# 2.0 DESCRIPTION OF PROPOSED ACTION

## 2.1 EXISTING KEYSPAN LNG STORAGE FACILITY

The proposed KeySpan LNG plant modifications would be conducted at the existing KeySpan LNG storage facility, which has been in operation for 30 years. The facility is located in an industrial waterfront area known as Fields Point, within the City of Providence. The site is on property that KeySpan LNG leases from New England Gas Company (NEGC). The existing plant includes a 95,390 $m^3$ (600,000 barrel) LNG storage tank, a containment system, LNG processing equipment and piping, administrative and support buildings, a truck loading and unloading station, and ancillary equipment. The plant also includes an unloading dock on the Providence River about 300 feet east of the storage tank and was originally designed to receive LNG by barge. This dock has not been used to receive barge deliveries of LNG since the 1970s, but a portion of the dock is currently being used by the neighboring St. Lawrence Cement to unload cement ships and barges. The existing storage tank is a vertical, cylindrical, double-wall, single-roof tank with a suspended insulation deck. The inner tank material is 9 percent nickel steel and the outer shell is carbon steel. The inner and outer diameters are 184 feet and 190 feet, respectively. The maximum liquid level is 127.7 feet, and the inner and outer shell heights are 132.3 feet and 138.5 feet, respectively. The overall height of the tank is 173 feet. The space between the inner and outer tanks is filled with perlite insulation. The outer tank is designed for an internal pressure of 1.5 pounds per square inch gauge (psig). No modifications to the existing storage tank are proposed as part of the KeySpan LNG Project.

The existing dual truck transfer station can accommodate the unloading or loading of LNG at a rate of 350 gallons per minute (gpm) per truck and can handle up to 24 trucks per day. The station includes a scale system that automatically shuts off flow at a predetermined weight. No changes are proposed to the truck transfer station.

Currently, the KeySpan LNG facility provides storage service to three customers that transport LNG to the plant by truck and take redelivery of LNG either by truck or in vaporized form for use primarily as a winter peaking supply. An existing interconnection between the LNG facility and NEGC allows for the delivery of up to 150 MMcfd of natural gas that is generated as BOG during facility operations.

Prior to the development of the LNG facility, the site and adjacent NEGC-owned properties housed a manufactured gas plant and were used for the production, generation, and transmission of natural gas or manufactured gas for over 100 years. Site investigations of the properties identified contaminated soils in an area to the north of the existing LNG truck loading and unloading station. This area has been remediated by NEGC. A portion of the proposed new process equipment would be located within this remediated area.

An aerial photograph showing the existing site conditions is provided on figure 2.1-1. A general project location map is provided on figure 2.1-2.

Figure 2.1-1

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Figure 2.1-2

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## 2.2 PROPOSED PROJECT

### 2.2.1 LNG Facilities

The KeySpan LNG Project would involve the installation of a new ship berth in the Providence River to allow marine ship deliveries of LNG. Additional modifications to the existing facility would include the installation of gas blowers to return vapor to the ship, a new two-stage pumping system, BOG compressors, a BOG condenser, and a new indirect fired vaporizer system that would increase the plant's vaporization capacity from 150 MMcfd to 525 MMcfd. A layout of the proposed facilities is provided on figure 2.2.1-1.

#### 2.2.1.1 Marine Facilities and LNG Unloading Facilities

The new ship berth would be located within the Fox Point Reach of the Providence River approximately 70 feet east of the existing bulkhead at the northeastern side of the LNG facility site (see figure 2.2.1-2). The single berth would include six mooring dolphins, four breasting dolphins, fender systems, quick release hooks, and capstans. An approximately 4,800-square-foot ($ft^2$) unloading platform would support the unloading and vapor arms, pipeline, and fire protection equipment. A 100-foot-long trestle would provide structural support for the cryogenic piping and utility lines between the shore and the unloading platform. The berth would include walkways for personnel access and a gangway between the LNG carrier and the unloading platform. A total of 33 piles would be driven into the river bottom to support the breasting and mooring dolphins, unloading platform, and a cement unloading pier to be used by the cement company on the adjoining property, which would share the proposed LNG berthing facility. A jetty control building, with an adjacent emergency generator, would be constructed on shore in the vicinity of the unloading platform to facilitate the monitoring of ship unloading operations. The new berth would be capable of accommodating LNG ships from 71,500 to 145,000 $m^3$ in capacity, and would be capable of mooring and offloading one LNG ship at a time. KeySpan LNG anticipates that approximately 50 to 60 ships per year would offload LNG at the terminal.

We received a scoping comment requesting an explanation of why the ship berth would be designed to accommodate LNG ships that have greater capacity than the existing storage tank. KeySpan LNG has stated that the design is intended to allow for maximum flexibility for berthing of most LNG vessels that operate in the Atlantic Basin and to accommodate the range of vessels in BG LNG's current fleet. If an LNG ship arrives carrying a larger cargo than the capacity of KeySpan LNG's storage tank, the vessel would carry out a partial discharge at the marine terminal. Alternatively, vessels might arrive with only partial cargos of a size appropriate to the available space in the LNG storage tank. Although KeySpan LNG and BG LNG are continuing to analyze the most appropriate and efficient method of delivery, they currently anticipate that the LNG ships would leave their supply sources fully loaded and unload partial cargos at import terminals served by BG LNG, including Elba Island, Georgia and Lake Charles, Louisiana as well as at the proposed KeySpan LNG terminal.

Figure 2.2.1-1

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Figure 2.2.1-2

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Due in part to potential impacts of LNG sloshing inside cargo tanks, certain restrictions apply to the carrying of partial cargos by LNG ships depending on the ship's design. Partial loads are especially of concern in ships with membrane cargo tank designs, particularly those with older membrane designs. Newer membrane cargo tanks are beginning to be designed to accommodate partial loading. KeySpan LNG notes that no such restrictions apply to LNG vessels with the moss spherical or Self Supported Prismatic type B cargo tank designs, and that some class societies that govern the standards for LNG vessels are allowing greater flexibility in the allowable range of liquid levels maintained at sea for ships using the membrane cargo tank design. Important issues related to the unloading of partial cargos are maintenance of the appropriate liquid operating heights within the cargo tanks and maintenance of the vessel hull girder within its design parameters for hull stress and stability. The ballasting sequence must be balanced with the cargo offloading sequence to maintain a relatively constant draft. To address these issues and allow for a safe and reliable discharge operation, the Chief Officer of the LNG vessel would be required to prepare and implement a Cargo Discharge Plan, which would include but not be limited to the quantity of LNG to be discharged, the discharge sequence, the amount of cargo in each of the ship's cargo tanks that would be discharged, and a ballasting plan. At present, the only two LNG vessels owned or under charter by BG LNG that could offload their full loads at the KeySpan facility are the *Methane Arctic* and *Methane Polar*. Both these vessels are of membrane design and are the oldest vessels in the fleet. Use of larger LNG vessels unloading partial cargos would be restricted to those with cargo tanks designed to accommodate the effects of sloshing.

The LNG would be transferred from the ship to the existing storage tank using the ship's pumps. The LNG would be unloaded from the ship through two 16-inch-diameter unloading arms and transferred from the pier to the storage tank through a 24-inch-diameter liquid unloading line that would be connected to the existing 30-inch-diameter tank fill nozzle. BOG blowers would return part of the vapor generated during the unloading process to the ship through one 8-inch-diameter line and a 12-inch-diameter vapor return arm. During times when a ship is not being unloaded, a 3-inch-diameter cooling line would be used to recirculate LNG from the tank to the main header at the end of the pier, after which the LNG would be returned to the tank through the 24-inch-diameter liquid unloading line.

KeySpan LNG would design the marine facilities in accordance with applicable codes and standards, including but not limited to the Waterfront Facilities Handling Liquefied Natural Gas (33 CFR 127), NFPA 59A, Society of International Gas Tanker and Terminal Operators (SIGGTO), Oil Companies International Marine Forum (OCIMF), the American Petroleum Institute (API), and the American Society of Civil Engineers.

#### 2.2.1.2 Vapor Handling

During normal operation, ambient heat input into the LNG storage tank and piping causes small amounts of LNG to vaporize. This LNG vapor is commonly referred to as BOG. Boil off of LNG is also caused by other factors, such as barometric pressure changes, heat input from the LNG pumps, and ambient heat input during LNG truck unloading operations. The existing LNG plant includes a BOG compression system that accommodates BOG generated from the existing facilities and current operations. No changes are proposed for the existing BOG compression system, which would continue to operate as it currently does. The storage tank over-pressure protection would continue to be provided by the existing pressure safety relief valves located at the top of the LNG tank.

As part of the project, a new BOG vapor handling system would be installed to accommodate the vapor generated during ship unloading. During unloading, vapor is generated as a result of ambient heat transfer to the ship, tanks, equipment, and piping, in combination with the heat production from the ship pumps and potential pressure changes during the unloading process. The BOG handling system would consist of two vapor return blowers, four BOG compressors, and a BOG condenser. The BOG blowers

would return a portion of the vapor generated during ship unloading back to the ship through the 8-inch-diameter line and the 12-inch-diameter vapor return arm to compensate for the volume of liquid pumped out of the ship into the LNG storage tank. The remaining vapor would flow to the BOG compressors. After being pressurized, the vapor would be sent to the BOG condenser and recondensed into liquid. Cooling would result from contact with subcooled LNG from the low-pressure sendout pumps. Performance of the condenser during unloading would be contingent on maintaining a minimum LNG sendout flow of approximately 125 MMcfd to cool and recondense the BOG. If this minimum flow were not available, the unloading rate would need to be decreased to avoid venting the BOG into the atmosphere.

#### 2.2.1.3 LNG Sendout System

The proposed LNG sendout system, which would supplement the existing vaporization system, would consist of a two-stage LNG pumping system and an indirect fired vaporizer system. The proposed system would increase the peak sendout capacity of the LNG plant from its current capacity of 150 MMcfd to 525 MMcfd (an increase of 375 MMcfd). KeySpan LNG anticipates that the upgraded plant would operate at a relatively constant sendout rate of 250 MMcfd during the 120-day winter period and at an average sendout rate of 125 MMcfd during the remainder of the year.

Three new low-pressure externally mounted (ex-tank) pumps, one of which would be a spare pump, would be installed at the LNG storage tank next to the existing ex-tank pumps. In addition to providing the first stage of sendout pumping, these pumps would also supply the recirculation flow necessary to cool down the LNG ship unloading line and could be used to circulate LNG within the storage tank. As it is discharged from the low-pressure pumps, the LNG would flow to the second stage of the pumping system, which would consist of three high-pressure pumps, one of which would be a spare pump. The high-pressure pumps would boost the LNG pressure to approximately 950 psig before going to the vaporizers.

The LNG would be vaporized using a closed loop heat exchanger system consisting of two vertical shell and tube heat exchangers. This process would involve warming the LNG and converting it back to a gaseous phase. Heat for the process would be provided by a 200 degrees Fahrenheit (°F) water/ethylene-glycol (WEG) mixture circulating through the heat exchanger. The WEG would be heated by gas-fired heaters. KeySpan LNG proposes to install five heaters, one of which would be a spare heater. The outlet gas from the vaporization would then be metered, odorized, and sent out to the pipeline at a pressure of 900 psig and a minimum temperature of 40 °F.

A smaller third vaporizer and separate WEG system would be dedicated to provide cooling to the BOG compressors and vapor return blowers during ship unloading.

#### 2.2.1.4 Buildings and Control System

The project would include an approximately 1,500 $ft^2$ expansion of the existing Control/Administration Building and the addition of four new buildings. The new buildings would be:

- a BOG Compressor Building consisting of an approximately 5,600 $ft^2$ insulated metal building to house the new BOG compressors;
- a Heater Building consisting of an approximately 4,400 $ft^2$ insulated metal building to house the WEG heaters;

- a Motor Control Center (MCC) Building consisting of an approximately 800 $ft^2$ insulated metal building to house the MCC required for the new electrical equipment; and

- a Berth Operations Control Room consisting of an approximately 450 $ft^2$ insulated metal building located on-shore to house ship berth operations controls.

The original pneumatic control system was replaced and upgraded with a microprocessor-based control system in 1999. Operator interface stations were located in the original facility control building. As part of the proposed project, this system would be modified to include controls for the upgraded facilities.

### 2.2.2 LNG Ships

LNG could be shipped to the proposed marine terminal from a variety of sources around the world. KeySpan LNG currently anticipates that supply sources would primarily be Trinidad, Equatorial Guinea, Nigeria, and Egypt. Although LNG vessels and their operation are directly related to the use of the proposed import terminal, they are not subject to the section 3 authorization sought in this application.

The ships that transport LNG are specially designed and constructed to carry LNG for long distances. LNG ship construction is highly regulated and consists of a combination of conventional ship design and equipment, with specialized materials and systems designed to safely contain liquids stored at temperatures of -260 °F.

The following sections present a brief overview of the main design and safety features of a typical LNG ship that may transport LNG to the proposed terminal.

**Profile**

LNG ships have a distinctive appearance compared with other transport ships. An LNG ship has a high freeboard (i.e., that portion of the ship above water) because of the comparatively low density of the cargo. Because of the high freeboard, when compared with vessels such as an oil tanker, wind velocity can adversely affect the maneuverability of the ship, particularly at slow speed, such as during docking.

**Hull System**

All LNG ships are constructed with double hulls while most other liquid transport ships presently in use have single hull construction. Double hull construction increases the structural integrity of the hull system and provides protection for the cargo tanks in case of an accident. The space between the inner and outer hulls is used for water ballast. The *International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk* (Gas Tanker Code) and Coast Guard regulations require that LNG ships meet a Type IIG standard of subdivision, damage stability, and cargo tank location.

The Type IIG design ensures the LNG ship could withstand flooding of any two adjacent compartments without any adverse effect on the stability of the ship. Type IIG design also requires that the cargo tanks must be a minimum of 30 inches from the outer hull and a minimum distance above the bottom of the ship equal to the beam of the ship divided by 15; or 6.5 feet, whichever is less. This distance is intended to prevent damage to the cargo tanks in case of low energy type accidents that might occur in harbors and during docking. Most large LNG ships have a distance of 10 to 15 feet between the outer hull and cargo tank.

**Containment Systems**

The containment system on an LNG ship consists principally of the cargo tank (sometimes called a primary barrier), the secondary barrier, and insulation. The containment system also includes cargo monitoring and control and safety systems.

Three basic tank designs have been developed for LNG cargo containment: prismatic free-standing, spherical, and membrane. The earliest form of LNG containment is the prismatic free-standing tank. It consists of an aluminum alloy or 9 percent nickel steel self-supporting tank that is supported and restrained by the hull structure. Insulation consists of reinforced polyurethane foam on the bottom and the sides with fiberglass on the top. The spherical tank design, also known as the Moss Rosenberg design, uses an unstiffened, spherical, aluminum alloy tank (usually four to six tanks per ship) that is supported at its equator by a vertical cylindrical skirt, with the bottom of the skirt integrally welded to the ship's structure. This free-standing tank is insulated with multi-layer close-cell polyurethane panels. In the membrane containment system, the ship's hull constitutes the outer tank wall which is separated from an inner tank membrane by insulation. Two forms of membrane are commonly used: the Technigaz membrane using stainless steel and the Gas-Transport membrane using Invar. KeySpan LNG anticipates that most of the ships that would deliver LNG to the proposed marine terminal would be of the membrane design, although ships of the spherical tank design might also deliver to the facility.

LNG tankers are of the double-hulled design regardless of the containment system used. A double bottom and double sides are provided for the full length of the cargo area and arranged as ballast tanks, independent of the cargo tanks. The double-hulled design provides greatly increased reliability of cargo containment in the event of grounding and collisions. Further, the segregated ballast tanks prevent ballast water from mixing with any residue in the cargo tanks.

**Pressure/Temperature Control**

A basic goal of all LNG containment systems is to maintain the LNG cargo at or near atmospheric pressure at the boiling temperature of the LNG (about -260° F). This is accomplished using "auto-refrigeration," a phenomenon that results from the constant heat flow into the tank and the removal of the associated vapor. The vapor ranges from 0.25 to 0.15 percent (by volume) per day and is used to supplement the bunker fuel in the ship's boilers. As a result, LNG ships have reduced emissions when compared with conventional oil-fired ships.

**Ballast Tanks**

Sufficient ballast water capacity must be provided to permit the ship to return to the loading port safely under various sea conditions. LNG cargo tanks are not used as ballast tanks because these tanks must contain a minimal amount of LNG to remain at cryogenic temperatures. Consequently, LNG ships must be designed to provide adequate ballast capacity in other locations.

Ballast water tanks on LNG ships are arranged within the LNG ship's double hull. It is essential that ballast water not leak into the LNG containment system. To reduce the potential for leakage, the ballast tanks, cofferdams, and void spaces are typically coated to reduce corrosion. LNG ships are also periodically inspected to examine the coating and to renew it as necessary.

A ballast control system, which permits simultaneous ballasting during cargo transfer operations, is also incorporated into each LNG ship. This system allows the LNG ship to maintain a constant draft during all phases of its operation to enhance performance. Under normal operating conditions, ballast water would be taken onto the ship during LNG offloading at the marine terminal. A typical LNG ship

serving the KeySpan LNG facility would take on about 8 to 11 million gallons of ballast water during offloading operations. Ballast water would not be discharged during unloading operations or while ships are in transit in the Providence River or Narragansett Bay.

**Ship Safety Systems**

The LNG vessels used in this project must comply with all federal and international standards regarding LNG shipping. The manner of construction of the ships must meet the requirements of the Gas Tanker Code and must comply with the International Maritime Organization (IMO) and be validated by the flag states and classification societies. Crew training and operations must comply with the requirements of the IMO International Safety Code and the International Ship and Port Facilities Security Code. As such, ships that transport LNG to the project would be fitted with an array of cargo monitoring and control systems. These systems would automatically monitor key cargo parameters while the ship is at sea and during the unloading of LNG.

The system includes provisions for pressure monitoring and control, temperature monitoring of the cargo tanks and surrounding ballast tanks, emergency shutdown of cargo pumps and closing of critical valves, monitoring of tank cargo levels, and gas and fire detection.

The LNG ships that transport LNG to the proposed terminal would be fitted with navigation and communication systems including:

- automatic radar plotting aids;
- automatic identification system;
- LORAN-C receivers;
- echo depth finders; and
- satellite communications.

All LNG ships also have redundant, independent steering control systems that are operable from the bridge or steering gear room to maintain rudder movement in case of a steering system failure.

**Fire Protection**

All LNG ships arriving at the terminal would be constructed according to structural fire protection standards contained in the International Convention for the Safety of Life at Sea (SOLAS). This would be done under the review and approval procedures of the Coast Guard.

LNG ships using the terminal would also be fitted with active fire protection systems that meet or exceed design parameters in Coast Guard regulations and international standards, such as the Gas Tanker Code and SOLAS including:

- a water spray (deluge) system that covers the accommodation house and central room and all main cargo control valves;

- a traditional fire water system that provides water to fire monitors on deck and to fire stations found throughout the ship;

- a dry powder extinguishing system for LNG fires; and

- a carbon dioxide ($CO_2$) system for protecting the machinery, ballast pump room, emergency generators, cargo compressors, etc.

**Crew Qualifications and Training**

All officers and crews of the LNG ships using the terminal would comply with the International Convention Standards of Training, Certification and Watch Keeping for Seafarers. Key members of the crew must have specific training in the handling of LNG and the use of the safety equipment. Officers must receive simulator training in the handling of the ship and the cargo systems specific to the conditions at the project site. In addition, a Northeast Marine Pilot would board each ship at the mouth of Narragansett Bay, guide it through the federal navigation channel, and oversee the berthing of the ship. The Northeast Marine Pilots is an independent association of experienced pilots who are licensed by the State of Rhode Island to operate certain large vessels (e.g., commercial vessels engaged in foreign trade and coastwise vessels engaged in domestic trade) within Rhode Island ports and coastal waters. Under state and federal laws, LNG ships would be required to carry a licensed pilot during transits through Narragansett Bay and the Providence River navigation channel.

**Ship Sizes and Certifications**

BG LNG would be responsible for the shipment of LNG to the KeySpan LNG facility. For maximum flexibility, the proposed LNG ship berth and loading platform would be designed to safely berth LNG ships of both the membrane and Moss Rosenberg (spherical) type LNG cargo tanks with capacities from 71,500 $m^3$ to 145,000 $m^3$. BG LNG owns or controls the following size and type of LNG ships, which might be used to deliver LNG to the proposed facility:

- 71,500 $m^3$ capacity membrane type;
- 88,000 $m^3$ capacity Moss Rosenberg type;
- 125,000 $m^3$ capacity Moss Rosenberg type;
- 138,300 $m^3$ capacity membrane type; and
- 145,000 $m^3$ capacity membrane type.

The lengths of these ships would range from about 800 to 950 feet. The beams (widths) of the LNG ships would range from about 114 to 140 feet, and the loaded drafts of the ships would range from 35 to 38 feet. Ships using the terminal would have to comply with the Coast Guard regulations for LNG ships. This compliance is demonstrated by the operator of the LNG ship having proper certificates authorizing the transport of LNG as follows:

- United States Flag LNG Ship - The Coast Guard Certificate of Inspection must be valid and endorsed for the ship to transport LNG (46 CFR 154, 1979).

- Foreign Flag LNG Ship - The ship must have a valid Certificate of Compliance issued by the Coast Guard. The certificate is issued after the ship has proved that it complies with the Coast Guard regulations and after it has been satisfactorily inspected by a Coast Guard Marine Safety Office (46 CFR 154, 1979).

Both U.S. and foreign flagships must be annually inspected by the Coast Guard and the flag state. A Coast Guard Certificate of Compliance is required to be renewed every 2 years for foreign vessels. Coast Guard officers from the Providence Marine Safety Office would board the LNG ships arriving at the mouth of Narragansett Bay to perform a security inspection and to assure compliance with safety standards.

### 2.2.3 Pipeline Facilities

Algonquin proposes to construct a new natural gas pipeline to connect the KeySpan LNG facility with Algonquin's existing G-12 Lateral. This connection to Algonquin's G-system would integrate the KeySpan LNG facility into the interstate natural gas pipeline system. Figure 2.2.3-1 shows the location of the proposed pipeline route. The route begins at the KeySpan LNG facility on Terminal Road in Providence. A meter station and pig launcher would be constructed at this receipt point (milepost (MP) 0.0). In its comments on the draft EIS, Algonquin provided revised alignment sheets showing a minor adjustment to the meter station location to accommodate the proposed LNG terminal design and a minor realignment at MP 1.36 to accommodate the Rhode Island Department of Transportation's (RIDOT's) proposed Interstate 95 realignment. As currently proposed, the route proceeds southwest across the KeySpan LNG facility for approximately 370 feet and continues across the abutting industrial NEGC property for approximately 1,160 feet. At this point, the route turns to the northwest and follows Allens Avenue (State Route 1A) for about 5,715 feet to the Henderson Street intersection. At the intersection, the route turns and proceeds east along Henderson Street for approximately 370 feet. It then leaves the street and proceeds north for about 40 feet to MP 1.44 where it would be tied into the existing Algonquin pipeline system. A 24-inch tap valve and pig receiver would be constructed at this tie-in location, which is on property owned by U.S. Generating New England, Inc. (U.S. Generating). Approximately 1.14 miles, or 79 percent of the route, would be constructed within the Allens Avenue and Henderson Street road corridors. The remaining 0.3 mile would be constructed on private property owned or leased by KeySpan LNG, NEGC, and U.S. Generating.

## 2.3 LAND REQUIREMENTS

### 2.3.1 LNG Facilities

The proposed onshore upgrades to the KeySpan LNG facility would be installed within the existing 17.5-acre plant site. The site is owned by NEGC and leased by KeySpan LNG. All of the permanent on-land facilities would be within the area leased by KeySpan LNG except for three mooring dolphins that would be constructed on an adjacent parcel leased from NEGC by St. Lawrence Cement. The pier and other marine facilities would be constructed within a 3.5-acre area of the Providence River adjacent to the plant site. Up to an additional 2.8 acres of land would be used for temporary facilities to support construction, such as offices, lunchrooms, wash facilities, parking, staging/laydown areas, and utilities. Most of the 2.8 acres would be located on property outside but adjacent to the plant site. Marine construction would be conducted from a work barge, approximately 40 feet by 140 feet by 10 feet, which would be anchored temporarily in the ship berth area. Access to the site would be provided by existing public and private roads. Within the existing LNG site, the LNG truck by-pass at the truck station would be relocated closer to the station, and additional occasional-use roads would be constructed to provide access to the new equipment.

Following construction, the total footprint of the new process areas and marine facilities would be approximately 5.5 acres. About half of the total footprint is for the new process areas and about half is for the ship unloading facilities (i.e., unloading platform, trestle, breasting dolphins, mooring dolphins, connecting walkways, jetty control building, and cement unloading pier). Additional information on the land use at the proposed LNG facilities is provided in section 4.8.1.1.

Figure 2.2.3-1

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### 2.3.2 Pipeline Facilities

Construction of the pipeline facilities would disturb a total of about 21 acres of land consisting of 12.4 acres of pipeline construction right-of-way, 0.3 acre of temporary extra workspace, 7.7 acres of staging areas, and 0.6 acre for construction of the aboveground facilities.

Approximately 2.0 acres of the 21 acres used for construction would be required for operation of the project. Of this total, 1.7 acres would be for the permanent pipeline right-of-way and 0.3 acre would be for the aboveground facilities. The remaining 19 acres would be allowed to revert to its former use.

During construction, Algonquin would gain access to the project area using existing public and private roads. For permanent access to the meter station during operations, Algonquin would construct a 100-foot long by 12-foot wide (<0.1 acre) paved driveway from the existing plant road to the meter station.

Table 2.3.2-1 summarizes the land requirements for the pipeline facilities.

TABLE 2.3.2-1

**Summary of Land Requirements Associated with Construction and Operation of the Pipeline Facilities for the KeySpan LNG Project**

| Facility | Land Affected During Construction (acres) | Land Affected During Operation (acres) |
|---|---|---|
| Pipeline Right-of-Way [a/] | 12.4 | 1.7 |
| Additional Temporary Workspace | 0.3 | 0.0 |
| Staging Areas | 7.7 | 0.0 |
| Aboveground Facilities | 0.6 | 0.3 [b/] |
| Access Roads [c/] | <0.1 | <0.1 |
| Pipeline Facilities Total | 21.0 | 2.0 |

a/ Construction impact is based on a maximum of a 75-foot-wide construction right-of-way between MPs 0.0 and 1.28, and various reduced right-of-widths between MPs 1.28 and 1.44 as measured from alignment sheets. Operation acreage is based on a 50-foot-wide permanent right-of-way between MPs 0.0 and 0.28. In-street portions of the route are not included because street installation would be by permit, and no easement would be retained by Algonquin.

b/ Does not include approximately 0.08 acre of the permanent tap valve site, which would overlap with the existing permanent easement for the G-12 lateral pipeline.

c/ Existing roads would be used for access during construction. A new permanent access road would be constructed for permanent access to the new meter station.

Algonquin would use up to a 75-foot-wide construction right-of-way to build the pipeline, but anticipates using a narrower construction right-of-way within Allens Avenue and Henderson Street in order to remain within the existing road corridors. Additional construction workspace for the pipeline would include one additional temporary workspace (ATWS) at approximate MP 0.3 and four contractor staging areas located adjacent to the route. One of the contractor staging areas would be on NEGC property west of and adjacent to the KeySpan LNG facility at approximate MP 0.1. The three other contractor staging areas would be adjacent to Allens Avenue at approximate MPs 0.6, 0.8, and 1.1. The staging areas and ATWS are all either empty lots or parking lots on private property.

Allens Avenue is a busy four-lane road in an industrialized area. Several utilities are present along the road including gas, water, and electric lines. Active Providence and Worcester Railroad tracks are also located within the roadway. Algonquin has compiled available information regarding the

locations of underground utilities within the road and is working to determine the exact placement of the pipeline and finalize workspace requirements. The available utility information indicates that there are available corridors within Allens Avenue without known existing utilities, in which the proposed pipeline could be placed. However, Algonquin has noted the possibility that additional, previously unidentified utilities, could be found during construction and would require avoidance. Among the facilities currently within Allens Avenue are two idle NEGC pipelines. Algonquin and NEGC are evaluating the possibility of Algonquin replacing one of the idle NEGC pipelines with Algonquin's proposed pipeline. Following construction, the pipeline under Allens Avenue and Henderson Street would occupy land under an occupancy permit issued by the RIDOT. Therefore, no permanent easement would be established for these portions of the pipeline. A 50-foot-wide permanent easement would be retained for the portions of the pipeline on private property.

The proposed meter station would be constructed on the existing KeySpan LNG facility site. Construction of the meter station would require a total workspace of about 0.42 acre, of which 0.23 acre would be retained for operation. About 0.13 acre of this site would be fenced. The tap valve would be constructed on U.S. Generating property. Construction of the tap valve would require about 0.25 acre of workspace. The permanent tap valve site would occupy 0.12 acre of land, of which 0.08 acre would be fenced.

## 2.4 CONSTRUCTION PROCEDURES

This section describes the general procedures proposed by KeySpan LNG and Algonquin for construction of the LNG facility upgrades and pipeline facilities, respectively. Refer to section 4 for more detailed discussions of proposed construction and restoration procedures as well as additional measures that we are recommending to mitigate environmental impacts.

The proposed LNG facilities and natural gas pipelines would be designed, constructed, operated, and maintained in accordance with federal safety standards that are intended to ensure adequate protection for the public and to prevent LNG and natural gas pipeline accidents or failures.

KeySpan LNG would construct the proposed LNG facilities in compliance with the terms and conditions of project authorizations and permits. In addition, under the provisions of the Natural Gas Pipeline Safety Act of 1968, as amended, KeySpan LNG would design, construct, operate, and maintain the proposed LNG terminal facilities in accordance with the DOT regulations in 49 CFR 193. The proposed facilities would also meet the standards in NFPA 59A, which specify siting, design, construction, equipment, and fire protection requirements for new LNG facilities. The ship unloading facilities and any appurtenances located between the LNG ships and the last valve immediately before the LNG storage tank would comply with applicable sections of the Coast Guard regulations for Waterfront Facilities Handling LNG, 33 CFR 127, and Executive Order 10173.

The proposed pipeline facilities would be designed, constructed, operated, and maintained in accordance with DOT regulations in 49 CFR 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards. Among other design standards, 49 CFR 192 specifies pipeline material selection; minimum design requirements; protection from internal, external, and atmospheric corrosion; and qualification procedures for welders and operations personnel. In addition, Algonquin would comply with the guidelines provided in 18 CFR 30 for the planning, construction, and maintenance of natural gas pipelines and aboveground facilities, and with the siting and maintenance requirements in 18 CFR 380.15.

KeySpan LNG is developing a soil erosion control plan that is based on the applicable sections of the FERC's *Upland Erosion Control, Revegetation and Maintenance Plan* (FERC Plan). KeySpan LNG

states it will file the soil erosion control plan with the FERC when completed. Although most of the measures in the FERC's *Wetland and Waterbody Construction and Mitigation Procedures* (FERC Procedures), which were developed for pipeline construction, would not apply to the proposed LNG upgrades, KeySpan LNG has stated that it would comply with the applicable aspects of the FERC Procedures.[1] Algonquin would construct the pipeline facilities in accordance with its Erosion and Sedimentation Control Plan (ESCP), which incorporates applicable provisions of the FERC Plan and Procedures. Several of the measures specified in the FERC Plan and Procedures are not applicable to the proposed pipeline construction because the route does not cross residential land, agricultural land, wetlands, or waterbodies. Algonquin requested approval for less than the 50-foot setback requirement specified in the FERC Procedures for two locations where the proposed workspace would be less than 50 feet from the Providence River. This request is discussed in section 4.3.2. The FERC Plan and Procedures are available on the FERC web site, and Algonquin's ESCP is provided in Appendix B.

In accordance with section IV of the FERC Procedures, which pertains to preconstruction planning, KeySpan LNG would develop spill prevention and response procedures, which we refer to as a Spill Prevention, Containment, and Countermeasure Plan (SPCC Plan) to be implemented during construction of the LNG facilities. The SPCC Plan must address potential spills of fuels, lubricants, and other hazardous materials and describe spill prevention practices, spill handling, emergency notification procedures, and training requirements. Similarly, Algonquin would comply with its SPCC Plan, which meets the requirements specified in the FERC Procedures.

### 2.4.1 LNG Facilities

The proposed LNG plant upgrade would include construction of the new LNG processing systems, support facilities, ship berth, and unloading facilities. The anticipated sequence of construction is mobilization, establishment of temporary facilities, marine construction, LNG systems construction, and testing.

#### Mobilization, Temporary Facilities, and Site Preparation

Construction activities would begin with the mobilization of construction personnel and equipment and with the establishment of certain temporary buildings, fencing, roads, parking areas, communications, and power and water supplies. Mobilization of various crews and equipment, as well as the construction of temporary facilities, would continue throughout the course of the project based on the specific activities to be conducted at a given time.

Site preparation would include initial grading, installation of base surfaces of roadway and storm drainage systems, and the installation of firewater piping. New process areas would be cleared of unsuitable soils and vegetation, and site excavation and grading would be designed to achieve the required drainage patterns and impoundment. The remediated area of the site where some of the new process equipment would be installed is at an elevation lower than the rest of the site. This area would be raised to an elevation approximately equal to the rest of the site, and the drainage of this area would be integrated into the existing site drainage system. Soils management would be conducted in accordance with KeySpan LNG's Soils Management Plan, which would be approved by the DEM. Once heavy equipment has completed the rest of the site preparation work, the roadwork finish, curbs, and sidewalks would be completed.

[1] Absent review of KeySpan LNG's soil erosion plan, discussion in the EIS of KeySpan LNG's proposed mitigation will refer to the FERC Plan and Procedures. Based on KeySpan's commitments, we anticipate that KeySpan LNG's plan will conform to the applicable provisions or our Plan and Procedures.

**Marine Construction**

Marine construction would begin with the installation of the piles necessary to support the ship mooring, the jetty head, and the jetty trestle. Pile driving cranes and hammers would be mobilized to the site on a work barge. The work barge would be stabilized by a four-point mooring system that would use "spuds," or open steel pipes that would extend from the barge into the river bed to anchor the barge in place. The steel pile material would be delivered to the work barge by supply barges, and the piles would be driven to the design depth. The trestle abutment would be constructed on shore concurrent with the installation of the piles.

Once the piles are in place, they would be capped with concrete structures to help distribute the load and provide support for the decks to be installed between the pile groupings. Trestle segments would then be installed, which would provide access for installing LNG unloading equipment, pipe, electrical and instrumentation equipment, and fire safety/hazard equipment. Curbed concrete decking would be installed beneath the unloading arms and associated pipeline in the marine transfer area to prevent the release of LNG into the river in the event of a spill.

No dredging is anticipated for the construction of the ship berth or unloading facilities.

**Building and LNG Process Systems Construction**

Once the site preparation and grading have been completed, foundations to support the large process equipment (e.g., compressors, heat exchangers, machinery) and buildings would be constructed, followed by foundations for smaller equipment and pipe racks. Buildings would be block wall and/or metal. Once set on its foundation, machinery would be leveled and shimmed, then secured. Rotating equipment would be aligned after the final attachment of the piping, then precommissioned with lubricant filling and electrical energizing of the motors to confirm correct directional rotation.

Pipe attachment would begin after process equipment is secured. KeySpan LNG anticipates that some of the pipe would be prefabricated and some would be fabricated on site. Lengths of pipe would typically be placed in the pipe racks and supported by temporary support rolls to permit jointing and welding. The temporary support rolls would then be removed and valves and/or flanges attached. Pipe and mechanical installation work is expected to occur at several locations within the plant simultaneously.

**Testing and Completion**

Pipe segments would be either hydrostatically or pneumatically tested unless otherwise specified by the manufacturer. Cryogenic piping would be pneumatically tested. Hydrostatic testing would be conducted using potable water obtained from the City of Providence water distribution system. KeySpan LNG estimates that about 100,000 gallons of potable water would be required to test the new process piping. No chemicals would be added to the test water, which would be discharged to the Providence River after testing is completed in accordance with the FERC Procedures.

The new LNG systems would be precommissioned, and pipeline exposed to LNG and/or methane gas would be purged with gaseous inert nitrogen. The methane purge and cool-down with LNG would be conducted with natural gas or LNG from the existing LNG tank. The LNG systems would be considered "mechanically complete" after the nitrogen purge.

Proper drainage and disposal would be accomplished by a combination of area contours and drainage channels in accordance with a detailed storm water management plan, which would be

developed to comply with local and state requirements. KeySpan LNG anticipates that storm water would discharge into the existing storm water system or the Providence River.

**Utilities and Services**

Electricity for the KeySpan LNG facility is provided by Narragansett Electric. To meet the increased power requirements resulting from the proposed upgrades, KeySpan anticipates obtaining 4,160 VAC, 3-phase, 60 Hz electric service via a new connection to Narragansett Electric's substation, transmission, and distribution facilities. The location and design of the new electric connection are under discussion by KeySpan LNG and Narragansett Electric. Narragansett Electric has conducted a supply study and evaluated six optional designs including combined overhead and underground configurations as well as underground-only configurations.

Sanitary systems at the existing LNG plant discharge to an existing septic system. As part of the project, the sanitary system from the control/administration building would be re-routed to the City of Providence sanitary sewer system. KeySpan LNG would be required to obtain applicable permits from the Narragansett Bay Commission and the City of Providence for the sewer connection.

The new electric and sewer connections would be nonjurisdictional facilities associated with the LNG facility upgrade. Because the environmental review of the nonjurisdictional facilities is not complete at this time, **we recommend that**:

- **KeySpan LNG file with the Secretary final construction plans for the planned nonjurisdictional sewer and electric connections <u>prior to construction of these utilities</u>. KeySpan LNG's filing should include documentation of applicable environmental clearances (i.e., cultural resources, threatened and endangered species) and permits**.

### 2.4.2 Pipeline Facilities

Due to constraints associated with constructing a pipeline in a congested urban area, typical cross-country construction techniques would not be practical for most of the proposed route. Special techniques to be used for in-street pipeline construction are discussed further in section 2.4.2.2.

#### 2.4.2.1 General Construction Techniques

Standard pipeline construction proceeds in the manner of an outdoor assembly line composed of specific activities that make up the linear construction sequence. These operations collectively include survey and staking of the right-of-way, clearing and grading, trenching, pipe stringing and bending, welding and coating, lowering-in and backfilling, hydrostatic testing, and cleanup. Although the current project would call for specialized construction techniques, the basic steps and components would be similar to those involved in standard construction.

**Survey and Staking**

Before construction, Algonquin's crews would survey and mark, flag, or stake the centerline and exterior boundaries of the construction right-of-way where necessary. The exterior boundary stakes or flags would mark the limit of approved disturbance areas. Utility lines would be located and marked to prevent accidental damage during pipeline construction.

**Clearing and Grading**

Minimal clearing is anticipated because the majority of the route would be within roads, and the remainder of the route crosses industrial areas with little or no vegetation. Similarly, little grading would be required due to the amount of in-road construction and the relatively flat topography.

**Trenching and Trench Dewatering**

Algonquin proposes to excavate a trench to a depth of at least 5 feet to allow for a minimum of 3 feet of cover over the pipe as required by DOT regulations. The depth of the trench and cover over the pipeline would be increased to 9 feet and 7 feet, respectively, within Allens Avenue.

Algonquin would develop a Soil and Groundwater Management Plan (SGMP) in consultation with the DEM to establish procedures and protocols to be used for trench excavation and dewatering activities in areas with contaminated groundwater or soil. The SGMP would address handling and disposal of contaminated soil and groundwater and would be incorporated into Algonquin's ESCP prior to construction. Contaminated groundwater removed during dewatering might require treatment prior to discharge to the ground surface or a permitted drainage system, or might need to be pumped into fractionation tanks prior to discharge. As discussed in 4.3.1, Algonquin has initiated discussions with the DEM regarding management of contaminated water and applicable permitting requirements.

**Bending**

Pipe joints would be bent as necessary to fit the horizontal and vertical contours of the trench. The bending engineer would survey the trench to determine the location and angle of each field bend, and this information would be marked on the pipe. A hydraulic pipe-bending machine would bend each individual pipe joint to the desired angle.

**Welding and Coating**

The pipe would be delivered with a factory coating of fusion-bonded epoxy or similar material to prevent corrosion. The ends of the joints would be left uncoated to allow for welding. After bending is complete, the individual joints of pipe would be cleaned, aligned, and welded together. Welding would be conducted in accordance with the API Standard No. 1104 ($18^{th}$ Edition, 1994). Algonquin would inspect each weld radiographically (i.e., x-ray). Any welds that do not meet the API requirements and Algonquin's specifications would be repaired or removed. Once the welds have been accepted, Algonquin would apply coating at the welded joints and would electronically inspect the pipeline coating to locate any defects in the coating. Any defects that are detected in the coating would be repaired in the field before the pipe is lowered into the trench.

**Lowering-in and Backfilling**

After welding and coating are completed, the pipe would be lowered into the trench by equipment. Once sections of the pipe are lowered in, a tie-in crew would make the final welds in the trench to connect the pipeline segments. As discussed in section 2.4.2.2, construction along much of the route would involve special techniques that would require several tie-ins.

The trench would be backfilled after the pipeline is installed. For construction within roadways, where it is likely that contaminated soils would be encountered, some of the excavated dirt might need to be removed and disposed of at an offsite facility. In these areas, the trench would be backfilled using controlled density fill (CDF), consisting of a mixture of 1 part cement to 15 parts clean sand. CDF sets

up and does not allow pavement to settle, but can be excavated by typical construction equipment if necessary. For portions of the route that are not within streets, backfill material would consist of native material; or if the native material is not suitable (e.g., is too rocky or in areas with contaminated soil), additional fill such as sand or other suitable material obtained from local quarries or sand pits would be used.

**Cleaning and Hydrostatic Testing**

Once Algonquin completes the pipeline tie-ins, Algonquin would internally clean the pipeline with pipeline pigs to remove dirt, water, weld slag, or debris.[2] The pipeline would then be hydrostatically tested in accordance with DOT regulations to ensure its integrity and confirm that the system is capable of operating at the design pressure. Algonquin would develop a hydrostatic test plan for review and approval by the Commission prior to construction.

The testing process involves filling a segment of the pipeline with water and maintaining a prescribed pressure for a specified amount of time. If a leak or break in the line were to occur during testing, Algonquin would repair and retest that section of pipe until DOT specifications are met. At the completion of the test, Algonquin would propel a pig through the pipeline with air to force the water out. Algonquin plans to obtain hydrostatic test water from the City of Providence or from the Providence River and anticipates that approximately 120,000 gallons of water would be required to conduct the necessary hydrostatic testing. Algonquin would conduct hydrostatic testing in accordance with applicable authorizations obtained from the appropriate federal, state, and/or local permitting agencies. No chemicals would be added to the test water. When testing is complete, Algonquin would discharge the test water to the Providence River in accordance with its ESCP and applicable permits.

**Restoration and Revegetation**

Because the pipeline would be constructed within city streets and on disturbed, mostly unvegetated industrial land, typical pipeline restoration and revegetation procedures would not apply. Repaving would be conducted in accordance with applicable permit requirements. Algonquin would plant shrubs along the boundary of the tap valve facility at MP 1.44 to provide visual screening.

#### 2.4.2.2 Special Construction Techniques

Several special pipeline construction techniques, such as those typically used to cross wetlands, waterbodies, steep topography, and agricultural or residential land, would not be applicable to the proposed pipeline because the proposed route does not cross any of these resources. However, Algonquin would employ special techniques to address the conditions it would encounter due to the congested, urban nature of the route, including in-street construction.

Two special techniques that Algonquin anticipates using are the stovepipe technique and the drag section technique. The stovepipe technique would be used for in-street construction and is described below. The drag section method is typically used when trying to reduce the time necessary to work in a given location. With this technique, multiple pipe joints would be pre-assembled (i.e., bent, welded, x-rayed, coated) in a staging area near, but not adjacent to, the trench where the pipeline is to be installed. Due to the number of utilities within the roadways along the proposed route, Algonquin does not anticipate using the drag section method for in-street construction, but might employ this method along other portions of the route.

[2] A pig is an internal tool that can be used to clean and dry a pipeline and/or to inspect it for damage or corrosion.

**In-Street Construction**

Algonquin proposes to develop site-specific construction plans for in-street construction and road crossings, and would obtain applicable state and local road construction permits. Construction in roadways would be scheduled in such a way to minimize impacts on commuter traffic, and provisions would be made for detours or other measures to permit traffic flow. Work hours and traffic control measures would be identified in consultation with the applicable authorities, and Algonquin would provide signage and other safety measures in compliance with state and local permits. For construction in Henderson Street, Algonquin anticipates constructing at night to avoid disrupting the public's access to Collier's Point Park, a public, multiple-use park that is open from dawn until dusk.

During construction, Algonquin would attempt to maintain at least one open lane of traffic when constructing within or across roadways. During the period when the road is cut open to install pipe, steel plates would be available on-site to permit access by emergency vehicles. Access to adjacent businesses would be maintained except for the brief, essential period required for laying the new pipeline. If it becomes necessary to disturb sidewalks, Algonquin would coordinate with municipal safety officials, install safety fencing or barriers, and provide temporary access for pedestrians.

The stovepipe technique is particularly well suited to congested areas with limited workspace. It is also a means of minimizing the duration of construction activities in a single location. Use of this technique would involve installing the pipe one joint at a time. Welding, radiography, and coating activities would be performed in the open trench. Simultaneously, the trench for the following pipe section would be excavated. The trench would be backfilled at the end of each day or covered with steel plates. Algonquin would limit the length of the excavated ditch within streets each day to the length of pipe that would be installed that day. At the end of each day, excavated areas would be backfilled, or the open trench would be covered with steel plates. Algonquin anticipates that the duration of the above described disturbance and restrictions at any one road location would be about 3 days.

**Utility and Railroad Crossings**

As noted previously, Algonquin has compiled available information about the locations of underground utilities along the proposed pipeline route. Review of engineering files and records indicates that installation of utilities within Allens Avenue began as far back as the late nineteenth century when the road was constructed and has continued to present times. A 102-inch-diameter storm sewer line runs the length of the proposed pipeline route where it follows Allens Avenue between Henderson Street and Terminal Road. Other utilities that Algonquin has identified include additional sewer lines and natural gas lines. The locations of telecommunications and electrical facilities along the route have not yet been identified. Prior to construction, Algonquin would contact the Rhode Island "Dig Safe" system and the City of Providence, and would mark the locations of all utilities along the route and on the construction plans. In some cases, utilities such as water, cable, gas, and sewer lines might be located by field instrumentation and test pits.

Property owners adjacent to construction areas would be notified in advance of any scheduled disruption of utilities, and Algonquin would attempt to minimize the duration of such interruptions. Representatives of local utility companies would be on-site during construction when necessary. Algonquin would also prepare a construction communication plan that would include applicable utility representatives and contacts, as well as a notification procedure in the event that emergency repairs become necessary during pipeline construction. Procedures for making such repairs would be dictated by the utility owner.

Algonquin would construct railroad crossings by boring beneath the crossing.

## 2.5 CONSTRUCTION SCHEDULE

KeySpan LNG anticipates that construction of the proposed LNG facilities would take approximately 43 weeks. Subject to the receipt of the necessary permits and authorizations, KeySpan LNG proposes in its application to begin construction in spring 2005 in order to have the new facilities in service for the 2005/2006 heating season. Depending on the final design, KeySpan LNG indicates that the nonjurisdictional new connection to the Narragansett Electric facilities required to provide power for the upgraded LNG facility could take between 52 and 98 weeks to complete. KeySpan LNG is working with Narragansett Electric to identify a solution that would accommodate the proposed project schedule. KeySpan LNG and Narragansett Electric expect to select one of the options and begin engineering and design by the end of 2004 and to have the interconnection completed by late 2005. Algonquin proposes to begin construction of the pipeline facilities in late spring 2005, and place the facilities in-service by November 2005.

## 2.6 ENVIRONMENTAL COMPLIANCE, INSPECTION, AND MITIGATION MONITORING

In preparing construction drawings and specifications for the project, KeySpan LNG and Algonquin would incorporate mitigation measures identified in their respective applications as well as respective requirements of federal, state, and local agencies. Contractors would also be provided copies of applicable environmental permits.

KeySpan LNG and Algonquin would conduct environmental training for construction personnel regarding proper field implementation of the FERC Plan and Procedures, KeySpan LNG's soil erosion control plan, Algonquin's ESCP (for personnel involved in construction of the proposed Algonquin pipeline), the companies' respective SPCC Plans, project-specific permit conditions, and other mitigation measures. Environmental training would be conducted prior to construction and throughout the construction process as needed.

KeySpan LNG and Algonquin would each be represented by its respective Chief Inspector or similar representative, who would be responsible for quality assurance and compliance with mitigation measures, other applicable regulatory requirements, and company specifications. Each Chief Inspector would be assisted by one or more craft inspectors and at least one Environmental Inspector. The Environmental Inspectors' duties are described in the FERC Plan and Procedures and in Algonquin's ESCP and would include ensuring compliance with environmental conditions attached to any FERC authorization and to other permits or authorization and to the respective company's environmental designs and specifications. Each Environmental Inspector would report directly to the respective company's Chief Inspector and would have the authority to stop activities that violate the environmental conditions of the FERC Certificate, state and federal environmental permit conditions, or landowner requirements, and to order appropriate corrective action.

In addition, the FERC staff would conduct inspections to monitor the project for compliance with the Commission's environmental conditions.

## 2.7 OPERATION AND MAINTENANCE PROCEDURES

### 2.7.1 LNG Facilities

Imported LNG would be obtained from liquefaction plants throughout the world (e.g., Trinidad, Equatorial Guinea, Nigeria, and Egypt) and delivered via LNG ships to the marine terminal. The Coast Guard has regulatory authority regarding LNG ship movements. KeySpan LNG would participate with the Coast Guard in developing and implementing an Operations and LNG Vessel Safety and Management

Plan regarding the operation of LNG ships within the approaches to Narragansett Bay, the East Passage, the Providence River Channel, the Port of Providence, and at the terminal.

LNG ships bound for the KeySpan LNG terminal would enter the mouth of Narragansett Bay and would follow the East Passage and Providence River Channel to the Port of Providence and the KeySpan LNG terminal. The Providence River Channel is maintained by the COE as a Federal Navigation Project. KeySpan LNG anticipates that the Coast Guard would board inbound LNG ships as they enter the mouth of Narragansett Bay to conduct inspections, verify documentation, and conduct security checks. The Coast Guard would inspect the ships again once the ship is moored, prior to authorizing the transfer of the LNG cargo from the ship. The Coast Guard might require that the LNG ships be escorted while in transit to and from the LNG facility and would enforce safety and security zones around the LNG ships.

The transit from the mouth of Narragansett Bay to the LNG terminal would take about 2 to 3 hours. The Northeast Marine Pilots Office in Newport, Rhode Island would provide pilots to navigate the LNG ship to the LNG terminal. KeySpan LNG plans to work with Northeast Marine Pilots over the next several months to determine the specific navigational aspects of the LNG ship transits. BG LNG would contract for the use of two new, purpose built reverse type tractor tugs with fire-fighting capabilities to assist with the turning and berthing of the LNG ships. Additional conventional tugs might also be used to assist or support the two tractor tugs. LNG ships would approach the berth from the south and would typically be turned 180 degrees in the Providence River before being pushed into the berth unless conditions do not allow for turning the ship prior to berthing.

Upon arrival at the terminal, the ship would dock securely at the berth, attach to the unloading arms, and transfer LNG to the storage tank using the ship's LNG pumps. The unloading arms would be designed to offload LNG from the ships at a rate of 33,000 gpm (7,500 $m^3$ per hour). As the LNG is offloaded, ballast water would be taken on to compensate for the loss of cargo. No ballast water or sanitary waste would be discharged into the river. After the LNG is offloaded, the ship would be detached from the unloading arms and mooring and breasting dolphins, moved from the berth with tug assistance, and begin its outbound transit. The entire unloading process from ship arrival to departure could range from 8 to 24 hours, but would generally take about 15 hours.

LNG would be stored in the existing storage tank at a temperature of approximately -260 °F. BOG generated from vaporization of LNG while in the storage tank would continue to be processed by the existing system and discharged to the NEGC distribution system. The proposed new two-stage sendout pumping system and closed loop shell and tube heat exchanger vaporization system would discharge natural gas to be metered, odorized, and sent out to the pipeline grid via the proposed new pipeline, which would connect the LNG facility with Algonquin's existing G-system.

While the vast majority of the LNG received at the terminal would be vaporized and sent out on the pipelines, some LNG would also be transported from the terminal via trucks. The LNG trucks would enter the loading station, load LNG, and then transport it to peak shaving facilities.

KeySpan would operate and maintain its proposed facilities in compliance with 49 CFR 193, 33 CFR 127, NFPA 59A, and other applicable federal and state regulations. In addition, in accordance with 33 CFR 127.305, KeySpan would prepare an operation manual that addresses specific procedures for the safe operation of the ship unloading facility. This manual would include training requirements and programs for operations and maintenance personnel.

### 2.7.2 Pipeline Facilities

Algonquin would operate and maintain the proposed pipeline facilities in accordance with the DOT standards in 49 CFR 192. Section 4.12.8 of this draft EIS presents a discussion of the DOT's safety regulations and requirements for natural gas pipelines and describes how these requirements would be met by the pipeline operator.

Algonquin would patrol the pipeline on a routine basis to observe general right-of-way conditions and to identify any indications of leaks, construction activity on or near the permanent right-of-way by outside parties, evidence of possible pipeline damage, or damage to erosion-control structures. Qualified personnel would conduct emergency or routine maintenance. Algonquin would investigate evidence of post-construction soil erosion or sedimentation and promptly implement corrective measures as required by its ESCP. The aboveground facilities would be inspected in accordance with DOT requirements. During these inspections, equipment would be tested, recalibrated, and repaired as needed.

## 2.8 SAFETY CONTROLS

### 2.8.1 LNG Facilities

The proposed LNG terminal facilities would be sited, designed, constructed, operated, and maintained in compliance with federal safety standards. Major federal siting and design requirements for proposed LNG facilities are summarized in table 2.8.1-1.

TABLE 2.8.1-1

**Major Applicable Federal Siting and Design Requirements for LNG Facilities**

| Requirement | Description |
|---|---|
| **Thermal Radiation Protection** (49 CFR 193.2057 and section 2.2.3.2 of NFPA 59A) | These requirements are designed to ensure that certain public land uses and structures outside the LNG facility boundaries are protected in the event of an LNG fire. |
| **Flammable Vapor-Gas Dispersion Protection** (49 CFR 193.2059 and sections 2.2.3.3 and 2.2.3.4 of NFPA 59A) | These requirements are designed to prevent a flammable vapor cloud associated with an LNG spill from reaching a property line that can be built upon. |
| **Wind Forces** (49 CFR 193.2067) | This requirement specifies that all facilities be designed to withstand wind forces of not less than 150 miles per hour without the loss of structural integrity. |
| **Impounded Liquid** (section 2.2.3.8 of NFPA 59A) | This requirement specifies that liquids in spill impoundment basins cannot be closer than 50 feet from a property line that can be built upon or a navigable waterway. |
| **Vaporizer Spacing** (section 2.2.5.2 of NFPA 59A) | This requirement specifies that integral heated vaporizers must be located at least 100 feet from a property line that can be built upon and at least 50 feet from other select structures and equipment. |
| **Process Equipment Spacing** (section 2.2.6.1 of NFPA 59A) | This requirement specifies that process equipment containing LNG or flammable gases must be located at least 50 feet from sources of ignition, a property line that can be built upon, control rooms, offices, shops, and other occupied structures. |
| **Marine Transfer Spacing** (33 CFR 127.105) | This requirement specifies that each LNG unloading flange must be located at least 985 feet from any bridge crossing a navigable waterway. |

#### 2.8.1.1 Spill Impoundment System

The existing LNG facility includes an impoundment system consisting of an earthen dike designed to contain 100 percent of the full storage tank volume,[3] and a "storage tank design spill" sub-impoundment with a capacity of about 94,500 cubic feet ($ft^3$) (729,350 gallons). The impoundment system was designed and constructed during the construction of the existing LNG facility in accordance with the standards specified in the 1971 edition of NFPA 59A. The system was subsequently modified to comply with retroactive requirements of 49 CFR 193, Liquefied Natural Gas Facilities: Federal Safety Standards, which pertained to hazards detection and mitigating systems, operating, emergency, security, and maintenance procedures, as well as training plans. Additional facility modifications such as the LNG truck transfer station, certain processing equipment, and associated buildings have been conducted in accordance with the versions of 49 CFR 193 and NFPA 59A that were in effect at the time the modifications were made.

49 CFR 193 and NFPA 59A require that the impoundment be sufficiently sized to accommodate a design spill, which is defined as the maximum flow from any single accidental leakage source for 10 minutes. The existing impoundment system would accommodate the proposed new LNG facilities, for which the greatest design spill scenario would be from the 24-inch-diameter LNG ship unloading line. The system would be modified by the addition of a "leakage source design spill" sump within the existing LNG tank spill sump to limit the surface area of a potential fire, and thus limit the thermal exclusion zone. The leakage source impoundment sump would have a capacity of 29,600 gallons. See section 4.12.3 for further discussion of the impoundment system and applicable regulations.

The proposed new vaporization and process equipment would be installed within the existing LNG tank impoundment. Concrete pads and curbing would be placed under all new LNG-containing equipment and pipelines, and concrete trenches would be installed to drain LNG away from equipment and pipelines to the existing tank sub-impoundment. The marine and ship unloading facilities would include the use of curbed concrete decking beneath the unloading platform and jetty, a curbed pad beneath the on-shore unloading piping, and a sloped concrete trench to drain spills to the tank impoundment sump.

Rainwater would be removed from the impoundment sump using a sump pump. Redundant leak detection systems installed throughout the spill impoundment system would automatically activate emergency shutdown of the pumps and isolation valves in the event of a spill. Low-temperature and hazardous gas detectors would be installed at all process and transfer areas, and low-temperature detectors would be installed in all impoundment sumps and trenches.

#### 2.8.1.2 Fire and Hazard Detection System

Existing fire and hazard detectors would be supplemented by additional detectors to accommodate the proposed LNG facility upgrades. These detection systems are designed to provide operating personnel early detection of releases of flammable gases and fires and to show the general location of a release or fire. The fire and hazard detection system would include:

- combustible gas and low temperature detectors to monitor for potentially hazardous conditions;

[3] Recent monitoring by KeySpan LNG indicated that the volume of the existing impoundment may have been reduced to less than the design parameter due to settling and erosion over time. In its comments on the draft EIS, KeySpan LNG stated that it recently increased the impoundment capacity to 102.3 percent of the full storage tank volume.

- high temperature, smoke, and ultraviolet/infrared (UV/IR) flame detectors to monitor for fire;
- an integrated system that would be monitored from a main control room;
- automatic emergency shutdown capabilities in the event of hazard or fire detections; and
- fire-fighting equipment ready for activation immediately upon fire detection.

Locations where combustible gas, low temperature, UV/IR flame, and smoke detectors would be installed are summarized in table 2.8.1-2.

TABLE 2.8.1-2

**Proposed Locations of Smoke, Combustible Gas, and UV/IR Flame Detectors at the LNG Terminal**

| Detector Location | Combustible Gas [a] | Low Temperature | UV/IR Flame [a] | Smoke [a] |
|---|---|---|---|---|
| **BUILDINGS** | | | | |
| MCC/Utility Building | 2 | | | 2 |
| Pier Control Room | 2 | | | 2 |
| Heater Building | 6 | | 6 | |
| BOG Compressor Building | 6 | | 6 | |
| **PROCESS AREAS** | | | | |
| Low Pressure Pump Area | 3 | 2 | 2 | |
| High Pressure Pump/Vaporizer Area | 6 | 4 | 6 | |
| Metering Area | 2 | | 2 | |
| Hot WEG Expansion Tank | 1 | | | |
| Warm WEG Expansion Tank | 1 | | | |
| **MARINE AREA** | | | | |
| Pier Area | 4 | 2 | 2 | |
| Isolation Valve at Shore | 2 | | 2 | |

[a] Numbers represent the number of detectors to be installed at each location.

As discussed in the previous section, low-temperature detectors would be installed in the spill impoundment sumps to prevent the start-up of the stormwater pumps in the event of an accidental release of LNG in the impoundment area. Additional low-temperature detectors would be installed in the spill collection trenches and other areas where LNG might be expected to accumulate. Combustible gas detectors would be located in all buildings and process areas where combustible gas may be present. Smoke detectors would be located in appropriate indoor areas such as electrical rooms and control rooms. Flame detectors would be placed in LNG and natural gas process areas.

KeySpan LNG's operations personnel use closed circuit television for monitoring. Computers monitor operation parameters to detect and alert personnel about abnormal conditions.

### 2.8.1.3 Fire and Hazard Control System

The existing fire protection systems at the KeySpan LNG facility would be supplemented as part of the proposed project. The fire-fighting systems and equipment would include:

- additional hydrants and monitors that would be tied into the looped, underground firewater distribution piping system to supply water to new equipment and buildings in the process area;

- fixed skid-mounted dry chemical units with manual monitors and hosing in the high-pressure sendout pump and vaporizer area and on the ship unloading platform;

- a portable wheeled dry chemical unit at the BOG compressor building; and

- hand-held $CO_2$ dry chemical fire extinguishers in certain buildings and process areas.

Structural members supporting LNG-containing equipment and piping or in impoundment areas subject to cryogenic exposure from spills would be supported with reinforced concrete columns for fireproofing. Other pipe supports would be constructed of structural steel.

The locations of the proposed fire protection equipment at the upgraded LNG terminal are provided in table 2.8.1-3.

TABLE 2.8.1-3

**Proposed Locations of Fire Protection Equipment for LNG Facility Upgrades**

| Location | Fire Water | | Fire Extinguishers | | | |
|---|---|---|---|---|---|---|
| | Hydrants (includes hose cabinet) | Monitors | Skid Mount Dry Chemical | Wheeled Dry Chemical | Hand Held Dry Chemical | Hand Held $CO_2$ |
| **BUILDINGS** | | | | | | |
| Pier Control Room | | | | | | 2 |
| MCC/Utility Building | 2 [a/] | 1[a/] | | | | 2 |
| Heater Building | 2 [b/] | 2 [b/] | | 1[b/] | 2 | |
| BOG Compressor Building | b/ | b/ | | b/ | 2 | |
| **PROCESS AREAS** | | | | | | |
| High Pressure Pump/Vaporizer Area | 2 [c/] | 2 [c/] | 1 | | 1 | |
| Metering Area | 2 [d/] | 1 | | | 1 | |
| **MARINE AREA** | | | | | | |
| Ship Unloading Platform | 2 | 2 | 2 | | 2 | |
| Firewater Connection to Ship | 2 | | | | | |

a/ One hydrant and one monitor would be shared between the MCC/Utility Building and the Heater Building; one of the two hydrants is existing.

b/ Two new hydrants, monitors, and wheeled dry chemicals would be shared between the Heater Building and the BOG Compressor Building.

c/ Includes one existing hydrant and one existing monitor.

d/ One hydrant and one monitor would be shared between the Metering Area and the BOG Compressor Building. One of the two hydrants is existing.

### 2.8.1.4 Emergency Shutdown System

The proposed LNG facilities would include a linked emergency shutdown system (ESD) between the LNG ship and the shore during LNG cargo transfer operations. The system would enable the LNG ship to shut down the LNG terminal and the LNG terminal to shut down LNG cargo from the ship. The

ESD sequence for the terminal and the LNG ship would have a time-sequenced valve closure system to provide an orderly shutdown and prevent pressure surges in the LNG pipelines.

Fail-safe shut-off valves would be located on the ship unloading platform to isolate each of the two unloading arms and the vapor return arm. The isolation valves operate in a timed sequence with the other designated emergency shutdown system valves to completely shut down the plant. Similar valves would be used at the shoreline to isolate the marine facilities from the onshore facilities. These valves would be located in the 24-inch-diameter ship unloading line, the 3-inch-diameter cooldown line, and the 8-inch-diameter vapor return line.

### 2.8.2 Pipeline Facilities

The proposed pipelines and aboveground facilities would be designed, constructed, operated, and maintained in accordance with DOT Minimum Federal Safety Standards in 49 CFR 192. These safety standards are discussed in section 4.12.8.

#### 2.8.2.1 Corrosion Protection and Detection Systems

The pipe used for the proposed pipeline would have a protective coating of fusion bond epoxy on the exterior of the pipe to prevent or minimize corrosion. A cathodic protection system would also be installed. The cathodic protection system would impress a low-voltage current to the pipeline to offset natural soil and groundwater corrosion potential.

Algonquin's gas control center in Houston, Texas monitors its system pressures, flows, and customer deliveries. The control center is staffed 24 hours a day year-round. Control valves can be operated remotely in the event of an emergency.

#### 2.8.2.2 Emergency Response Procedures

Pipeline system emergencies can include gas leaks, fire or explosion, and/or damage to the pipeline and aboveground facilities. In accordance with DOT regulations, Algonquin would develop a new plan or revise its existing plan to address procedures to be followed in the event of an emergency along the proposed pipeline. This plan would include training of employees on emergency procedures; establishing liaisons with appropriate fire, police, and other community officials; and informing the public on how to identify and report an emergency condition on the pipeline routes.

## 2.9 FUTURE PLANS AND ABANDONMENT

Neither KeySpan LNG nor Algonquin have current or reasonably foreseeable plans for future expansion or abandonment of the facilities proposed as part of the project. KeySpan LNG would abandon the existing 12-inch-diameter LNG barge unloading line from the Providence River bulkhead to the existing storage tank to provide space for installation of the proposed new 8-inch-diameter ship vapor return line. KeySpan LNG would also remove the existing pipe supports and concrete foundations if necessary.

Should the proposed facilities be expanded or abandoned, or if expansion of the Algonquin G-system is required due to the additional demand for natural gas service, these expansions or abandonments would require applicable FERC authorizations. The FERC would be required to conduct associated environmental and non-environmental analyses. In addition, the expansions or abandonments would be subject to other appropriate federal, state, and local regulations.