric Corrosion |
| | (e) Internal Corrosion/Monitoring |
| 193.2637 | Remedial Measures |

| | |
|---|---|
| **193.2639** | Maintenance Records |
| **193.2707** | Operations & Maintenance |
| **193.2709** | Security Training |
| **193.2711** | Personnel Health |
| **193.2713** | Training, Operations & Maintenance |
| **193.2715** | Training; Security |
| **193.2717** | Training; Fire Protection |
| **193.2719** | Training; Records |
| **NFPA 59A, Chapter 9** | Fire Protection |
| **NFPA 59A, Chapter 9** | Fire Prevention Plan |
| **NFPA 59A, Chapter 9** | Smoking |
| **NFPA 59A, Chapter 9** | Open Fires |
| **NFPA 59A, Chapter 9** | Hotwork |
| **NFPA 59A, Chapter 10** | Storage of Flammable Fluids |
| **NFPA 59A, Chapter 9** | Motorized Equipment |
| **NFPA 59A, Chapter 9** | Fire Protection Equipment |
| **NFPA 59A, Chapter 10** | Gas Detection |
| **NFPA 59A, Chapter 9** | Fire Detection |
| **193.2903** | Security Procedures |
| **193.2905** | Protective Enclosure Construction |
| **193.2907** | Protective Enclosures |
| **193.2909** | Security Communications |
| **193.2911** | Security Lighting |
| **193.2913** | Security Monitoring |
| **193.2915** | Alternative Power Sources |
| **193.2917** | Warning Signs |

As stated, Gulf is actively engaged in the supply, transportation and distribution of LNG and natural gas. The company's LNG transportation activities are regulated by the Federal Motor Carrier Safety Administration (FMCSA) and the Pipeline and Hazardous Materials Safety Administration (PHMSA), which outline procedures to determine the safety fitness of motor carriers to handle hazardous material. Gulf owns and operates three LNG vehicle fueling facilities and 44 LNG powered tractors. Vehicle fueling is guided by NFPA 57 Liquefied Natural Gas (LNG) Vehicular Fuel Systems Code. Gulf personnel have also operated portable pipeline systems, which provide a temporary supply of natural gas to a gas distribution system, and designed satellite storage and regasification systems for customers stranded from the traditional natural gas pipeline grid. These applications adhere to NFPA 59A Standards for the Production, Storage, and Handling of Liquefied Natural Gas (LNG).

Gulf has safely and reliably delivered LNG to 15 different LDC-owned peak shaving facilities throughout the Northeast including three terminals in New Hampshire. Prior to delivery, Gulf LNG Operations personnel visit each facility and familiarize themselves with the LNG operations manual, offload procedures and emergency response plans.

Gulf is also a member of the LNG Academy Steering Committee of the Northeast Gas Association (NGA), which coordinates annual LNG training programs and updates the regional LNG Trucking Emergency Plan. Gulf is also a member of the NGA's Public Awareness Committee, which coordinates regional education, communication and evaluation programs.

Lastly, Gulf is authorized by the U.S. Department of Energy to import up to 2 BCF of LNG into the U.S. from Canada and Mexico and by Canada's National Energy Board to export LNG into the U.S.

# SECTION N

DG 15-155
Valley Green Natural Gas, LLC
Liberty/EnergyNorth Set 1 to Valley Green Natural Gas, LLC

Date Request Received: 09/30/15 Date of Response: 10/12/15
Request No. LU TECH 1-1 Witness: James W. Campion, IV

REQUEST: Follow-up to the response to EnergyNorth 1-3. Please identify the alternative sites considered for the storage and regasification facility. For each alternative site, please list the factors that contributed to that site not being selected.

RESPONSE:
a) As stated in response to Energy North 1-3, no other property in Lebanon and Hanover satisfied all of the site-specific qualifications listed. Valley Green researched all land use zones suitable for its project in the City of Lebanon and Town of Hanover. In Lebanon, these zones included the Ind-H (industrial heavy) zoning district in the south west corner of Lebanon on Route 12A, the Ind-RA (industrial rail access) zoning district approximately 1.4 miles further north on Route 12A, and the Ind-L (light industrial) zoning districts. In Hanover, this included the BM (service business and limited manufacturing) zoning district. See attached zoning maps for City of Lebanon and Town of Hanover.

b) Important factors in selecting a site within the zoning districts were the proximity of the demand for natural gas and other aspects of the project to the site. These factors also played an important role in Valley Green's decision to seek a distribution franchise. Because there are no zoning districts in Lebanon and Hanover that specifically list a storage and vaporization facility as a permitted use, Valley Green sought to compare all potential sites in the context of all activities Valley Green intended to conduct on the site, including not just a tank and vaporizer but also other regulated and unregulated uses. Valley Green's ultimate choice of site represented a local and logical integration of the tank and vaporizer with other components intended to address community needs.

Transportation
Valley Green's first site plan presented to the Lebanon Planning Board substantially involved the Valley transportation sector. Although transportation is not a regulated activity by the Public Utilities Commission and for that reason was not emphasized in Valley Green's franchise petition, transportation was and is an important aspect of Valley Green's overall project. This importance is demonstrated by the fact that Valley Green sought a separate zoning variance for a natural gas vehicle refueling station. Transportation was a factor in site selection. Valley Green's plan includes a bus terminal and refueling depot to service Dartmouth Coach, Advanced Transit and other bus lines because transit buses are perfect candidates for conversion to natural gas. Indeed, Dartmouth Coach burns natural gas at other locations where it is available and is located close to Valley Green's site. Dartmouth Coach is presently investing in a larger site, still in close proximity to Valley Green. Additionally, the Etna Road area has been emphasized in planning commission reports as the most suitable location for additional transit services. In 2010, Exit 18 on Interstate 89 was selected as the proposed site for an intermodal transportation facility. See, *Upper Valley Intermodal Transportation Facility Study – Upper Valley Region –*

*NH & VT* (June 2010). The Route 120 corridor was also selected by the Upper Valley Lake Sunapee Regional Planning Commission, after extensive research, as the best location for additional regional transit. See the Commission's *NH 120 Claremont-Lebanon/Hanover Transit Planning Services Final* Report (2011). Proximity to these types of transportation customers was an important site selection factor.

Other factors that affected selection of the site and rejection of other sites were that the site was proximate to both commercial and industrial areas as well as fleet vehicle refueling opportunities. The Route 120 corridor is traversed by, or is in close proximity to, transit bus routes offered by Advanced Transit. http://www.advancetransit.com/routefinder.htm. Since the very first stages of Valley Green's project development efforts in 2011, Advanced Transit has expressed interest in moving to more economical, cleaner-burning natural gas.

Proximity to Customers

The Route 120 corridor near Valley Green's site is the connecting ribbon between the downtown areas of Lebanon and Hanover. It is home to the energy consumers that are larger by an order of magnitude higher than consumers near other sites. The site is also more accessible than sites in other zoning districts. As compared to other candidate sites, Valley Green's site is closer to, or even abuts, multiple other businesses that run fleet vehicles like Hypertherm, Unifirst, FedX , F.W. Webb. Casella Waste Systems, Inc. has a fleet of 52 vehicles servicing the Valley. Casella owns the lot adjacent to Valley Green for its construction debris recycling facility and leases space from Choice Storage for its dumpsters and roll-offs. Casella services customers in Vermont and effective in 2016, Vermont's ban on food waste in the waste stream will go into effect. Casella and Choice Storage/Valley Green are discussing solutions to the food waste prohibition and the outcome may provide Valley Green with a reliable source of methane to add to its regulated utility operation.

By contrast, sites in Lebanon's Ind-H zoning district would be much further away from the largest potential customers. Valley Green's site offers the ability to reach approximately 80% of its Stage I target customers with approximately 4.2 miles of pipeline. Sites in Ind-H, and using Liberty/EnergyNorth's route, would involve approximately 19 miles of main pipe to reach these customers, including multiple crossings of the Mascoma River and Interstate 89. Also, the City of Lebanon recently completed millions of dollars of infrastructure and roadwork in the Seminary Hill area. Re-opening this work to lay main would greatly increase construction costs. When looking at these factors and the associated order of magnitude difference in cost, it became easy for Valley Green to de-select all of the candidate tracts in the Ind-H zoning district.

Variance/Traffic

The ability to obtain a zoning variance was also a factor in site selection. Valley Green rejected lots within the Lebanon Ind-H zoning district because obtaining a variance for a fleet fuel station in that district would be unlikely. Traffic is difficult in that area. For example, the lots in the Ind-H district would involve vehicles having to negotiate three stop-and-go miles, through 10 stoplights, to and from Interstate 89. In Valley Green's opinion, that would be untenable. Valley Green felt that the likelihood of convincing product handlers and people movers that a site that involved these characteristics was desirable would be low.

Ample Room

Methane - Valley Green's mission all along has been to introduce renewable alternatives to fossil fuels into its overall fuel mix. Casella Waste Systems, Inc. and Valley Green have been in discussions for over a year to integrate a bio-digester to be fed by the collected food waste from the area's largest employers into Valley Green's site plan. The methane resulting from the bio-digestion process would be mixed into Valley Green's fuel supply to customers. This aspect of Valley Green's project responds to a real need, especially as new recycling regulations become effective in Vermont. A temporary solution of depositing food waste on the Lebanon landfill is in place but it is not exactly recycling. Casella's current alternative is to grind food waste and transport it to a digester in northern Vermont, but that facility is already over capacity. Working together, the Valley Green network can become a substantial user for this local food waste and can create methane from these renewables.

Adding renewable components to a natural gas project requires additional space. Bio-digesters require a substantial footprint and an existing distribution network and customer load so that when methane is available it can be used to supplant natural gas. Valley Green chose its site and rejected other sites in part because the selected site had ample space to introduce this solution to food waste in complement with the vaporization facility.

Flood Control Limitations - Another factor that caused Valley Green to reject sites in Lebanon's Ind-H zoning district was flood control. On one lot in the Ind-H zoning district, a substantial portion of the land is dedicated to floodwater retention. This lot is also less than 800 feet wide at its widest, which would have made it difficult to fit a refueling station, takedown station, and parking onto the site. The site was also too small to accommodate inclusion of renewable features such as a bio-digester. Because of these site limitations, Valley Green didn't evaluate whether this site could meet vapor dispersion requirements or wetland setbacks.

Too Many Compromises

Each of the available lots in Lebanon's Ind-L zoning district and Hanover's BM zoning district would require substantial compromises as compared to the selected site, which Valley Green considered to be the ideal site. For example, the Airport Park in the Ind-L zoning district was too close to the airport. The Altaria and Centerra lots in Lebanon consist of two, fully site-planned and permitted commercial/office/residential planned business parks. Proposed uses for the parks do not include Valley Green's proposed uses, and Valley Green's project would not fit with the intended uses of the parks in any event. In addition, the price of acquisition would have been too high and the available lot was not large enough to accommodate renewables. The location of the lot made it less than optimal for fleet refueling. Also, a variance would be required. For Hanover's BM district, the lots owned by Altaria Lebanon Park LLC and Dartmouth College abutting property in Lebanon were land-locked and had no current access.

Lots in Lebanon's Ind-RA zoning district were too close to either the airport, residential areas, or Route 12A congestion. These lots also would have required additional pipe length, similar to the Ind-H and Ind-L lots.

# OFFICIAL ZONING MAP
# LEBANON,
# NEW HAMPSHIRE

CITY OF LEBANON N.H. INCORPORATED JULY 4 1761 ESTABLISHED 1958

*Data Sources:*
*Zoning - LebGIS*
*Roads/Streets - LebGIS*
*Hydrology - USGS*
*Municipal Boundary - Granit*

LebGIS
Map Printed: 11/12/2013

ADOPTED: July 19, 1978
AMENDED: April 18, 1979
July 16, 1981
September 16, 1981
December 2, 1981
February 17, 1982
December 5, 1990
August 7, 1991
November 6, 1991
December 4, 1991
September 16, 1992
June 15, 1994
January 18, 1995
April 16, 1997
May 20, 1998
August 2, 2000
March 15, 2001
December 5, 2001
June 5, 2002
April 6, 2005
May 20, 2009
January 6, 2010
March 11, 2010
September 15, 2010

WEST LEBANON

DOWNTOWN LEBANON

For Additional Information: Lebanon Zoning Regulations availible at the Planning / Codes Office, City Hall 1st Floor, and on-line at www.lebcity.com

**District**
- RL3 - Rural Lands 3
- RL2 - Rural Land 2
- RL1 - Rural Land 1
- R1 - Residential 1
- R2 - Residential 2
- R3 - Residential 3
- RO Residential Office
- RO1- Residential Office 1
- GC - General Commercial
- Central Business District
- IND-L - Industrial Light
- IND-RA - Industrial Rail Access
- IND-H - Industrial Heavy
- MC - Medical Center
- NC - Neighborhood Commercial
- PBD - Proffessional Business District

0 0.225 0.45 0.9 Miles
0 2,500 5,000 10,000 Feet

Zoning Districts:

- BM Service Business and Limited Manufacturing
- D Downtown:
  - D-1 Downtown Center
  - D-2 Downtown Edge
- B Business
- RO Residence and Office
- OL Office and Laboratory
- I Institutional
- GR General Residence:
  - GR-1 General Residence–1
  - GR-2 General Residence–2
  - GR-3 General Residence–3
  - GR-4 General Residence–4
- SR Single Residence:
  - SR-1 Single Residence–1
  - SR-2 Single Residence–2
  - SR-3 Single Residence–3
- RR Rural Residence
- GP Goose Pond
- F Forestry & Recreation
- NP Natural Preserve

NORWICH, VT.

HANOVER CENTER

ETNA

LEBANON

sources:
United States Geological Survey
Complex Systems Research Center at the University of New Hampshire
Grafton County Registry of Deeds
Town of Hanover Assessors, Planning, and Public Works records

scale = 1 : 25,000

1 inch = 2,084 feet = 0.40 miles

0 0.5 miles 1.0 1.5

N

Note: This map does not contain precise delineation of Zoning Districts, for which see a set of fifty-one maps, each entitled "Property Map for Hanover, N.H." with the Zoning District boundaries superimposed on Assessors Maps. See also West End Neighborhood Overlay District Map

TOWN of HANOVER

# ZONING

## Urban Area

as of May 12, 2015

# SECTION O

DG 15-155
Valley Green Natural Gas, LLC
NG Advantage LLC's Set 1 to Valley Green Natural Gas, LLC

Date Request Received: 08/24/15 Date of Response: 09/03/15
Request No. NG Advantage 1-1 Witness: James W. Campion, IV

REQUEST: Is it Valley Green's position that LNG supply for customers in the proposed Hanover and Lebanon franchises will be more cost-effective than a CNG supply or a hybrid consisting of CNG and LNG? If so, please describe your analysis and provide all documents relating to the analysis.

RESPONSE: Yes and no. There are times when CNG is cheaper than LNG and vice-versa. The real cost analysis, however, needs to be at a broader level and include costs associated with CNG customers having to switch between CNG and another fuel when CNG becomes so expensive that the service becomes interruptible. Using CNG to meet the Commission's 7-day requirement is more costly from an engineering perspective. CNG storage tank sizes are limited which means storage has to be met with tanker trucks, which is a more costly and physically difficult option.

The documents supporting this financial analysis of costs are sensitive business information and protected under RSA 91-A:5, IV and will not be provided.

See Response to Staff 1-3 for additional detail regarding supply. In this Response you will see VGNG discusses why LNG is being pursued as the primary fuel source, as well as the statement that VGNG is designing its plant to include a CNG takedown station to mix CNG with our vaporized product when it is competitive with its base supply source, LNG.

# SECTION P

DG 15-155
Valley Green Natural Gas, LLC
Arwen Set 1 to Valley Green Natural Gas, LLC

Date Request Received: 08/24/15 Date of Response: 09/03/15; 4/22/16
Request No. Arwen 1-2 Witness: Kenneth H. Stanley

REQUEST: Ref. Stanley Testimony p. 4, line 10. Please identify the authority that has granted the permit for up to 1.19 million gallons of storage. Please provide a copy of the permit. How was the ultimate storage capacity requirement determined?

RESPONSE: The permit being referenced in Stanley Testimony p. 4, line 10 is the Zoning Permit issued on April 21, 2014 granted pursuant to a Lebanon Zoning Board of Adjustments Notice of Decision. A copy of the permit is attached. The permitted storage capacity is intended to accommodate anticipated future growth and non-regulated distribution. The Permit was extended for two years pursuant to a vote of the Zoning Board of Adjustment on March 21, 2016.

Codes Department

Building and Zoning
51 North Park Street
Lebanon, NH 03766
Telephone 603-448-1524
Facsimile 603-448-0684

# ZONING PERMIT

On approval by the Board of Adjustment of an administrative appeal, variance or special exception, the Zoning Administrator shall issue a Zoning Permit as of the date of approval of the Board of Adjustment.

**Zoning Permit Issued to:**

**Request for: JAMES W. CAMPION IV, TRUSTEES:** A request for Variances from the terms of Article III Section 303.2 to allow the construction of a natural gas vaporization facility which would include bulk liquid storage of gas and the eventual distribution of the product by pipeline. Applicant also seeks a Variance to allow the installation of a vehicular refueling station. The property is located at Etna Road and Lombard Road, Lebanon, NH in the IND-L and RL-3 zones. (Tax Map 26 Lot 17) #ZBVAR2014-06

**THIS ZONING PERMIT IS GRANTED PURSUANT TO THE ATTACHED ZONING BOARD OF ADJUSTMENT NOTICE OF DECISION AND APPROVED PLAN.**

Signed: David Brooks

David Brooks, Senior Planner/Interim Zoning Administrator

Date of Zoning Board Approval/Issuance of Zoning Permit: April 21, 2014

**Zoning Ordinance**:

901.6 Time Limit of Permit.

A zoning permit shall become void if construction is not begun thereunder within 2 years from the date of issuance of the permit or grant of a special exception or variance.

901.7 Non-Transferable.

No permit issued hereunder shall be transferable to a subsequent owner.

901.8 Date of Issuance of Zoning Permit.

On approval by the Board of Adjustment of an administrative appeal, variance or special exception, the Zoning Administrator shall issue a zoning permit as of the date of approval of the Board of Adjustment. Zoning permits shall be conditioned upon receipt of Site Plan Review approval from the Planning Board, when such approval is required. When Site Plan Review is required, the date of the zoning permit for the purposes of SECTION 901.6 shall be the date of receipt of Site Plan Review approval.

Codes Department

Building and Zoning
51 North Park Street
Lebanon, NH 03766
Telephone: 603-448-1524
Facsimile: 603-448-0684

**NOTICE OF DECISION**
**ZONING BOARD OF ADJUSTMENT**

On March 17, April 7, and April 21, 2014, at duly-noticed meetings of the Lebanon Zoning Board of Adjustment, there appeared **James Campion** and Attorney Bradford Atwood seeking a Variance from the terms of Article III, Section 303.2 of the Zoning Ordinance to allow the construction of a liquid natural gas vaporization facility, which would include bulk liquid storage of gas and the eventual distribution of the product by pipeline. The applicant also seeks a Variance to allow the installation of a natural gas vehicle refueling station. The property is located at Etna Road and Labombard Road, Lebanon, NH, in the Light Industrial (IND-L) and Rural Lands-Three (RL-3) zoning districts. (Tax Map 26, Lot 17) #ZBVAR2014-06.

Based on testimony given, plans presented, and supporting documents submitted, the Lebanon Zoning Board of Adjustment makes the following findings of fact:

1. The Applicant's property, a lot of +/-182 acres, is located in the IND-L and RL-3 zoning districts.

2. The Applicant seeks to construct a liquid natural gas vaporization facility, which would include bulk storage of liquid product and the eventual distribution of gaseous product by pipeline to properties within up to five miles of the Etna Road location.

3. The Zoning Ordinance makes no provision for the construction or location of a liquid natural gas vaporization facility.

4. The Applicant testified that bulk storage of up to 4,500 $m^3$ of liquid natural gas is sought to allow the applicant to incrementally increase storage if and when the demand is realized.

5. The Applicant also seeks to install a vehicular refueling station associated with the natural gas vaporization facility to service various fleets of vehicles operated by local and regional companies.

6. The applicant testified that the natural gas refueling station, which is closely akin to a service station, would provide fuel on a wholesale basis for fleets of vehicles operated by local and regional companies.

7. Service stations are a permitted use only within the General Commercial zoning district.

8. The applicant testified that any distribution of natural gas across property lines requires approval by the Public Utility Commission and creation of a public utility.

9. The applicant testified that the Public Utility Commission would dictate the area of franchise and the amount of required gas storage.

10. The applicant testified that operation of the "primary loop" of natural gas service along Etna Road, Route 120, and Heater Road would require two times as much liquid natural gas as Kleen Laundry currently stores and uses (which is 68 $m^3$ x 2).

11. Rose Grenier testified that her property abuts the subject property to the north and that she has lived there for 12 years. Ms. Grenier stated that she feels the project would be visually unattractive and easy to see from Route 120 and Etna Road. She stated that she feels the proposed use is potentially hazardous and that no information has been provided as to the effects on wildlife in the area. Ms. Grenier noted that the property abuts Signal Hill, which is a City conservation parcel, and that the proposed development road runs through a swamp area. She noted that the proposed use will affect her property value due to noise and traffic from the development.

12. Perry Seale, Director of Facilities for Hypertherm, stated that his company has nine properties within 1.5 miles of the site, and he feels that the installation could be advantageous to companies in the area.

13. Nicole Cormen testified that the proposed project would not be hidden from view and that development on the property has occurred without NHDES permits. Ms. Cormen recommended that the Zoning Board should review the minutes and submission materials from the Planning Board's conceptual discussion with the applicant concerning the development of the property.

14. Robert Morse, representing Yvonne Labombard, testified that Ms. Labombard's property abuts the subject property along Etna Road. Mr. Morse commented about the disturbance of wildlife in the area due to logging of the property and suggested that swamps and wetlands on the property have already been impacted.

15. Charles Grenier testified that his property abuts the subject property along Etna Road. Mr. Grenier expressed concerns about safety and visibility of the property.

16. Terry Moody, a resident of Etna Road, spoke against the project.

As a result of the above findings of fact, documentation, testimony and inspections, the Board concludes for the Variance to construct a natural gas vaporization facility:

1. The variance **will not** be contrary to the public interest;

2. The spirit of the ordinance **is** observed;

3. Substantial justice **is** done;

4. The values of surrounding properties **are not** diminished; and,

5. Literal enforcement of the provisions of the ordinance **would** result in an unnecessary hardship.

(a) In this section "unnecessary hardship" means that, owing to special conditions of the property that distinguish it from other properties in the area:

(I) No fair and substantial relationship exists between the general public purposes of the ordinance provision and the specific application of that provision to the property; and,

(II) The proposed use is a reasonable one.

Now therefore be it resolved, the Lebanon Zoning Board of Adjustment hereby **GRANTS** the request of **James Campion**, for a Variance from Article III, Section 303.2 to construct a natural gas vaporization facility, as referenced above.

As a result of the above findings of fact, documentation, testimony and inspections, the Board concludes for the Variance to construct a natural gas vehicle refueling station:

1. The variance **will not** be contrary to the public interest;

2. The spirit of the ordinance **is** observed;

3. Substantial justice **is** done;

4. The values of surrounding properties **are not** diminished; and,

5. Literal enforcement of the provisions of the ordinance **would** result in an unnecessary hardship.

(a) In this section "unnecessary hardship" means that, owing to special conditions of the property that distinguish it from other properties in the area:

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(II) The proposed use is a reasonable one.

Now therefore be it resolved, the Lebanon Zoning Board of Adjustment hereby **GRANTS** the request of **James Campion**, for a Variance from Article III, Section 303.2 to construct a natural gas vehicle refueling station, as referenced above.

A variance shall expire if: (1) the use is not in place within two years of the date of issuance of a zoning permit or approval by the Zoning Board of Adjustment for a variance; or, (2) if the use is discontinued for any reason for more than two (2) years. In such cases, a new application for a variance must be completed.

NOTE: (RSA 677:2) Within 30 days after any order or decision of the zoning board of adjustment, or any decision of the local legislative body or a board of appeals in regard to its zoning, the selectmen, any party to the action or proceedings, or any person directly affected thereby may apply for a rehearing in respect to any matter determined in the action or proceeding, or covered or included in the order, specifying in the motion for rehearing the ground therefor; and the board of adjustment, a board of appeals, or the local legislative body, may grant such rehearing if in its opinion good reason therefor is stated in the motion. This 30-day time period shall be counted in calendar days beginning with the date following the date upon which the board voted to approve or disapprove the application in accordance with RSA 21:35; provided however, that if the moving party shows that the minutes of the meeting at which such vote was taken, including the written decision, were not filed within 5 business days after the vote pursuant to RSA 676:3, II, the person applying for the rehearing shall have the right to amend the motion for rehearing, including the grounds therefor, within 30 days after the date on which the written decision was actually filed.

The Zoning Board of Adjustment voted to **GRANT** this appeal on April 21, 2014.

# SECTION Q

DG 15-155
Valley Green Natural Gas, LLC
Almy-Wood Set 1 to Valley Green Natural Gas, LLC

Date Request Received: 08/20/15 Date of Response: 8/31/15
Request No. Almy-Wood 1-2 Witness: James W. Campion, IV

REQUEST: Was the wetland delineation of this site done before or after the site was heavily logged in a way that required a post-facto alteration-of-terrain permit and restoration, both still incomplete?

RESPONSE: At the request of Choice Storage LLC, Pathways Engineering conducted a Phase I Environmental Study of the site dated June 4, 2010, prior to Choice Storage's purchase of the property from Dartmouth College Trustees. Wetlands were noted but not delineated as part of that study. (See attached Phase I.) Photographs from that study show debris and other solid waste in the wetlands. The first wetland delineation of tax map 26-17 under current ownership was completed by Holden Engineering on July 30, 2010.

DES is still in the process of reviewing the alteration of terrain permit application. However, as noted in response to Almy-Wood 1-1, restoration of wetlands is complete and has resulted in a net increase in wetland function from the condition they were in prior to purchase from Dartmouth.

# PHASE I ENVIRONMENTAL SITE ASSESSMENT

## FOR PROPERTY OF

## DARTMOUTH COLLEGE TRUSTEES
## ETNA ROAD
## LEBANON, NEW HAMPSHIRE

## PREPARED FOR

## JAY CAMPION
## 44 SOUTH MAIN STREET
## HANOVER, NEW HAMPSHIRE 03755

**June 4, 2010**

**PROJECT NO. 11959**

*Prepared by:*

*Holly A. Lewis-Poulin, Environmental Engineer*

*Reviewed and Approved by:*

*A. Dana Arey, Vice President/Director of Environmental Services*

**PATHWAYS CONSULTING, LLC**
Planning • Civil & Environmental Engineering • Surveying • Construction Assistance
240 Mechanic Street • Suite 100
Lebanon, New Hampshire 03766
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# 1.0 INTRODUCTION

## 1.0 INTRODUCTION

This report is a Phase I Environmental Site Assessment (ESA) conducted at a property located on Etna Road in Lebanon, New Hampshire. The property is identified as Lot 17 on Map 26 of the Lebanon Assessors' maps. According to the City of Lebanon records, the Dartmouth College Trustees currently own the property.

The objective of this Phase I ESA is to identify, to the extent feasible pursuant to the processes described herein, recognized environmental conditions in connection with the property. Work relating to the ESA has been conducted in general accordance with the American Society for Testing and Materials (ASTM) Standard E 1527-05, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process. Recognized environmental conditions are defined in the ASTM Standard E 1527-05 as "the presence or likely presence of any hazardous substances or petroleum products on the property under conditions that indicate an existing release, past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water on the property." Information used in the preparation of this report was gathered from sources including:

- a visual site reconnaissance conducted on May 20, 2010 to collect information regarding the physical setting of the property and surrounding areas;
- a review of available Internet records on file with the New Hampshire Department of Environmental Services (NHDES) on May 17, 2010 to obtain information relative to hazardous materials, oil storage and handling, and releases at the subject property and properties within a one-half mile search radius thereof;
- a review of the NHDES Brownfield Sites List on May 18, 2010;
- a review of the United States Environmental Protection Agency (EPA) Superfund National Priorities List, 2008 Toxic Release Inventory List, and Enforcement and Compliance History Online on May 18, 2010;
- a review of the National Response Center Emergency Response and Notification System (ERNS) database on May 18, 2010;
- a review of the United States Department of Agriculture Web Soil Survey on May 18, 2010;
- a review of online records at the City of Lebanon Assessors' Office on May 17, 2010;
- a review of aerial photographs dated 2007, 2003, and 1998, and an 1855 Eaton Parcel Map on the City of Lebanon's Geographic Information System online mapping program;

- a review of aerial photographs dated February 26, 2010, September 20, 2009, August 24, 2008, October 7, 2006, August 2, 2005, April 29, 2005, September 22, 2003, and May 12, 1992, accessed via Google Earth©; and

- a review of the City of Lebanon Sanborn Fire Insurance Maps.

This Phase I ESA is intended to provide information relating to environmental conditions that were visually discernable or documented by the record information reviewed. No evaluations of asbestos-containing materials, lead paint, mold, or other substances not defined in this report were conducted for this ESA. This report is subject to the Limitations described in Appendix G.

## TABLE OF CONTENTS


1.0 INTRODUCTION ..... 1

2.0 SITE DESCRIPTION/CHARACTERISTICS/HISTORY ..... 4

3.0 RECORDS REVIEW ..... 6

4.0 SITE RECONNAISSANCE ..... 11

5.0 DATA GAPS ..... 13

6.0 FINDINGS AND CONCLUSIONS ..... 16


APPENDIX


A. FIGURES

B. ASSESSORS' PROPERTY RECORD CARD

C. USDA SOIL MAP

D. TABLES

E. PHOTOGRAPHS

F. CONSULTANT'S QUALIFICATIONS

G. LIMITATIONS AND DECLARATION

# 2.0 SITE DESCRIPTION/CHARACTERISTICS/HISTORY

## 2.0 SITE DESCRIPTION/CHARACTERISTICS/HISTORY

The site, which is the subject of this ESA, is designated as Lot 17 on Map 26 of the Lebanon Assessors' maps, and it is currently owned by the Dartmouth College Trustees. For the purpose of this assessment, the property will be referred to as the Site. The Site is approximately 185 acres and it is currently undeveloped. Figure 1 of Appendix A depicts the property in a regional perspective as shown on the U.S. Geological Survey quadrangle sheet. Figure 2 shows the property from the Lebanon Assessors' maps. A copy of the Assessors' card is included in Appendix B.

The Site is located approximately 1.3 miles northeast of the downtown commercial district of Lebanon, New Hampshire. The Site is in three zoning districts. The eastern portion is zoned Rural Lands 3 (RL3), the western portion is zoned Industrial Light (IND-L), and a small portion in the northwest is zoned Rural Lands 2 (RL2). A copy of the Lebanon Zoning map is included as Figure 3. The property is bound to the east by undeveloped wooded parcels, to the south by a residential property and two light industrial warehouse properties, to the west by light industrial properties and offices, and to the north by residential properties.

The Site topography is illustrated on Figure 4. A copy of the United States Department of Agriculture Web Soil Survey that includes the Site is included in Appendix C. The Site primarily consists of Cardigan-Kearsarge-Rock outcrop complex silt loam, 15 to 60 percent slopes and Charlton fine sandy loam, 15 to 25 percent slopes, very stony. Both Cardigan-Kearsarge-Rock outcrop complex and Charlton fine sandy loam are rated in the "B" hydrologic soil group, described as soils having a moderate infiltration rate when thoroughly wet and a moderate rate of water transmission.

The City of Lebanon Assessors' information contains no records of development on the property. Google Earth© images of the site were reviewed dated February 26, 2010, September 20, 2009, August 24, 2008, October 7, 2006, August 2, 2005, April 29, 2005, September 22, 2003, and May 12, 1992. In addition, the City of Lebanon Geographic Information System (GIS) maps include 2007, 2003, and 1998 aerial photographs of the Site. The property appears wooded and no structures are visible in the photographs. Topographic maps dated 1932 and 1927 were reviewed from the USGS Mascoma Quadrangle. The Site is depicted as undeveloped along the west side of Signal Hill. Sanborn Fire Insurance Maps were reviewed for the Lebanon, New Hampshire area; however, no coverage was provided for the Site area. The Lebanon GIS maps show the Site on historical topographic maps dated 1930, 1892, 1860, 1776, and 1767, as well as 1855 Eaton and Parcel maps. The property is undeveloped on all the maps. Based on this information, apparently the property has never been developed.

Ownership history for the Site is summarized in Table 1 in Appendix D.

# 3.0 RECORDS REVIEW

## 3.0 RECORDS REVIEW

Records reviewed in support of this ESA were located on the NHDES and EPA Internet web sites. The historical information identified in Section 1.0 of this report, including Sanborn Fire Insurance Maps and records from the Lebanon Assessors' Internet web site, were reviewed to obtain general information regarding property history and characteristics as described in Section 2.0 of this report. The following sections discuss the information derived from the NHDES and EPA records reviews, and they are intended to evaluate documented conditions of known or potential environmental significance on the property and surrounding properties within the required search radii in general accordance with the ASTM Standard E 1527-05.

### 3.1 NHDES Records Review

Records relating to environmental issues were reviewed on the NHDES Waste Management Division Internet files on April 17, 2010, and included the following documents:

- Oil Remediation and Compliance Bureau (ORCB) - Remediation and Initial Response Spill (RIRS) Sites,
- National Pollutants Discharge Elimination System (NPDES) Outfall Listings,
- Air Stationary Source Listings,
- Asbestos Disposal Sites,
- Automobile Salvage Yards,
- ORCB Underground Storage Tank (UST) and Aboveground Storage Tank (AST) Registration Listing, and
- Resource Conservation and Recovery Act (RCRA) Hazardous Waste Generators List.

The NHDES files contained six RIRS sites, two of which are active, three UST facilities, one AST facility, one air stationary source, one NPDES outfall, and thirteen hazardous waste generators within the one-half mile search radius of the Site. No asbestos disposal sites, or automobile salvage yards were located within a one-half mile radius of the Site.

The NHDES GIS maps depicting the locations of the hazardous waste generators; air stationary source, AST facility, one air stationary source, and NPDES Outfall; UST facilities; and RIRS sites are depicted on Figures 5 through 8, respectively. The names and addresses of these sites are included in Table 2 in Appendix D. The information derived from the NHDES records for the active RIRS sites is described in the following paragraphs.

**Verizon Garage, 92 Etna Road (NHDES Site No. 198606022)**

The Verizon Garage is located immediately west of the subject Site. In 1986, four USTs were registered at the Verizon Garage. In 1988, four of these USTs were removed, including a 1,000-gallon waste motor oil, a 500-gallon waste oil, and a 4,000-gallon gasoline. The fourth tank, a 5,000-gallon #2 fuel oil UST, was removed in 1991. The NHDES records also contain closure documentation for a 10,000-gallon unregistered fuel oil tank at the Verizon Garage circa 1990. The closure reports document no evidence of contamination at the time of closure associated with the USTs; however, only the 1991 closure report includes analyses of three soil samples.

In 2005, a release of hydraulic oil was reported at the Verizon Garage during the replacement of a hydraulic lift. Approximately 100 tons of petroleum-impacted soil were excavated and shipped for off-site treatment. A groundwater sample collected from the bottom of the excavation contained elevated concentrations of methyl tert-butyl ether (MTBE), which was not believed to be associated with the release of hydraulic oil. The spill/release project number on the site was closed and an Ether project was established.

In January 2007, an Initial Site Characterization (ISC) report was submitted to the NHDES, including the installation of four groundwater monitoring wells and soil sampling. No petroleum-impacted soil was detected at the Verizon Garage during the completion of the ISC. Groundwater in a monitoring well installed downgradient from the former hydraulic oil release area contained 125 micrograms per liter (µg/l) of MTBE, exceeding the Ambient Groundwater Quality Standard (AGQS) of 13 µg/l. The consultant for Verizon recommended the installation of downgradient monitoring wells to delineate the extent of the contamination. Based on the relatively low concentrations of MTBE, the NHDES only requested groundwater sampling in April and November 2007.

In addition to groundwater monitoring, the NHDES approved voluntary remedial actions at the Verizon Garage site, including the injection of 2,300 pounds of sodium persulfate in June 2007 and an additional sampling event in July 2007. The concentration of MTBE continued to exceed the AGQS during all three 2007 sampling events, and the NHDES requested annual groundwater sampling in November 2008 and 2009. A voluntary sampling event was also completed in July 2008. The groundwater quality at the Verizon Garage site improved significantly, and MTBE was detected within the AGQS during the November 2009 sampling event. The NHDES anticipates site closure following two consecutive sampling events indicating groundwater quality has remained within the AGQS.

The groundwater flow at the Verizon Garage site flows southeast, generally toward the subject Site and a small pond located on the east side of the Verizon Garage property. The approximate distance from the Verizon Garage release area and the subject Site is 415 feet. Due to the lack of source identification and release delineation, the full extent of the release at the Verizon Garage is unknown. Therefore, the potential for adverse environmental impacts to the

subject Site is also unknown. The NHDES files relating to the Verizon Garage site contained no evidence of known adverse impacts to the subject Site.

**Bond Optics, 76 Etna Road (NHDES Site No. 199204007)**

The Bond Optics site is located to the west of the subject Site. Contamination was first discovered at the Bond Optics site circa 1992 during the closure of an 8,000-gallon #2 fuel oil UST initially installed circa 1968. The UST was closed in-place adjacent to the southern portion of the Bond Optics building. Samples collected at the time of the closure contained elevated concentrations of chlorinated volatile organic compounds (CVOCs), potentially originating from a former 500-gallon trichloroethene (TCE) AST, also formerly located adjacent to the southern end of the building. Based on the findings of the UST closure, the Bond Optics site was added to the NHDES Hazardous Waste Remediation Bureau database for management. After a review of potential remedial alternatives, an electron donor pilot study was selected and implemented in September 2001. The pilot study goal was to use in-situ anaerobic dehalogenation as a method to bioremediate CVOCs at the Bond Optics site. The pilot study consisted of one injection of a slurry with 70% lactose and 30% brewer's yeast into 28 injection points. The overall concentration of CVOCs on the Bond Optics site has declined since implementation of the pilot study in 2001.

Contaminated groundwater on the Bond Optics property flows in a southerly direction. However, the area of contamination has been defined and no evidence was reviewed to indicate that contamination has migrated off the Bond Optics property. Thus, this site is unlikely to have impacted the subject Site.

The NHDES files contained no other reference to relevant hazardous materials incidents within one-half mile of, or at, the subject site.

According to the New Hampshire Code of Administrative Rules Env-Wm 1401, New Hampshire does not require registration of UST facilities which are used solely for residential or domestic heating, or which have tanks with a storage capacity of less than 1,100 gallons and are used solely for the storage of heating oil for on-premises use. Therefore, tanks could exist on properties within a one-half mile radius of the subject Site without any record in the NHDES files.

## 3.2 Environmental Protection Agency National Priorities List and Miscellaneous Federal and State Database Review

The EPA's National Priorities List (NPL) and Delisted NPL, Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) and CERCLIS No Further Action Proposed (NFAP) site list contained no sites within a one-mile radius of the subject Site.

The EPA's Enforcement and Compliance History Online (ECHO) database contains information pertaining to the Clean Air Act (CAA) Stationary Source Program, Clean Water Act (CWA) NPDES, and RCRA sites. A review of the ECHO database returned nineteen results within a one-mile radius. The results

are summarized in Table 3 in Appendix D. None of the files on the ECHO database indicated a release or threat of a release at or within a one-mile radius of the subject Site.

The hazardous waste site listings (state NPL/CERCLIS site equivalent) identified within a one-half mile radius of the Site are discussed in Section 3.1 of this report.

The National Response Center Emergency Response and Notification System (ERNS) database was reviewed for records containing recognized environmental conditions on the subject property or in the immediate vicinity. No releases were identified at the subject Site or in the immediate vicinity.

No landfills or solid waste disposal sites were located within a one-half mile radius of the subject Site. No specific state voluntary cleanup site databases, or state or federal institutional control/engineering control registries were located for review as part of this ESA.

# 4.0 SITE RECONNAISSANCE

## 4.0 SITE RECONNAISSANCE

A visual reconnaissance of the subject Site was conducted on May 20, 2010. The site reconnaissance included a general walkover of the property. Photographs of the property are included in Appendix E.

The Site is currently vacant, generally rectangular in shape, and is located on the west side of Signal Hill. The property slopes moderately toward the west. The Site is accessed via a dirt road off a short length of road frontage on Etna Road on the west side of the property. The parcel is almost entirely wooded with recreational paths throughout. Surface drainage flows westerly into several interconnected beaver ponds and Great Hollow Brook (Rix Brook) on the west side of the property.

Solid waste was observed on the west side of the property, congregated primarily in areas accessible via the dirt road off Etna Road. The solid waste included a refrigerator, several tires, vehicle parts, paint cans, metal pipes/culverts, and other debris. All the solid waste appeared aged. Although some of the materials disposed of at the Site may have once contained hazardous liquids/materials (i.e. refrigerant, oil based paints, and automobile fluids), no evidence of soil staining, stressed vegetation, or residual products was observed at the time of the site reconnaissance. Due to the age of the materials, it does not appear that the subject property is currently utilized for solid waste disposal.

# 5.0 DATA GAPS

## 5.0 DATA GAPS

The following data gaps were encountered in the preparation of this report:

*Section 6.2 Review Title and Judicial Records for Environmental Liens or Activity and Use Limitations (AULs):*

A review of title and judicial records for environmental liens or AULs was not conducted in support of this report; however, environmental liens or AULs, if present, would be contained in the NHDES files discussed in Section 3.1 of this report.

*Section 8.2.1 Standard Environmental Record Sources:*

The following resources were not reviewed during completion of this report:

- Federal Institutional Control/Engineering Control Registries

  Federal Institutional Control/Engineering Control Registries could not be identified in support of this report.

- State Voluntary Clean Up

  A state Voluntary Clean Up list was not identified in the preparation of this report. According to the New Hampshire Administrative Rules Env-Or 604.06, the following discharges of oil require immediate notification to the NHDES: a discharge or any oil onto surface water or groundwater of the state, a discharge of 25 gallons or more of oil to land, a discharge of less than 25 gallons of oil to land, unless the discharge is cleaned-up immediately and properly disposed of, a discharge of oil that results in the presence of vapors that pose an imminent threat to human health, a discharge of oil resulting in a violation of the groundwater quality criteria of Env-Or 603.01 in a sample collected from a water supply well, or a discharge of oil resulting in the detection of [non-aqueous phase liquids] NAPL. According to Env-Or 604.07, the responsible party or other person who becomes aware of a potential discharge of oil based on an exceedance of the soil remediation standards of Env-Or 606.19 that might have been caused by an oil discharge shall notify the department no more than 60 days after obtaining knowledge of the exceedance. Based on this information, voluntary clean-up sites are listed as an RIRS site.

- State Institutional Control/Engineering Control Registries

  A state Institutional Control/Engineering Control Registry was not identified in the preparation of this report. Based on the Site history and use, it is unlikely that Institutional Control/Engineering Control Registry reviews would be useful.

- State landfill and/or solid waste disposal site list

  A state landfill and/or solid waste disposal site list was not identified in the preparation of this report; however, many state landfill and solid waste disposal

sites generally cross-reference with the state databases for RIRS sites or hazardous waste generators.

*User Questionnaire, Appendix X3*

A User Questionnaire was not completed in support of this report.

# 6.0 FINDINGS AND CONCLUSIONS

## 6.0 FINDINGS AND CONCLUSIONS

This Phase I ESA was completed on property located on Etna Road in Lebanon, New Hampshire. The Site is identified as Lot 17 on Map 26 of the Lebanon Assessors' maps. The property is currently undeveloped.

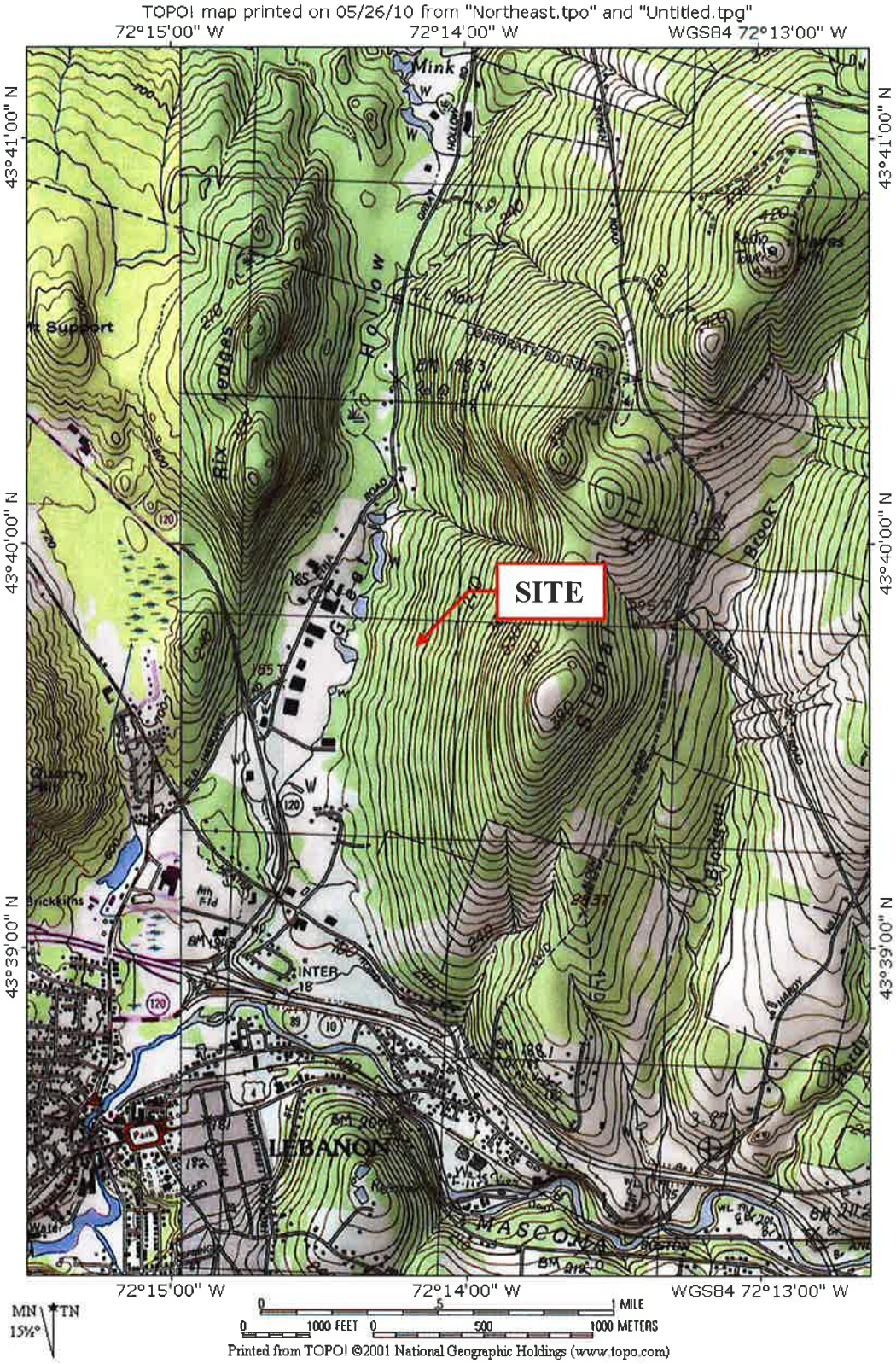
The records reviewed in Section 3.0 of this report revealed two active RIRS sites within a one-half mile radius of the subject Site. The records reviewed in association with the Bond Optics release site revealed no evidence of a potential adverse environmental impact to the subject Site. The records reviewed related to the Verizon Garage site contained limited information on the source and extent of contamination on that site. The subject Site is located approximately 415 feet downgradient from the release area at the Verizon Garage property. Based on the available information, it could not be determined whether the release at the Verizon Garage site could adversely impact the subject Site.

The site reconnaissance revealed an accumulation of solid waste on the western portion of the property. The solid waste included a refrigerator, paint cans, automobile parts, tires, and other debris. Although these materials do not appear to have adversely impacted the subject Site, we recommend their removal and disposal in accordance with state and federal regulations as a good housekeeping measure.

The visual reconnaissance of the property did not reveal any evidence of the release of any hazardous substances or petroleum products, or a material threat of a release of any hazardous substances or petroleum products, into structures on the property or into the ground or groundwater on the property.

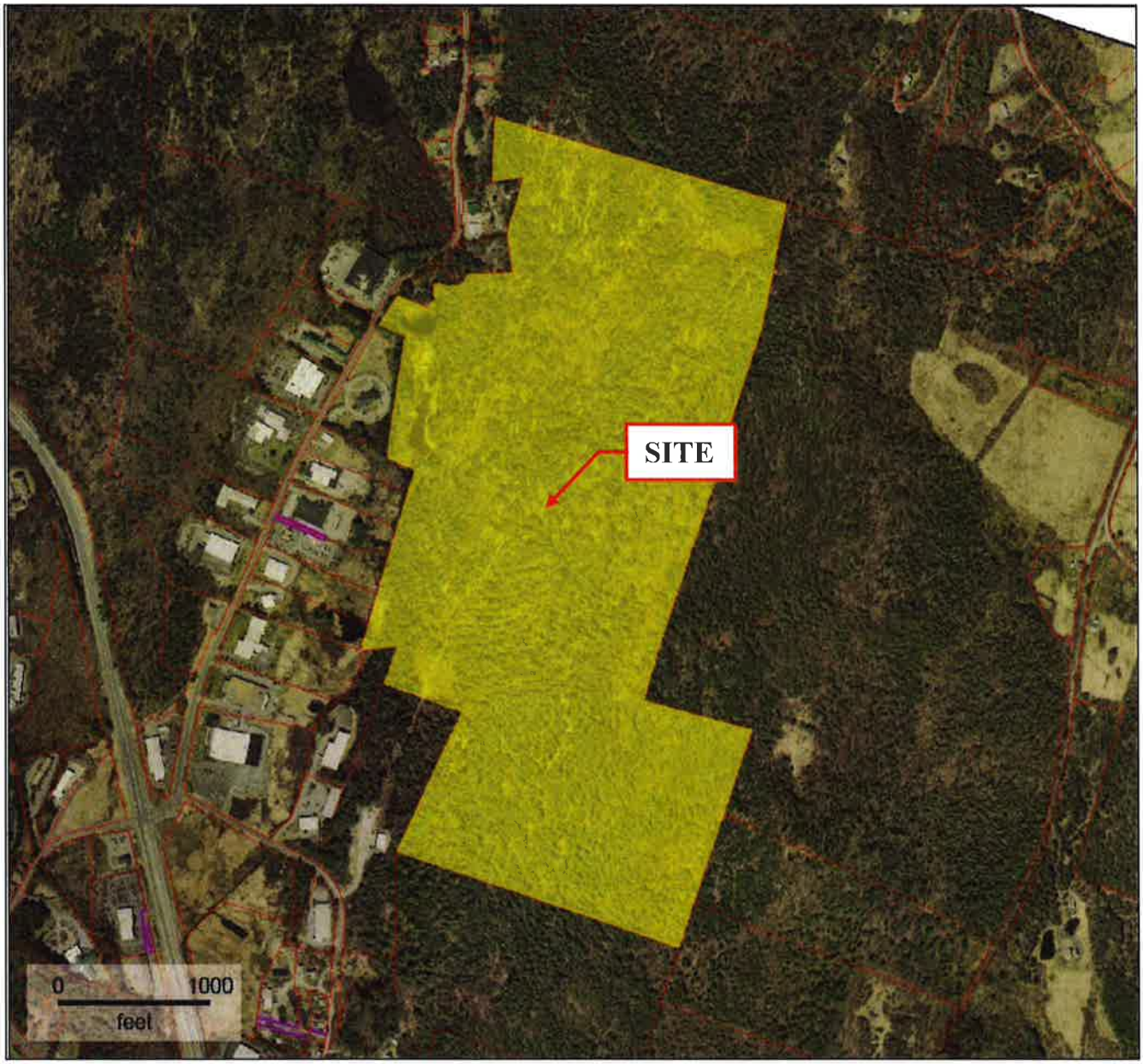
# APPENDIX

# A. FIGURES

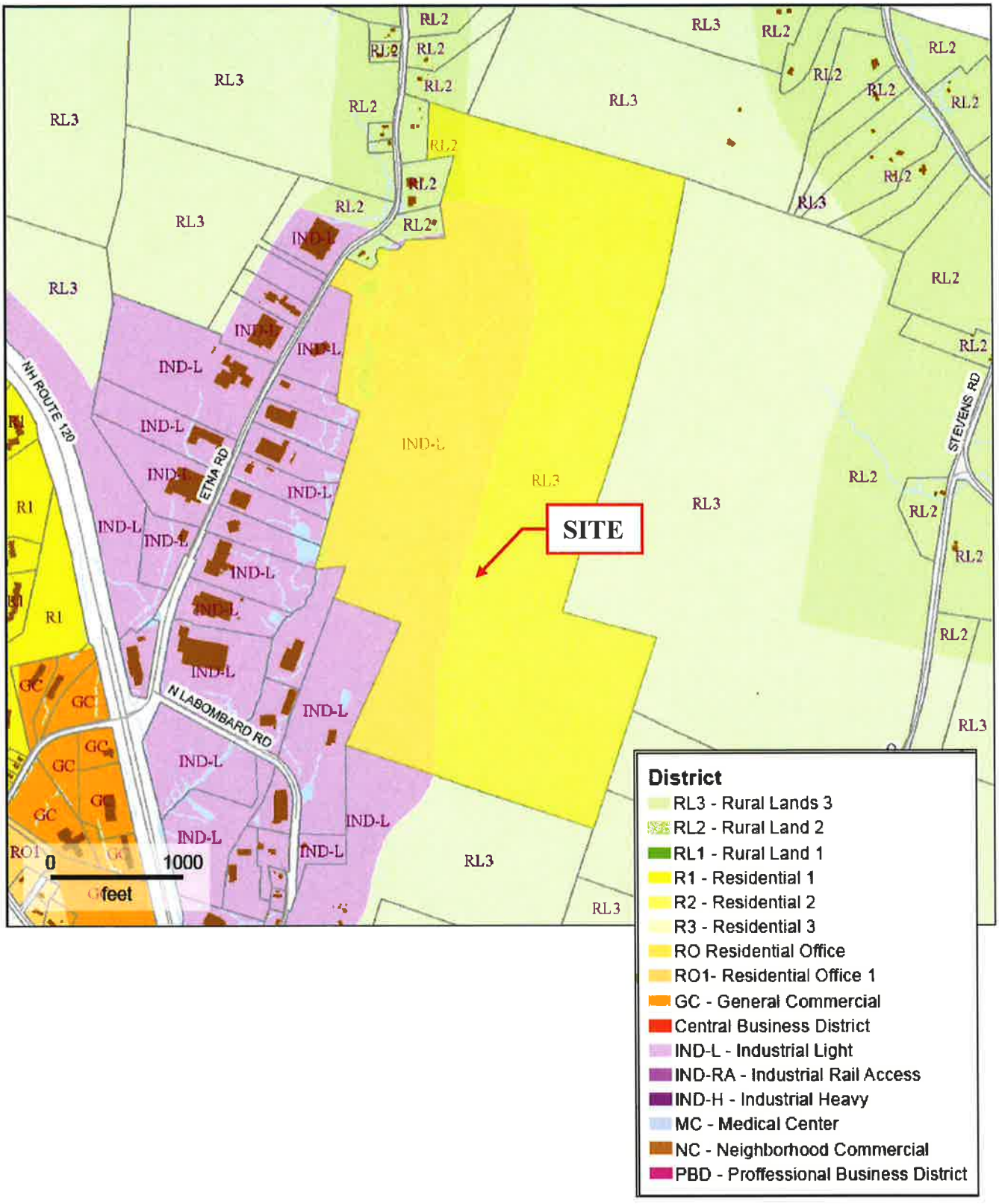



| | | |
|---|---|---|
| PATHWAYS CONSULTING, LLC<br>240 MECHANIC STREET<br>SUITE 100<br>LEBANON, NH 03766<br>(603) 448-2200 FAX (603) 448-1221 | SITE LOCUS MAP<br>MAP 26, LOT 17 SITE<br>ETNA ROAD<br>LEBANON, NEW HAMPSHIRE | FIGURE<br>1 |

PREPARED BY: HLP | DATE: JUNE 2010 | PROJECT NUMBER: 11959

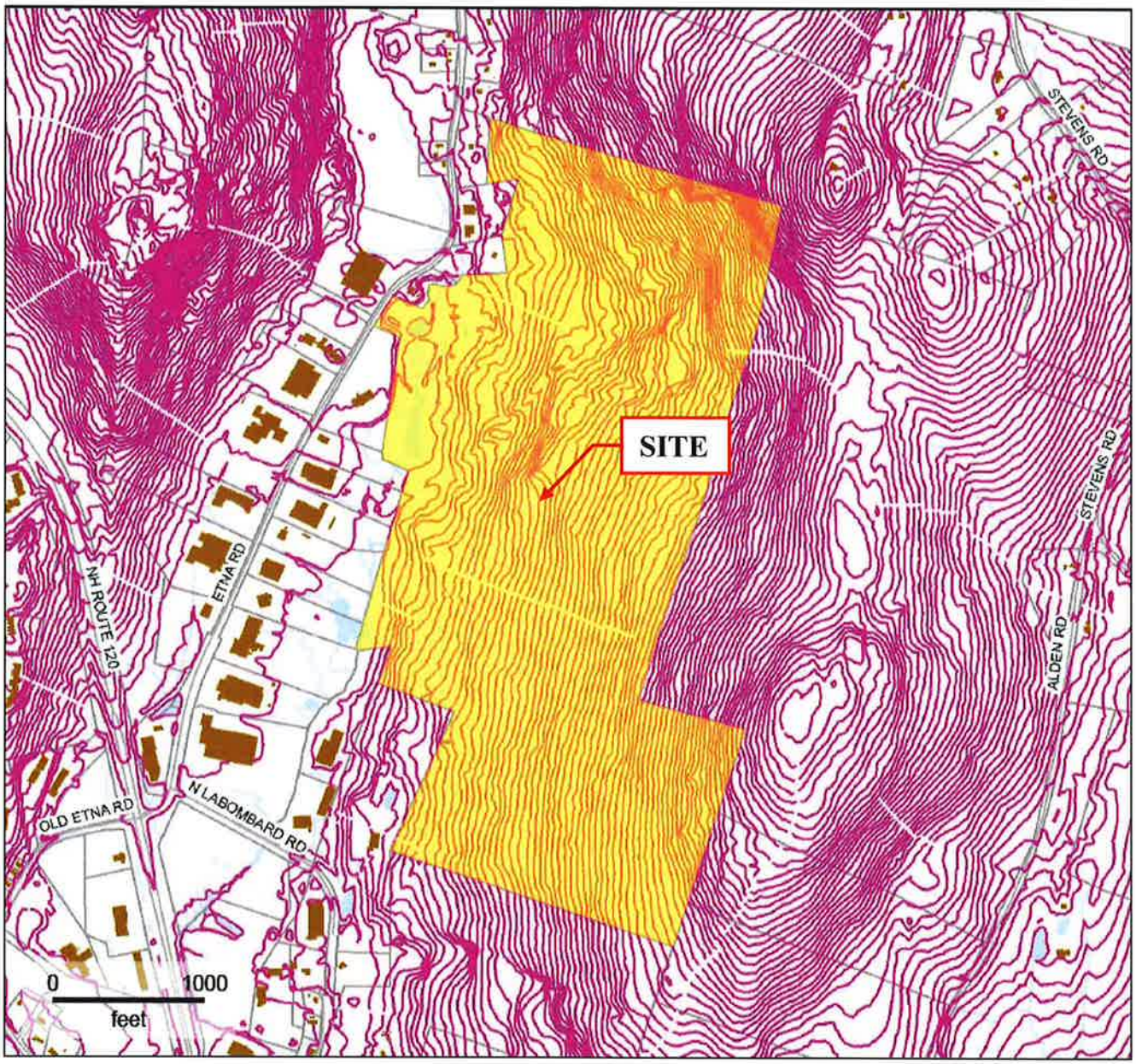



| | | |
|---|---|---|
| PATHWAYS CONSULTING, LLC<br>240 MECHANIC STREET<br>SUITE 100<br>LEBANON, NH 03766<br>(603) 448-2200 FAX (603) 448-1221 | LEBANON ASSESSORS' MAP<br>MAP 26, LOT 17 SITE<br>ETNA ROAD<br>LEBANON, NEW HAMPSHIRE | FIGURE<br>**2** |
| PREPARED BY: HLP | DATE: JUNE 2010 | PROJECT NUMBER: 11959 |



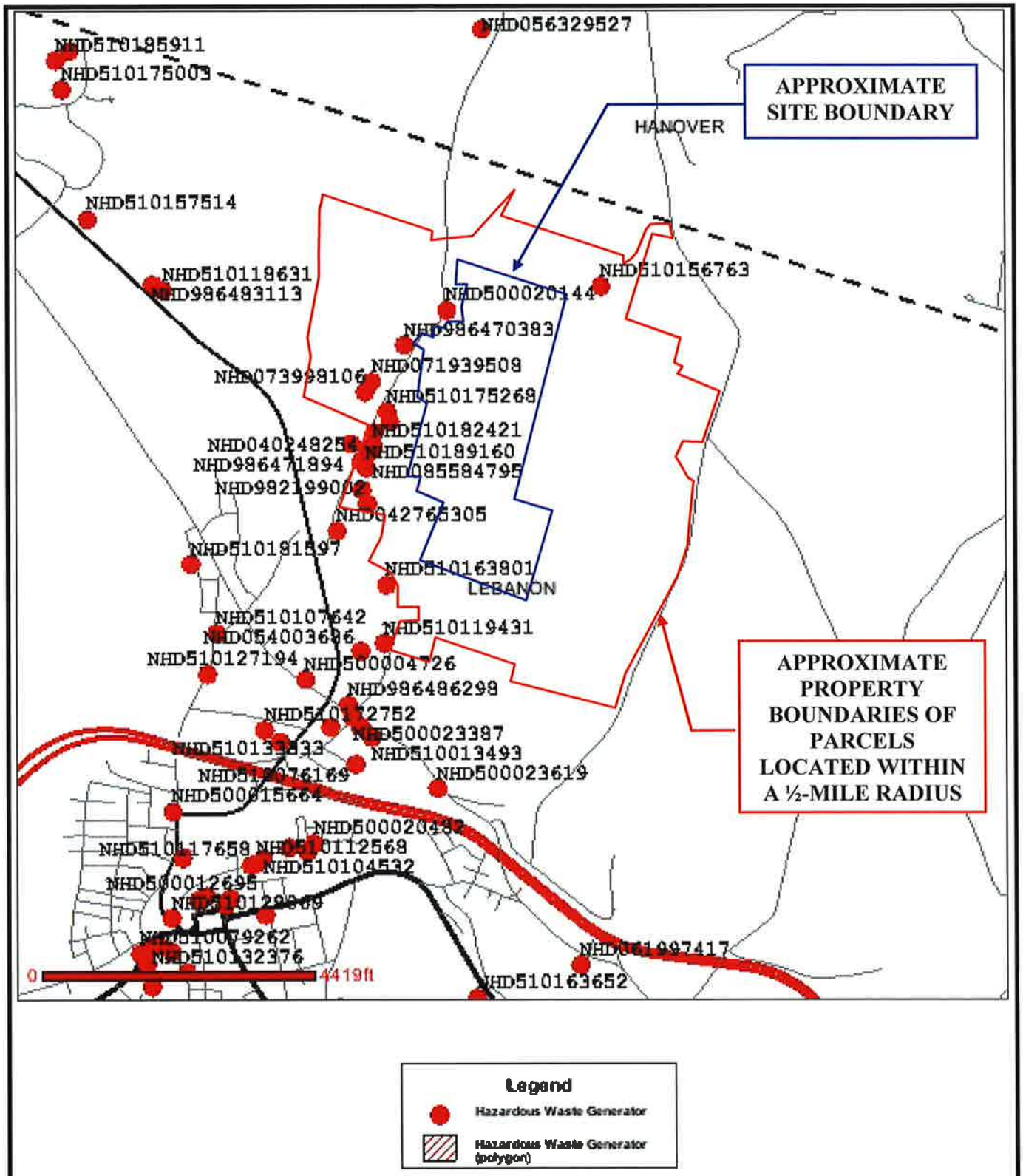

| | | |
|---|---|---|
| PATHWAYS CONSULTING, LLC<br>240 MECHANIC STREET<br>SUITE 100<br>LEBANON, NH 03766<br>(603) 448-2200 FAX (603) 448-1221 | LEBANON ZONING MAP<br>MAP 26, LOT 17 SITE<br>ETNA ROAD<br>LEBANON, NEW HAMPSHIRE | FIGURE<br>3 |

PREPARED BY: HLP | DATE: JUNE 2010 | PROJECT NUMBER: 11959



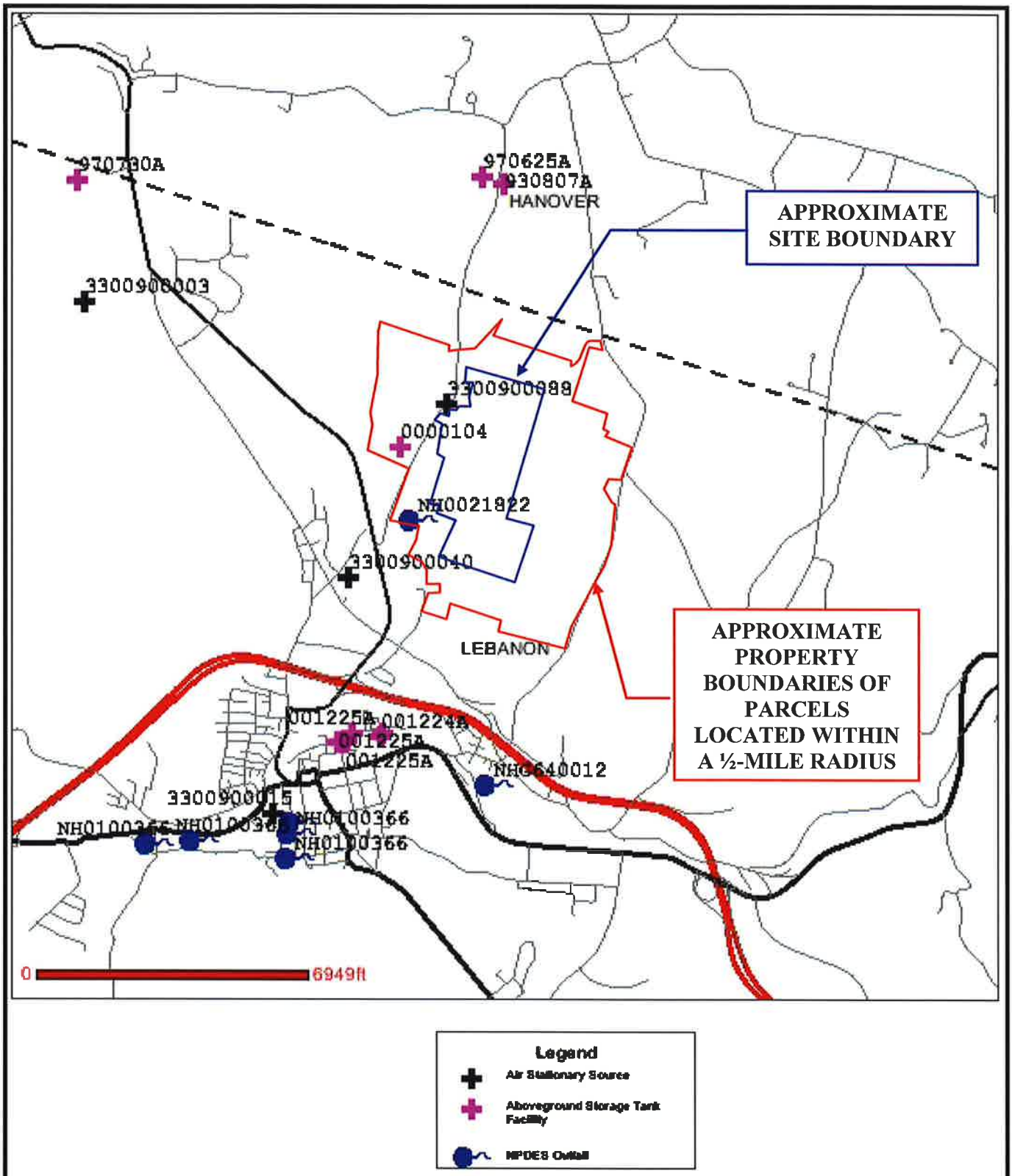

| | | |
|---|---|---|
| PATHWAYS CONSULTING, LLC<br>240 MECHANIC STREET<br>SUITE 100<br>LEBANON, NH 03766<br>(603) 448-2200 FAX (603) 448-1221 | LEBANON TOPOGRAPHIC MAP<br>MAP 26, LOT 17 SITE<br>ETNA ROAD<br>LEBANON, NEW HAMPSHIRE | FIGURE<br>4 |

PREPARED BY: HLP DATE: JUNE 2010 PROJECT NUMBER: 11959

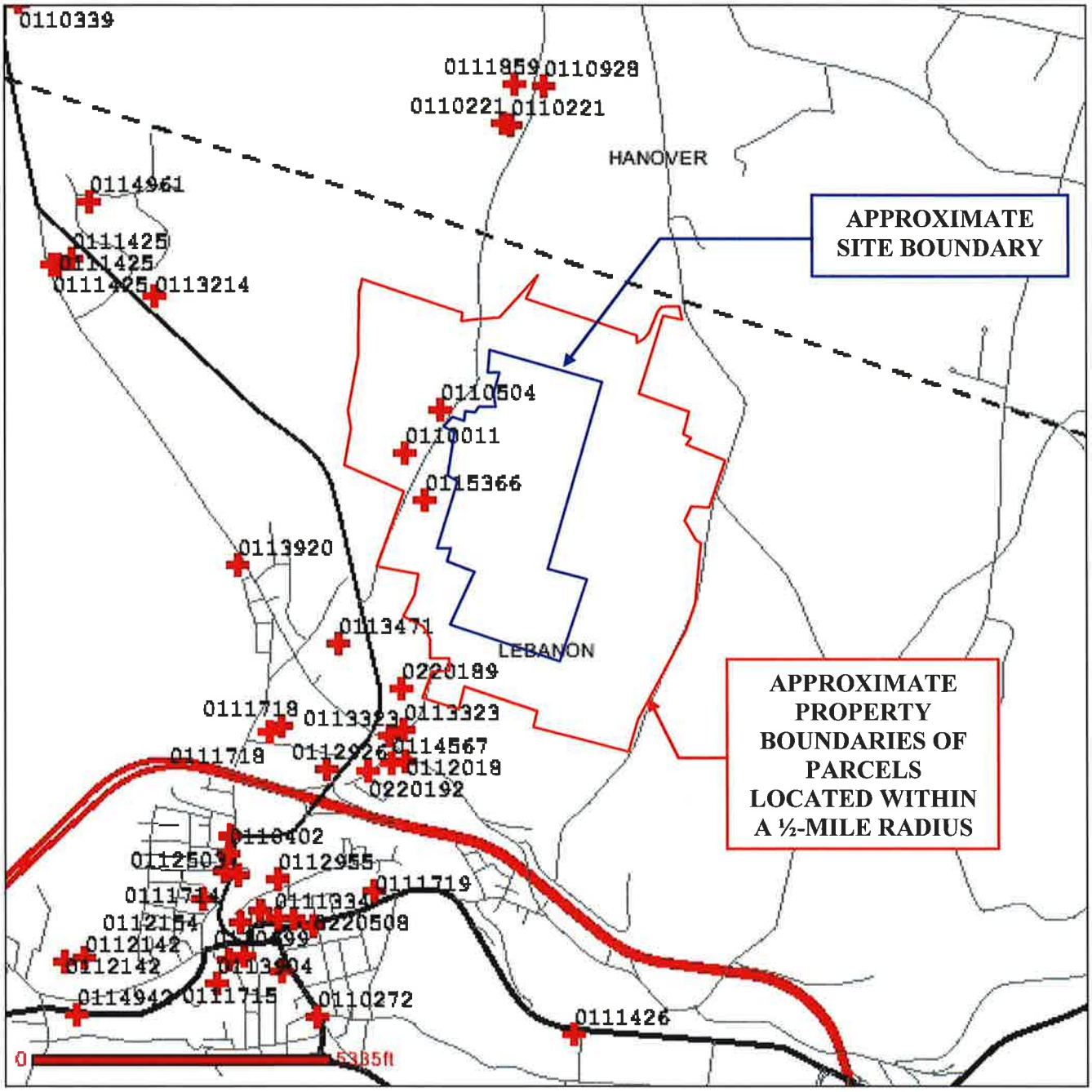



| | | |
|---|---|---|
| PATHWAYS CONSULTING, LLC<br>240 MECHANIC STREET<br>SUITE 100<br>LEBANON, NH 03766<br>(603) 448-2200 FAX (603) 448-1221 | NHDES HAZARDOUS WASTE SITES<br>MAP 26, LOT 17 SITE<br>ETNA ROAD<br>LEBANON, NEW HAMPSHIRE | FIGURE<br>**5** |

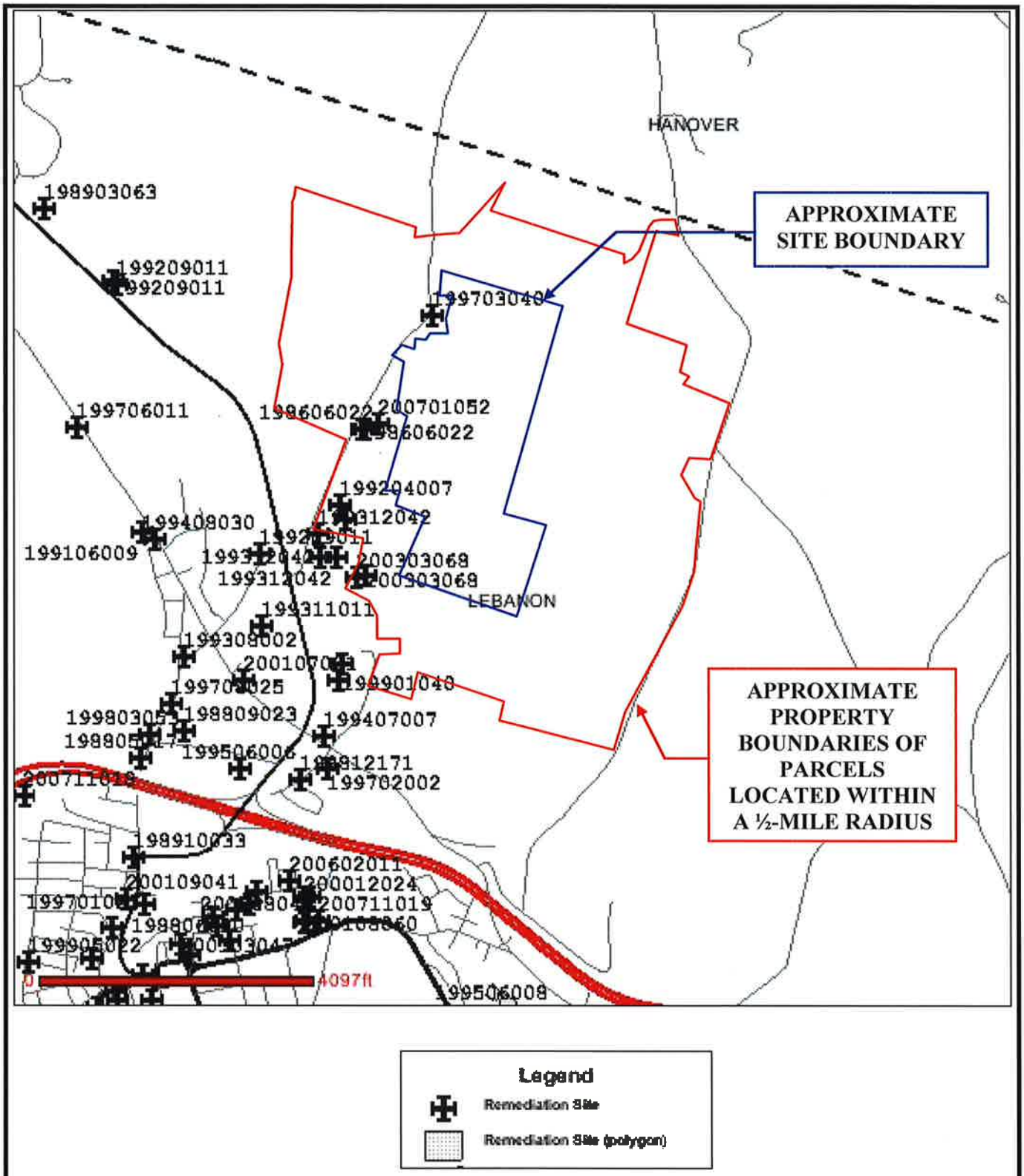
PREPARED BY: HLP | DATE: JUNE 2010 | PROJECT NUMBER: 11959




| | | |
|---|---|---|
| PATHWAYS CONSULTING, LLC<br>240 MECHANIC STREET<br>SUITE 100<br>LEBANON, NH 03766<br>(603) 448-2200 FAX (603) 448-1221 | NHDES AIR, AST, AND NPDES SITES<br>MAP 26, LOT 17 SITE<br>ETNA ROAD<br>LEBANON, NEW HAMPSHIRE | FIGURE<br>**6** |
| PREPARED BY: HLP | DATE: JUNE 2010 | PROJECT NUMBER: 11959 |




| | | |
|---|---|---|
| PATHWAYS CONSULTING, LLC<br>240 MECHANIC STREET<br>SUITE 100<br>LEBANON, NH 03766<br>(603) 448-2200 FAX (603) 448-1221 | NHDES UST FACILITIES<br>MAP 26, LOT 17 SITE<br>ETNA ROAD<br>LEBANON, NEW HAMPSHIRE | FIGURE<br>7 |
| PREPARED BY: HLP | DATE: JUNE 2010 | PROJECT NUMBER: 11959 |




PATHWAYS CONSULTING, LLC
240 MECHANIC STREET
SUITE 100
LEBANON, NH 03766
(603) 448-2200 FAX (603) 448-1221

NHDES RIRS SITES
MAP 26, LOT 17 SITE
ETNA ROAD
LEBANON, NEW HAMPSHIRE

FIGURE
**8**

PREPARED BY: HLP | DATE: JUNE 2010 | PROJECT NUMBER: 11959

# B. ASSESSORS' PROPERTY RECORD CARD

# Unofficial Property Record Card - Lebanon, NH

## General Property Data

| | | | |
|---|---|---|---|
| Parcel ID | 26-17 | Account Number | 5125 |
| Prior Parcel ID | -- | | |
| Property Owner | DARTMOUTH COLLEGE TRUSTEES | Property Location | 0 ETNA RD |
| | PAUL OLSEN REAL EST OFC | Property Use | 620 |
| Mailing Address | PO BOX 5188 | Most Recent Sale Date | 1/1/1900 |
| | | Legal Reference | |
| City | HANOVER | Grantor | DARTMOUTH COLLEGE TRUSTEES |
| Mailing State | NH Zip 03755 | Sale Price | 0 |
| ParcelZoning | INDL | Land Area | 0.000 acres |

## Current Property Assessment

| Card 1 Value | Building Value | Xtra Features Value | Land Value | Total Value |
|---|---|---|---|---|
| | 0 | 0 | 93,600 | 93,600 |

## Building Description

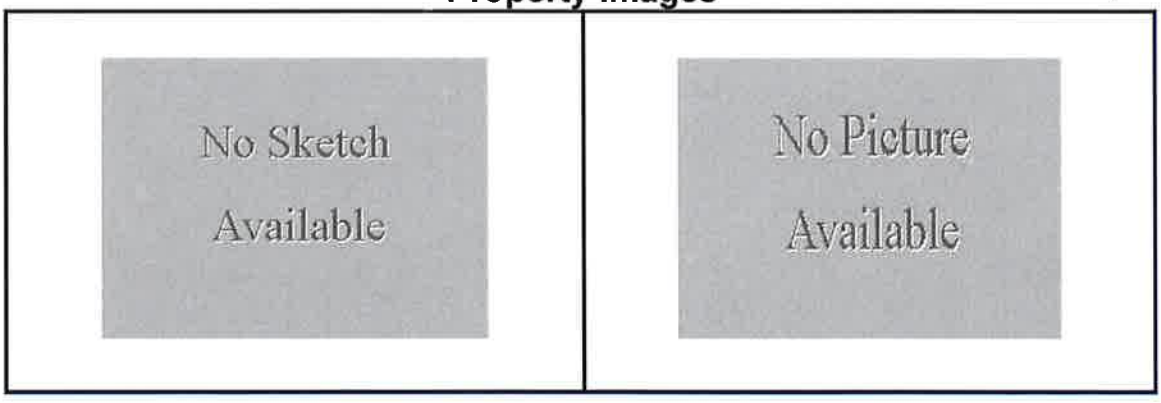
| | | |
|---|---|---|
| Building Style N/A | Foundation Type N/A | Flooring Type N/A |
| # of Living Units N/A | Frame Type N/A | Basement Floor N/A |
| Year Built N/A | Roof Structure N/A | Heating Type N/A |
| Building Grade N/A | Roof Cover N/A | Heating Fuel N/A |
| Building Condition Average | Siding N/A | Air Conditioning 0% |
| Finished Area (SF) N/A | Interior Walls N/A | # of Bsmt Garages 0 |
| Number Rooms 0 | # of Bedrooms 0 | # of Full Baths 0 |
| # of 3/4 Baths 0 | # of 1/2 Baths 0 | # of Other Fixtures 0 |

## Legal Description

## Narrative Description of Property

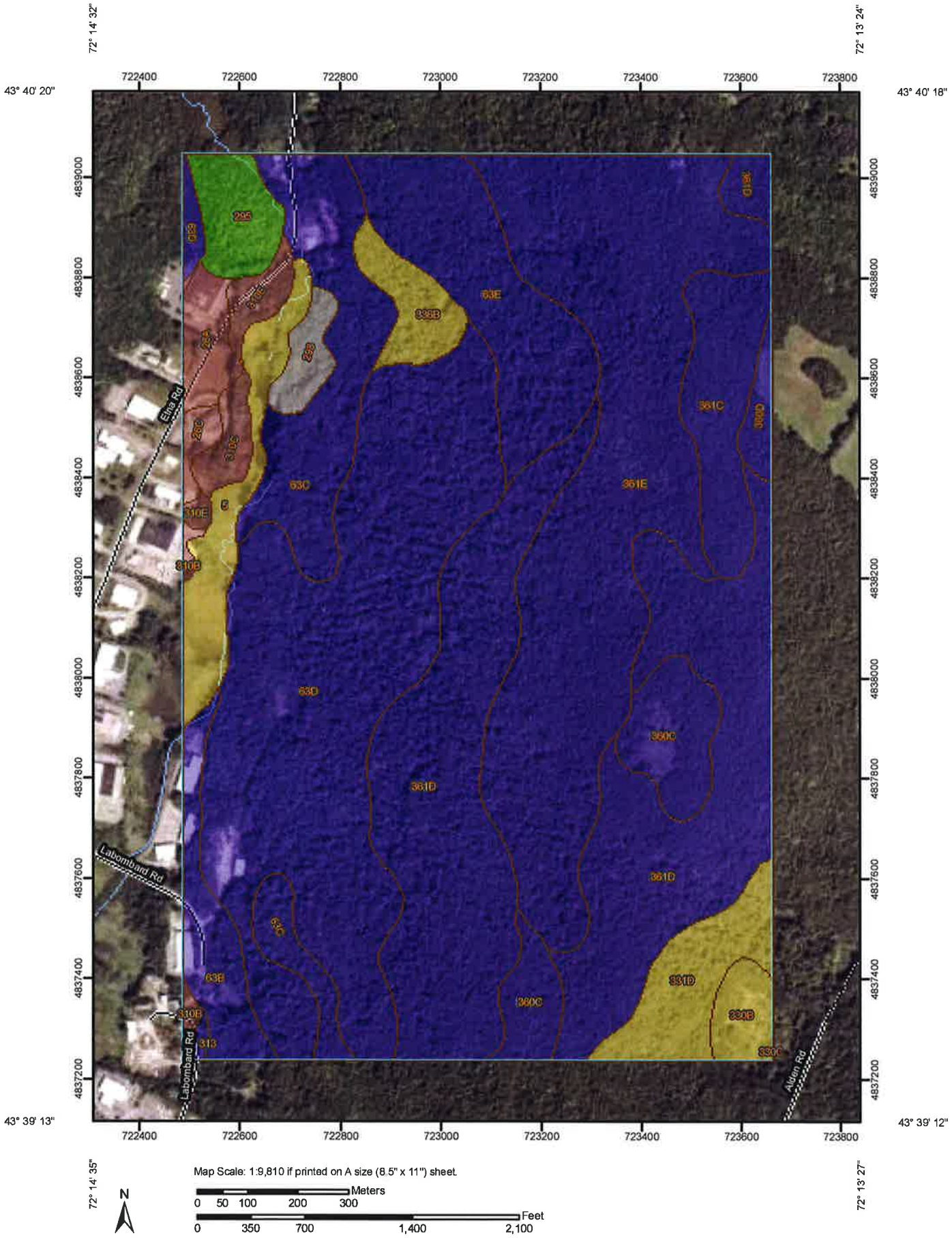
This property contains 0.000 acres of land mainly classified as 620 with a(n) N/A style building, built about N/A , having N/A exterior and N/A roof cover, with N/A unit(s), 0 room(s), 0 bedroom(s), 0 bath(s), 0 half bath(s).

## Property Images




Disclaimer: This information is believed to be correct but is subject to change and is not warranteed.

# C. USDA SOIL MAP


72° 14' 32"
72° 13' 24"
43° 40' 20"
43° 40' 18"
722400
722600
722800
723000
723200
723400
723600
723800
4839000
4838800
4838600
4838400
4838200
4838000
4837800
4837600
4837400
4837200
295
63B
63E
338B
361C
361D
63C
361E
310E
310B
63D
360C
361D
63C
63B
330B
313
330D
330B
330C
Elna Rd
Labombard Rd
Labombard Rd
Alden Rd
43° 39' 13"
43° 39' 12"
72° 14' 35"
72° 13' 27"
Map Scale: 1:9,810 if printed on A size (8.5" x 11") sheet.
N
Meters
0 50 100 200 300
Feet
0 350 700 1,400 2,100

## MAP LEGEND

**Area of Interest (AOI)**

- Area of Interest (AOI)

**Soils**

- Soil Map Units

**Soil Ratings**

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Political Features**

- Cities

**Water Features**

- Oceans
- Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

## MAP INFORMATION

Map Scale: 1:9,810 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 18N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Grafton County, New Hampshire
Survey Area Data: Version 13, Oct 23, 2009

Date(s) aerial images were photographed: 8/24/2003; 9/7/2003

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Hydrologic Soil Group

| Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire | | | | |
|---|---|---|---|---|
| **Map unit symbol** | **Map unit name** | **Rating** | **Acres in AOI** | **Percent of AOI** |
| 5 | Rippowam fine sandy loam | C | 14.4 | 2.7% |
| 26A | Windsor loamy fine sand, 0 to 3 percent slopes | A | 6.4 | 1.2% |
| 26C | Windsor loamy fine sand, 8 to 15 percent slopes | A | 2.2 | 0.4% |
| 63B | Charlton fine sandy loam, 3 to 8 percent slopes, very stony | B | 12.7 | 2.4% |
| 63C | Charlton fine sandy loam, 8 to 15 percent slopes, very stony | B | 35.0 | 6.6% |
| 63D | Charlton fine sandy loam, 15 to 25 percent slopes, very stony | B | 109.8 | 20.9% |
| 63E | Charlton fine sandy loam, 25 to 35 percent slopes, very stony | B | 31.4 | 6.0% |
| 295 | Greenwood mucky peat | A/D | 8.8 | 1.7% |
| 298 | Pits, gravel | | 4.6 | 0.9% |
| 310B | Quonset loamy sand, 3 to 8 percent slopes | A | 1.2 | 0.2% |
| 310C | Quonset loamy sand, 8 to 15 percent slopes | A | 4.0 | 0.8% |
| 310E | Quonset loamy sand, 15 to 60 percent slopes | A | 4.4 | 0.8% |
| 313 | Deerfield fine sandy loam | B | 0.8 | 0.2% |
| 330B | Bernardston silt loam, 3 to 8 percent slopes | C | 5.6 | 1.1% |
| 330C | Bernardston silt loam, 8 to 15 percent slopes | C | 0.0 | 0.0% |
| 331D | Bernardston silt loam, 15 to 25 percent slopes, very stony | C | 15.1 | 2.9% |
| 336B | Pittstown loam, 3 to 8 percent slopes, very stony | C | 8.0 | 1.5% |
| 360C | Cardigan-Kearsarge complex, 8 to 15 percent slopes | B | 17.7 | 3.4% |
| 360D | Cardigan-Kearsarge complex, 15 to 25 percent slopes | B | 3.5 | 0.7% |
| 361C | Cardigan-Kearsarge-Rock outcrop complex, 8 to 15 percent slopes | B | 18.2 | 3.5% |
| 361D | Cardigan-Kearsarge-Rock outcrop complex, 15 to 25 percent slopes | B | 119.4 | 22.7% |
| 361E | Cardigan-Kearsarge-Rock outcrop complex, 25 to 60 percent slopes | B | 103.1 | 19.6% |
| **Totals for Area of Interest** | | | **526.5** | **100.0%** |

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* *None Specified*

*Tie-break Rule:* Lower

# D. TABLES

**TABLE 1**
**SUMMARY OF OWNERSHIP HISTORY**
**MAP 26, LOT 17 SITE**
**ETNA ROAD**
**LEBANON, NEW HAMPSHIRE**

| TO | FROM | DATE | BOOK/PAGE |
|---|---|---|---|
| JAMES A. BROWNING | TRUSTEES OF DARTMOUTH COLLEGE | 12/20/1984 | 1529/968 |
| GERARD AND GLORIA CHALOUX | JAMES A. BROWNING | 7/13/1972 | 1166/248 |
| ARMOND J. ALLARD | GERARD AND GLORIA CHALOUX | 7/8/1959 | 929/411 |
| CHARLES A. LABOMBARD | ARMOND J. ALLARD | 4/11/1947 | 749/335 |
| NELLIE A. HALL | CHARLES A. LABOMBARD | 11/10/1920 | 560/388 |

**TABLE 2**
**SUMMARY OF NHDES SITES**
**MAP 26, LOT 17 SITE**
**ETNA ROAD**
**LEBANON, NEW HAMPSHIRE**

| SITE ID | SITE NAME | SITE LOCATION | SITE STATUS |
|---|---|---|---|
| **HAZARDOUS WASTE GENERATORS** | | | |
| NHD510182421 | DARTMOUTH TRANSPORTATION CO. INC. | 90 ETNA ROAD | ACTIVE |
| NHD510156763 | DIGITAL MASK | 187 STEVENS ROAD | ACTIVE |
| NHD510163801 | FEDEX | 41 NORTH LABOMBARD ROAD | ACTIVE |
| NHD073998106 | FUJIFILM DIMATIX INC. | 101 AND 109 ETNA ROAD | ACTIVE |
| NHD510189160 | HYPERTHERM INC. | 82 ETNA ROAD | ACTIVE |
| NHD510175268 | NEW ENGLAND INDUSTRIES | 100 ETNA ROAD | DECLASSIFIED |
| NHD982199002 | NEW HAMPSHIRE INDUSTRIES, INC. | 68 ETNA ROAD | INACTIVE |
| NHD042765305 | NEW JERSEY MACHINE, INC. | 56 ETNA ROAD | ACTIVE |
| NHD500020144 | NH DOT DISTRICT 2 | 138 ETNA ROAD | ACTIVE |
| NHD071939508 | ROCKWELL AUTOMATION, INC. | 109 ETNA ROAD | INACTIVE |
| NHD510119431 | SSC AUTO | 25 LABOMBARD ROAD | INACTIVE |
| NHD986470383 | UNIFIRST CORP. | 192 ETNA ROAD | INACTIVE |
| NHD085584795 | VERAX CORP. | ETNA ROAD | INACTIVE |
| **AIR STATIONARY SOURCE** | | | |
| 3300900040 | NEW HAMPSHIRE INDUSTRIES INC. | 68 ETNA ROAD | ACTIVE |
| **AST FACILITIES** | | | |
| 104 | SPECTRA, INC. | 101 ETNA ROAD | 1 ACTIVE AST |
| **NPDES OUTFALL** | | | |
| 21822 | MPB CORPORATION - NH INDUSTRIES | RIX BROOK | INACTIVE |
| **UST FACILITIES** | | | |
| 115366 | DARTMOUTH TRANSPORTATION CTR. | 90 ETNA ROAD | 1 ACTIVE UST |
| 110011 | SPECTRA, INC. | 101 ETNA ROAD | INACTIVE |
| 110504 | UNIFIRST CORP. | 125 ETNA ROAD | 1 ACTIVE UST |
| **RIRS SITES** | | | |
| 199204007 | BOND OPTICS | ETNA RD. | ACTIVE HAZWASTE, CLOSED UIC |
| 200303068 | DARTMOUTH HITCHCOCK MEDICAL CENTER | 52 NORTH LOBOMBARD ROAD | CLOSED IRSPILL, SPILL/RLS |
| 200701052 | HYPERTHERM, INC. | 100 ETNA ROAD | CLOSED OPUF |
| 199312042 | NEW JERSEY MACHINE, INC. | 56 ETNA ROAD | CLOSED LUST |
| 199703040 | NHDOT-DISTRICT 2, PS#207-LEBANON | ETNA ROAD | CLOSED UIC |
| 198606022 | VERIZON GARAGE | 92 ETNA ROAD | ACTIVE ETHER, CLOSED SPILL/RLS |

**TABLE 3**
**SUMMARY OF ECHO SITES**
**MAP 26, LOT 17 SITE**
**ETNA ROAD**
**LEBANON, NEW HAMPSHIRE**

| SITE ID | PROGRAM | SITE NAME | SITE LOCATION |
|---|---|---|---|
| NHD085586501 | RCRA | BOND OPTICS | 76 ETNA ROAD |
| NHD510163801 | RCRA | FEDEX | 41 NORTH LABOMBARD STREET |
| NHD073998106 | RCRA | FUJIFILM DIMATIX, INC. | 101 & 109 ETNA ROAD |
| NHD510191489 | RCRA | FUJIFILM DIMATIX, INC. | 56 ETNA ROAD |
| NHD040248254 | RCRA | HYPERTHERM, INC. | 88 ETNA ROAD |
| NHD510150576 | RCRA | HYPERTHERM, INC. | 100 ETNA ROAD |
| NHD510189160 | RCRA | | |
| 03766HYPRT1ETNA | TRI | | |
| NHD510172752 | RCRA | LEBANON MOTOR TOYS | 63 EVANS DRIVE |
| NHD500004726 | RCRA | MCKIBBIN, A.D. DR. | 206 HEATER ROAD |
| NHD 054003686 | RCRA | MILLER AUTO CO. | 13 LABOMBARD ROAD |
| NHD037707361 | RCRA | MILLER BUICK PONTIAC GMC | 51 EVANS ROAD |
| NHD510167109 | RCRA | MILLER NISSAN JEEP VOLVO | 145 ROUTE 120 |
| NHP250066 | PCS | NEW ENGLAND INDUSTRIES | 85 ETNA ROAD |
| NHD986471894 | RCRA | | |
| 3300900040 | AFS | NEW HAMPSHIRE INDUSTRIES | 68 ETNA ROAD |
| NHD982199002 | RCRA | | |
| 03766NWHMP68ETN | TRI | | |
| NHD986486298 | RCRA | NH ARMY NATIONAL GUARD | 180 HEATER ROAD |
| NHD500020144 | RCRA | NH DOT DISTRICT 2 | 138 ETNA ROAD |
| NHD510198237 | RCRA | NORTHEAST WASTE TRANSFER STATION | 40 NORTH LABOMBARD ROAD |
| NHD500023619 | RCRA | SPAULDING DON SERVICES | 98 HEATER ROAD |
| NHD510194830 | RCRA | THOMAS G. SCHELL | 31 OLD ETNA ROAD |
| 3300900088 | AFS | UNIFIRST CORP. | 192 ETNA ROAD |
| NHD986470383 | RCRA | | |

# E. PHOTOGRAPHS

Photograph 1: Typical view of the wooded portions of the Site.

Photograph 2: Typical view of a beaver pond on the western-central portion of the Site.

Photograph 3: View of a metal pipe on the western-central portion of the Site.

Photograph 4: View of a large deteriorated culvert on the western-central portion of the Site.

Photograph 5: View of the refrigerator and a paint can on the western-central portion of the Site.

Photograph 6: View of solid waste debris on the western-central portion of the Site.

Photograph 7: View of tires and solid waste on the western-central portion of the Site.

Photograph 8: View of vehicle parts on the western-central portion of the Site.

# F. CONSULTANT'S QUALIFICATIONS

## HOLLY A. LEWIS-POULIN, E.I.T.

Eff. 2-10

**EDUCATION:**

Worcester Polytechnic Institute
M.S. Environmental Engineering, May 2007 - Current

Concordia University
B.Sc. in Biochemistry, 2006

**PROFESSIONAL AFFILIATIONS:**

Student Member, American Society of Civil Engineers'
Certified Engineer in Training in New Hampshire

**PROFESSIONAL HISTORY:**

July 2006 - Present

Environmental Engineer with Pathways Consulting, LLC, Lebanon, NH. Responsible for assisting the company in activities relating to environmental projects. Perform Phase I and Phase II Environmental Site Assessments, underground storage tank closures, environmental site investigations, and monitoring and reporting for groundwater management sites.

September 2004 - May 2006

Laboratory Technician for Dr. Elaine Newman at Concordia University. Responsible for preparation and sterilization of all laboratory media and equipment in a microbiology research laboratory.

**SHORT COURSES:**

40-Hour Hazardous Waste Operations and Emergency Response (29CFR 1910.120) Certification, 2006

8-Hour Annual Refresher Training for Hazardous Waste Operations and Emergency Response – 2007-2009

10-Hour Occupational Safety and Health Training Course in Construction Safety and Health, 2008

**A. DANA AREY** Eff. 2-10

**EDUCATION:** Vermont Technical College,
A.S. in Civil Engineering, 1976

**PROFESSIONAL AFFILIATIONS:**
New Hampshire Grade IV Wastewater Operator
New Hampshire Grade III Water Operator
New Hampshire Grade I Water Distribution System Operator
Vermont Grade III Water Operator
New Hampshire Certified Asbestos Inspector
Member, New Hampshire Wastewater Operator's Association
Member, New Hampshire Waterworks Association
Member, American Water Works Association

**PROFESSIONAL HISTORY:**

January 2001 - Present

Vice President/Director of Environmental Services with Pathways Consulting, LLC, Lebanon, NH. Responsible for company activities relating to the design and operation of water supply and wastewater treatment facilities. Responsible for asbestos inspections, Phase I and Phase II environmental site assessments, environmental site investigations, underground storage tank closures, remedial action plans and implementation, and underground storage tank and aboveground storage tank design. Provide consulting services relating to industrial waste pre-treatment. Assist with design and permitting of residential, commercial, and industrial developments.

August 1989 - December 2000

Project Engineer with T&M Associates, Inc., Lebanon, NH. Responsible for company activities relating to design and operation of water supply and wastewater treatment facilities. Assisted in environmental site assessments, environmental site investigations, underground storage tank closures, and remedial action plans and implementation. Provided consulting services relating to industrial waste pre-treatment and discharge.

October 1986 - August 1989

Public Utilities Director for the City of Lebanon, NH. Responsible for operation and maintenance of the City's wastewater treatment facility and wastewater collection system, 4.0 mgd water treatment facility, four water storage reservoirs, and the water distribution system. Responsibilities also included supervision of 22 employees, budget preparation, and planning.

May 1982 - October 1986

Superintendent of Wastewater Department for the City of Lebanon, NH. Responsible for overseeing operation and maintenance of the wastewater treatment facility and wastewater collection system. Responsibilities also included budget preparation, and planning and expansion of the wastewater collection system and treatment plant.

October 1980 - May 1982

Chief Operator, City of Lebanon, NH Wastewater Treatment Plant. Responsible for day-to-day operation of wastewater treatment facility, including supervision of plant personnel, process control, record keeping, and permit reporting.

October 1976 - October 1980

Operator I, City of Lebanon, NH Wastewater Treatment Plant. Responsible for day-to-day operation of wastewater treatment facility, including running equipment, laboratory analysis, and record keeping.

**OTHER ACTIVITIES:**

Expert Witness: Daniel Plourde et. al. v. Walter Gladstone et. al., Grafton County Superior Court Docket No. 99-E-108, July 18, 2000

**SHORT COURSES:**

40-Hour Hazardous Waste Site Course per 29CFR 1910.120, 1992
8-Hour Hazardous Waste Site Course yearly refreshers - 1993-2009
24-Hour Asbestos Site Inspector Training - 2004, yearly recertification 2005-2009.

# G. LIMITATIONS AND DECLARATION

## LIMITATIONS

1. Review of available information regarding this Site was done so for the purpose of identifying the likelihood that hazardous wastes or oils exist beneath the Site. The findings of this review are presented in this report. Based on this review, analytical tests were not completed for the purpose of revealing a potential problem, as that was not considered warranted at the time.

2. The evaluation presented in this report has been completed without chemical test data. Should chemical analyses become available, these data should be reviewed by Pathways Consulting, LLC and the conclusions presented herein may be modified. It should be noted that variations in the types of contaminants, their concentrations, and their direction of flow would occur due to water table fluctuations and alteration of disposal practices, as well as other factors. As such, it cannot be stated with absolute certainty whether or not a hazardous waste contamination problem exists or will exist in the future at the Site.

3. This study and report have been prepared for the exclusive use of Jay Campion solely as an environmental evaluation of the Site. Except for the purpose of satisfying federal, state, and local regulations, this report and the findings contained herein, shall not, in whole or in part, be disseminated or conveyed to any other party, nor used by any other party, in whole or in part, without prior written consent of Pathways Consulting, LLC. This report has been prepared in accordance with generally accepted environmental assessment practices. No other warranty, expressed or implied, is made.

## DECLARATION

We declare that, to the best of our professional knowledge and belief, we meet the definition of "Environmental Professional" as defined in § 312.10 of 40CFR312, and we have specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. We have developed and performed the appropriate inquiries in conformance with the standards and practices set forth in 40CFR312.