4.0 ENVIRONMENTAL ANALYSIS

The environmental consequence of constructing and operating the proposed KeySpan LNG Project would vary in duration and significance. Four levels of impact duration were considered: temporary, short term, long term, and permanent. Temporary impact generally occurs during construction with the resource returning to preconstruction condition almost immediately afterward. Short term impact could continue for up to 3 years following construction. Impact was considered long term if the resource would require more than 3 years to recover. A permanent impact could occur as a result of any activity that modifies a resource to the extent that it would not return to preconstruction conditions during the life of the project, such as the construction of a new LNG terminal. We considered an impact to be significant if it would result in a substantial adverse change in the physical environment.

In this section, we discuss the affected environment, general construction and operational impact, and proposed mitigation for each resource. KeySpan LNG and Algonquin, as part of their proposals, agreed to implement certain measures to reduce impact. We evaluated KeySpan LNG's and Algonquin's proposed mitigation to determine whether additional measures are necessary to reduce impact. These additional measures appear as bulleted, boldfaced paragraphs in the text. We will recommend that these measures be included as specific conditions to authorizations that the Commission may issue to KeySpan LNG and Algonquin.

Conclusions in this EIS are based on our analysis of the environmental impact and the following assumptions:

- KeySpan LNG and Algonquin would comply with all applicable laws and regulations;
- the proposed facilities would be constructed as described in section 2.0 of this document; and
- KeySpan LNG and Algonquin would implement the mitigation measures included in the application and supplemental filings to the FERC.

4.1 GEOLOGIC RESOURCES

4.1.1 Physiographic and Geologic Setting

The proposed project is situated in the Seaboard Lowland Section of the New England Physiographic Province, which is characterized by gently seaward sloping topography with low relief hills and rounded ridges. Topography in the immediate project area is generally level, the result of Pleistocene glaciation subsequently modified by alluvial and estuarine processes. Natural features in the project area have been modified by infilling and industrial development along the Providence River over the last 100 years.

The proposed project is located within the western margin of the Narragansett Basin, a fault-bounded regional tectonic feature. During the Pennsylvanian age (325 to 286 million years ago), the basin filled with up to 12,000 feet of non-marine clastic sedimentary rocks which were unconformably deposited on Precambrian crystalline basement or Cambrian metasedimentary rocks. The sedimentary rocks within the basin were subsequently deformed and metamorphosed during the Allegheny Orogeny of Permian age (286 to 245 million years ago), marking the end of collisional-compressional tectonics on the eastern margin of North America.

Bedrock in the project area is the Pennsylvanian Rhode Island Formation consisting of interbedded sandstone, siltstone, shale, conglomerate, and a few beds of coal. Based on soil borings at the KeySpan LNG Project site and other resources (Roberts and Halberg, 1945), the depth to the Rhode Island Formation ranges from approximately 100 to 200 feet below ground surface in the project area. The bedrock surface rises steeply toward the east, forming the low bluffs along the east side of the Providence River.

Bedrock units in the region are covered by a complex sequence of unconsolidated gravel, sand, silt, and clay deposited by Pleistocene (1.8 million to 11,000 years ago) continental glaciers. At the KeySpan LNG Project site, the first distinct glacial unit overlying bedrock is a dense till consisting of dark gray, silty sand with gravel and cobbles. This till unit is probably a basal till, deposited directly by the ice sheet as it overrode the area southward. The depth to the till unit at the site varies from 14 feet to greater than 107 feet below the ground surface. The till unit is overlain primarily by dense sand and silt with gravel deposited as outwash in front of the receding glacial ice; silt and fine sand deposits within the outwash may represent episodes of local glacio-lacustrine environments. The outwash deposits extend from the top of the till to approximately 30 feet below the surface of the KeySpan LNG Project site.

As the last glacier receded northward, sea level rose and estuaries were established along the edges of Narragansett Bay. Organic silt and peat developed on top of the previous outwash, ranging from 0 to 53 feet thick at the site with an average thickness of 10 feet. In the late 1800s or early 1900s the City of Providence developed loading, docking, and storage facilities along the Providence River. The existing industrial zone of the project site was created at this time as a result of filling behind a constructed bulkhead. Recent geotechnical soil borings by KeySpan LNG indicate that the fill at the project site ranges from 7 to 20 feet thick and consists of silty sand with miscellaneous debris including wood, metal, cinders, and ash.

Because the existing LNG facility is underlain by fill, construction and operation of the project would not materially alter the existing geologic conditions at the site. Some areas of the site would be permanently altered by filling to raise the overall site grade above the 100-year flood level (which is 18.68 feet above Mean Lower Low Water (MLLW)). These modifications would benefit the site by providing additional protection against possible flooding.

Geologic conditions along Algonquin's proposed pipeline route are expected to be similar to those at the existing LNG facility. Construction and operation of the proposed Algonquin pipeline would not materially alter existing topographic or geologic conditions. After construction, Algonquin would restore topographic contours, surface finishes, and drainage conditions along the pipeline corridor to preconstruction conditions to the extent possible.

4.1.2 Blasting

Blasting would not be required for construction of the proposed KeySpan LNG or Algonquin facilities due to the thickness of the unconsolidated fill and natural deposits overlying the bedrock in the area.

4.1.3 Mineral Resources

There are no significant, potentially exploitable mineral or fuel resources in or near the proposed KeySpan LNG or Algonquin facilities. According to the University of Rhode Island Department of Geology, historical mining in the area consisted of small sand and gravel pits and coal extraction from surface exposures of the Rhode Island Formation around Narragansett Bay. No active mineral recovery operations would be affected by the project, and it is unlikely that future mineral recovery operations

would occur in the area given the limited occurrence of mineral resources and the highly developed nature of the surrounding area.

4.1.4 Geologic Hazards

Geologic or other hazards in the vicinity of the proposed projects consist of seismic-related hazards, the low load-bearing capacity of the soils at the LNG terminal site, subsidence, and flooding. Conditions necessary for the development of geologic hazards including karst terrain, avalanches, and volcanism are not present in the project area.

In general, the potential for geologic or related natural hazards to significantly affect the construction or operation of the proposed projects is low. The risk of damage resulting from these types of natural hazards would be avoided or reduced by specific engineering design and construction techniques and operating procedures to be implemented by KeySpan LNG and Algonquin.

4.1.4.1 Seismic-related Hazards

The proposed projects are situated in an area with a relatively low potential for significant seismic activity. Potential seismic-related hazards that exist in the area include earthquakes, surface faulting, soil liquefaction and related soil failures, and tsunamis.

Detailed, site-specific geotechnical and geoseismic studies were conducted for the KeySpan LNG Project site in 1996 in conjunction with a proposed facility upgrade that was not implemented. These studies were prepared by CH2MHill and are included as appendix 13E of Exhibit F in KeySpan LNG's application to the FERC.

In April and May 2004, KeySpan LNG also obtained additional site-specific geotechnical data to assist in foundation designs and other project design elements for the proposed LNG facility upgrades. Algonquin also conducted a general seismic review of the area for construction of the proposed pipeline. The following discussions incorporate the earlier geotechnical and geoseismic studies and recent data and information from KeySpan LNG and Algonquin.

Earthquakes

The majority of significant earthquakes around the world are associated with tectonic subduction zones, where one crustal plate is overriding another (e.g., the Japanese islands), or where plates are sliding past each other (e.g., California). Unlike these highly active tectonic regions, the East Coast of the United States is located on the "trailing edge" of the North American continental plate, which is characterized by generally low magnitude seismic events consistent with passive plate margin processes.

Earthquakes that occur in the project area are largely thought to be due to trailing edge tectonics and residual stress release from past orogenic (mountain building) events. New England earthquakes are typically not associated with a specific fault but rather occur in zones associated with deep crustal weakness between tectonic provinces and around the margins of other major geologic features such as plutons.

Earthquakes are characterized by their magnitude, a measure of the amount of energy released during the event, or their intensity, a measure of the effects of the event at the land surface. Instrumentation measurements of earthquake magnitudes in New England began in the early 20th century, whereas damage reports extend back 300 years. According to the U.S. Geological Survey (USGS), (2004a) the largest magnitude earthquake recorded in Rhode Island was a magnitude 3.5 event that

occurred in 1976 near Newport, approximately 20 miles south of the project area. The effects of this earthquake included cracked plaster, fallen tabletop lamps, and snow being shaken from rooftops. In terms of intensity, the most significant event experienced in the project area was associated with an earthquake that occurred in 1755 near Cape Ann, Massachusetts, approximately 75 miles northeast of the project area. This earthquake is estimated to have been a magnitude 6 event which resulted in Modified Mercalli Intensity (MMI) V or VI damage in the project area. Typical MMI VI effects include broken windows, dishes and glassware; books falling off shelves; furniture moving; and cracking of weak plaster. For reference, a stronger MMI VII event would cause slight to moderate damage to ordinary, well-built buildings, but only negligible damage to buildings of good design and construction (USGS, 2004a).

Seismic risk can also be quantified by the motions experienced by the ground surface or structures during a given earthquake, expressed in terms of the acceleration due to gravity, or "g." The USGS (2002) has developed a series of maps for the entire United States which describe the likelihood for shaking of varying degrees to occur in a given area. According to the USGS, there is a 10 percent probability of a seismic event occurring within the next 50 years (an approximate 500-year return period) which would result in a peak ground acceleration (PGA) of 3 percent (0.03) g in the project area. An earthquake with an approximate return period of 2,500 years would result in an estimated PGA of 0.09 g in the area. For reference, a PGA of 0.10 g is the approximate threshold for damage to older structures or structures not made to resist earthquakes (USGS, 2004a). In 1998, the State of Rhode Island building codes adopted seismic provisions which specify an effective peak acceleration of 0.12 g for the entire state.

As noted above, a detailed, site-specific geoseismic study was conducted of the LNG facility site in 1996, in conjunction with a proposed facility upgrade that was not carried out. The geoseismic study was conducted in accordance with NBSIR 84-2833, *Data Requirements for the Seismic Review of LNG Facilities*. The site-specific geoseismic study determined that the maximum earthquake potential for the project area would be a MMI VII event, resulting in a PGA of 0.13 g at the site (CH2MHill, 1996). This event would have a return period greater than 2,500 years.

In conclusion, the likelihood of a major earthquake occurring in the project area during the operating life of the proposed facility upgrades is low. KeySpan LNG would design and construct the proposed facility upgrade in accordance with current building codes and sound engineering practices, and would operate them in accordance with applicable safety regulations. Some commentors raised a concern that the existing tank may not meet the federal seismic design requirements of the DOT (Title 49 CFR Part 193). We recommended in the draft EIS that KeySpan LNG perform an analysis to determine whether its existing LNG facilities comply with the current seismic design requirements. The results of KeySpan LNG's analysis are discussed in section 4.12.3 as part of the discussion of safety and reliability.

Ground shaking would not be expected to materially affect the proposed pipeline, which would be constructed of modern steel that is capable of remaining elastic during the level of shaking that could potentially occur in the area (O'Rourke and Palmer, 1994).

Surface Faulting

Bedrock faults along the western margin of the Narragansett Basin are located approximately 3 miles west of the project area, and other basement faults have been identified in southern New England. These faults were generally active during the Allegheny Orogeny 286 to 245 million years ago (CH2MHill, 1996). According to the USGS (2004b), there are no faults or folds within at least 25 miles of the proposed project that have been active during the Quaternary (from 1.8 million years ago to today). Furthermore, the low to moderate level of seismic activity that occurs in the project area has not been associated with movement on any specific fault.

The above indicates that the potential for surface faulting to occur in the project area is low. The proposed facilities would be constructed to meet or exceed applicable engineering standards and building codes, further reducing any potential damage that could occur in the highly unlikely event of surface faulting in the project area.

Soil Liquefaction

Secondary seismic effects triggered by strong ground shaking are often more serious than the shaking itself. One such secondary effect, soil liquefaction, is a physical process in which saturated, cohesionless soils temporarily lose their bearing strength when subjected to strong and prolonged shaking. Soil liquefaction can also lead to other ground failures, including settlement and lateral spreading.

The previous site-specific geoseismic study of the proposed LNG terminal concluded that some site soils could liquefy if subjected to the shaking caused by the estimated maximum earthquake for the site, a magnitude 5.75 event (CH2MHill, 1996). This event has a return period in excess of 2,500 years; therefore, the potential for earthquake-induced liquefaction to occur at the proposed LNG terminal site is low.

Largely because of static stability concerns with existing site soils (see section 4.1.4.2), the recent geotechnical study recommended that KeySpan LNG construct the heavy process area equipment such as heaters and recondensers on deep pile foundations. These pile foundations should be installed to competent soils at depths of at least 50 to 100 feet below existing grade (GZA, 2004). Pile foundation systems are also recommended, and planned by KeySpan LNG, for construction of the offloading platform and other marine structures. The recommended piling systems would be installed to address static stability concerns, but they would also serve to avoid or reduce the potential effects of soil liquefaction, although soil liquefaction is very unlikely to occur at the site.

Because the risk of a strong earthquake in the project area is low, the potential for soil liquefaction to occur along the proposed pipeline is low. Additionally, due to their strength and ductility, modern steel pipelines can span considerable distances unsupported without soil liquefaction threatening the integrity of the pipeline.

Tsunamis

Tsunamis are long oceanic waves generally caused by seismic activity. While a tsunami could potentially occur along the East Coast of the United States, only two Atlantic Ocean tsunamis have ever been recorded: a tsunami that struck Lisbon, Portugal in 1755 and one that struck eastern Canada in 1929. The probability of a significant tsunami occurring along the East Coast is very low (NOAA, 2003); therefore, tsunamis would not pose a significant risk to the project.

4.1.4.2 Load Bearing Capacity

A site-specific geotechnical investigation was conducted at the proposed process equipment and marine structure areas. This investigation included 11 standard penetration tests (SPTs) and 5 cone penetrometer test (CPT) locations. SPT borings ranged from 1.5 to 174 feet in depth, and CPT borings ranged from 19 to 71 feet deep (GZA, 2004) The geotechnical analysis concluded that soils in the process area would not provide suitable support for the heavy load structures proposed for installations in those areas without significant soil correction or foundation treatment. As discussed in section 4.1.4.1, the geotechnical study recommends that KeySpan LNG construct the process area equipment on deep pile foundations, thereby avoiding or reducing settlement or load-bearing capacity concerns with site soils to

acceptable levels. Site-specific geotechnical analysis was also used in designing the pile foundations for the proposed offloading platform and marine structures.

Keyspan LNG has committed to implementing the recommended foundation systems, although current foundation designs (GZA, 2004) must be finalized in conjunction with the final designs of the project equipment and structures. To provide us an opportunity to determine that the final design ensures the stability of the proposed process area equipment, offloading dock, breasting and mooring dolphins, and all other waterfront structures, **we recommend that:**

- **KeySpan LNG file all final foundation designs for all LNG facility upgrade components with the Secretary for review and written approval of the Director of OEP <u>prior to construction</u>.**

The proposed LNG and pipeline facilities are located in a developed area of low relief, with a low susceptibility and occurrence of landslides (USGS, 1999). Therefore, it is unlikely that landslides or other forms of mass wasting would affect the proposed facilities.

4.1.4.3 Subsidence

Regional subsidence is most often caused by significant groundwater use or petroleum production. The proposed project is not located in an area of known regional subsidence and none of the proposed facilities overlie or cross any underground mines or karst areas. Therefore, it is unlikely that subsidence or localized land surface collapses would affect the proposed facilities.

4.1.4.4 Flooding

Storm surge, the abnormal rise in sea level due to the wind and pressure forces associated with hurricanes and other tropical storms, is often the most significant cause of damage to facilities and property in low-lying coastal areas. Five Category 3 or greater hurricanes have made landfall in southern New England in the last 700 years (Donnelly, et al., 2000). In modern times, the Category 3 Great New England Hurricane of 1938 struck at high tide and generated storm surges of 12 to 15 feet in Narragansett Bay, flooding downtown Providence under a storm surge of nearly 20 feet (NOAA, 1996). Downtown Providence was again flooded in 1954, when Category 3 Hurricane Carol generated storm surges of over 14 feet in the upper reaches of Narragansett Bay. After Hurricane Carol, the City of Providence constructed a wall to prevent future flooding of the downtown area by tropical storm surge.

Existing site grades range from 9 to 33 feet above MLLW, with the 33-foot elevation occurring on the top of the containment berm around the existing LNG storage tank. The majority of the site is relatively flat, with elevations ranging from 10 to 15 feet above MLLW. The current Federal Emergency Management Agency Flood Insurance Rate Map for the KeySpan LNG Project site indicates that the 100-year flood elevation for the site is 18.68 feet above MLLW. Therefore, portions of the existing site are lower than the predicted water level associated with a 100-year flood event, and could be flooded during such an event. To reduce the potential for flooding to affect the site, KeySpan LNG proposes to raise all low areas of the site to elevations above the 100-year base flood elevation. Proposed alterations to the LNG site include installation of additional storm water catchment basins tied to a new outfall to the Providence River, which would further reduce the potential for flooding to affect the site.

Flash flooding could cause temporary construction delays and localized erosion. However, the potential for flash flooding to occur and significantly affect construction or operation of the proposed project is low. The greatest potential for flash flooding to occur would be during a tropical storm or severe frontal storm. Such storms are usually accompanied by significant precipitation over a short

period of time. The potential effects associated with high rainfall events during construction of the projects would be mitigated by implementing the FERC Plan and Procedures. After construction of the KeySpan LNG Project, significant precipitation would be diverted to the Providence River by way of the facility's upgraded storm water management system.

4.1.5 Paleontological Resources

It is unlikely that the proposed project would encounter or affect materials of paleontological significance due to the presence and depth of man-made fill and the relatively recent unconsolidated sediments that are present at the LNG terminal and along the pipeline route.

4.2 SOILS AND SEDIMENTS

4.2.1 Soil Resources

LNG Facilities

Soils underlying the existing KeySpan LNG facility site are mapped as Udorthents–Urban land complex. This complex consists of moderately well drained to excessively drained soils that have been disturbed by cutting or filling and areas that are covered by buildings and pavement. The mapping unit is about 70 percent Udorthents, 20 percent Urban land, and 10 percent other soils. No bedrock has been identified at or near the surface of the project site.

The proposed activities at the LNG terminal would have minimal impacts on soils because construction would be contained within the existing LNG plant. There are no active agricultural fields, residential areas, or wetlands present on the site. The ground surface is primarily covered with gravel and stone, and no topsoil is present. Despite the absence of conditions such as steep slopes, wetlands, and agricultural land, there is potential for erosion due to sediment discharge from temporary soil stockpiles into catch basins and storm drains located close to work areas. KeySpan LNG would implement a soil erosion control plan based on applicable local soil erosion control requirements and the applicable portions of the FERC's Plan. KeySpan LNG has indicated that it will file this plan with the FERC when it is completed.

Soils at the KeySpan LNG Project site are contaminated due to historical industrial operations at and near the site. In particular, a former manufactured gas plant that was present at the site from 1910 until 1954 produced coal gas, carbureted water gas and, to a limited extent, high-BTU oil gas. By-products of the process included coke, coal tar, ammonia, toluene, and benzene.

KeySpan LNG reviewed DEM files pertaining to the site and found that extensive investigations have been conducted with DEM approval since 1994. These investigations have included the installation of numerous soil borings, test pits, and monitoring wells coupled with laboratory analysis of soil and groundwater samples primarily for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), petroleum, metals, and polychlorinated biphenyls (PCBs). The extent of soil contamination varies across the site, ranging vertically from the ground surface to below the water table and extending over large portions of the site. Groundwater quality beneath the site is discussed in section 4.3.1.

In 1998, the DEM approved a Remedial Action Work Plan (RAWP) that defined the remedial objectives for the site, including objectives for surface soils (0-2 feet below ground surface), subsurface soils (greater than 2 feet below ground surface) within 100 feet from the Providence River shoreline, and subsurface soils more than 100 feet from the Providence River shoreline. Two major soil remedial actions have occurred at the site since approval of the 1998 RAWP. In 1999, Algonquin LNG, Inc.

(ALNG), which owned and operated the LNG facility at the time, excavated contaminated soil from an area southeast and adjacent to the truck offloading facility and from an area within the containment dike, adjacent to the LNG tank sub-impoundment. The second major soil remedial action occurred in 2002 when ALNG removed contaminated soil from between the north waterfront and the truck offloading facility. Other areas of contaminated soil have been covered with various materials including clean sand, crushed stone, and rip-rap.

While remedial actions have removed surficial contaminated soil from the site to the extent practicable, some site soils that exceed applicable DEM criteria remain, especially along the northern and eastern access roads that surround the LNG containment berm, within the truck offloading area, and within the southwestern-most portion of the site. Soils in these areas are primarily contaminated by metals, SVOCs, and petroleum.

Due to the presence of contaminated soils at the site, KeySpan LNG would submit an RAWP for the proposed project, including the draft Soil Management Plan filed in appendix 7B of KeySpan's application, to the DEM for review and approval prior to construction. Other agencies that may review elements of the RAWP include the local health department, the Providence Fire Department, and the Providence Emergency Response Agency. The RAWP would include methods for handling, storing, and disposing of contaminated soils generated during excavation activities as well as measures to minimize worker exposure to contaminated areas. As part of its RAWP, KeySpan LNG would wet soil stockpiles when needed to reduce dust production, wind erosion, and sedimentation. KeySpan LNG would use polyethylene sheeting and hay bales to minimize water erosion and sedimentation. Hay bales would also be stacked around catch basins and storm drains in order to minimize sediment discharge.

In conclusion, contaminated soil could be encountered during construction of the proposed KeySpan LNG facilities. To mitigate potential impacts associated with existing contaminated soils at the site, KeySpan LNG would implement the measures identified in its RAWP. By obtaining state and local approval of its RAWP and adhering strictly to the RAWP provisions, KeySpan LNG could safely manage existing contaminated soil at the site during construction of the proposed project. To allow the Commission the opportunity to review the mitigation measures in the RAWP, **we recommend that**:

- **<u>Prior to construction</u>, KeySpan LNG file with the Secretary a copy of its DEM-approved RAWP.**

Pipeline Facilities

According to published soils information (USDA, 1981), the entire proposed pipeline route, the meter station and pig launcher at the LNG terminal, and the tap valve and pig receiver at the tie-in with the Algonquin G-12 Lateral are underlain by fill material mapped as Udorthent–Urban land complex. About 79 percent of the pipeline route would be within the Allens Avenue and Henderson Street road corridors. The meter station would be within the KeySpan LNG facility, and the tap valve would occupy less than 1 acre of land on U.S. Generating property. Because the pipeline facilities would be located in areas that have been previously disturbed and/or paved, the impacts of construction on soils are expected to be minimal.

<u>Hydric Soils/Prime Farmland</u>

The project area contains no hydric soils, which reduces the potential for rutting and compaction associated with construction in saturated soils. There are no areas within the proposed project area that are classified as prime farmland.

Erosion

Erosion is a continuing natural process that can be accelerated by human disturbance. Factors that influence the degree of erosion include soil texture, soil structure, length and percent of slope, vegetative cover, and rainfall or wind intensity. Soils most susceptible to erosion are typified by bare or sparse vegetative cover, noncohesive soil particles with low infiltration rates, and moderate to steep slopes. Clearing, grading, and equipment movement could accelerate the erosion process and, without adequate protection, result in discharge of sediment to waterbodies and wetlands.

The potential for erosion as a result of pipeline construction is difficult to determine due to the presence of impervious land surfaces and the lack of consistent soil features within the Udorthents mapping unit. As noted previously, despite the absence of conditions such as steep slopes, wetlands, and agricultural land, there is potential for erosion due to sediment discharge from temporary soil stockpiles into storm drains along roadways. Algonquin proposes to use stovepipe construction techniques for pipeline construction along roadways, which would minimize erosion potential associated with soil stockpiles. Algonquin would implement its ESCP to further minimize potential erosion impacts.

Soil Contamination

Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment could adversely affect soils. Algonquin has developed an SPCC Plan that is designed to minimize the frequency and volumes of spills and leaks. Additionally, Algonquin's SPCC Plan specifies cleanup procedures in the event that soil contamination does occur from spills or leaks of fuel, lubricants, coolants, or solvents.

The City of Providence has documented the presence of contaminated soil along or near Allens Avenue between approximate MPs 0.3 and 1.1 of the proposed pipeline (GZA, 2003). Obvious indications of contamination were observed in 6 of the 14 sampling locations in the area, including 2 locations along the western side of Allens Avenue near MPs 0.4 and 0.6. Laboratory analysis also identified the following compounds in soil samples:

- Total petroleum hydrocarbons (TPH) were detected in 16 of the 28 samples which field screening suggested were impacted, indicating that field screening instrumentation is a useful tool in identifying TPH-contaminated soil in the area. Nine of the 28 samples had TPH concentrations above the DEM's Method 1 Residential and/or Industrial Direct Exposure criteria.

- Only one VOC, 1,1,2-trichloroethane, was detected in one soil sample at a concentration exceeding the DEM's Method 1 Residential and/or Industrial Direct Exposure criteria.

- SVOCs were detected in most soil samples, but only three samples contained SVOCs at concentrations exceeding the DEM's Method 1 Residential and/or Industrial Direct Exposure criteria.

- No pesticides or PCBs were detected in any of the soil samples.

To further evaluate the potential to encounter contaminated soil along the pipeline route, Algonquin searched various environmental regulatory databases including but not limited to the federal Superfund list, the DEM Spills List, and the State Leaking Underground Storage Tank database. Soil contaminants identified at the various sites include petroleum, VOCs, metals, and PCBs. See section 4.3.1 for further discussion of known and potentially contaminated sites along or near the pipeline route.

Based on the City of Providence study and the regulatory file reviews performed by Algonquin, it appears likely that contaminated soil would be encountered during construction of the proposed pipeline. During a September 28, 2004 meeting with DEM staff, Algonquin presented its plan to conduct additional field investigations for contamination within the construction right-of-way. The plan met with DEM approval. After collecting and analyzing these data, Algonquin will prepare and submit an SGMP to the DEM for approval. The DEM staff informed Algonquin that the SGMP would need to describe management of contaminated soil including excavation, stockpiling, transport, and disposal, as well as dewatering activities and a limited work plan referencing handling and management procedures for unforeseen subsurface conditions. The DEM also noted that as part of the approval process, the SGMP would be placed in public notice in the newspaper for public comment and would be reviewed by the DEM Offices of Waste Management and Water Resources. Algonquin would incorporate the SGMP into its ESCP prior to construction. By conducting site-specific investigations of the route and implementing a DEM-approved plan for the management of contaminated soil, Algonquin would avoid or minimize the potential to exacerbate existing contamination conditions and provide for the safety of its construction workers. To allow the Commission the opportunity to review the mitigation measures in the SGMP, **we recommend that**:

- **<u>Prior to construction</u>, Algonquin file with the Secretary a copy of its DEM-approved SGMP.**

4.2.2 Sediments

Aquatic sediments in the vicinity of the KeySpan LNG Project site are considered contaminated (COE, 2001). As currently configured, no dredging would be required for the KeySpan LNG Project, and therefore the project would not disturb a significant volume of the contaminated sediment. However, a spud barge would be used during construction of the marine facilities. The use of spuds to anchor the construction barge would result in some direct impacts on the channel bottom, and removal and repositioning of the spuds would result in suspended sediment and turbidity. The water quality effects of the turbidity and suspended sediment are discussed in section 4.3.2. Impacts on the channel bottom and benthic organisms are discussed in section 4.6.2.

4.3 WATER RESOURCES

4.3.1 Groundwater

Regional Groundwater Quality and Quantity

The most productive and widely used groundwater resources in Rhode Island are part of the surficial aquifer system (USGS, 1995). In the project area, the surficial aquifer system consists of glacially derived, unconsolidated layers of sand and gravel outwash or ice contact deposits. These aquifers are typically unconfined, of small areal extent, and less than 100 feet thick, although they occur as more extensive sheet-type deposits in some parts of New England.

Throughout New England, the depth to the surficial aquifer system ranges from 10 feet to more than 150 feet below the ground surface. Yields from wells utilizing the aquifer are highly variable, commonly ranging from 10 to 1,000 gpm, but exceeding 3,000 gpm in some wells. Groundwater quality in the surficial aquifer system is generally adequate for most uses. The USGS (1995) reported that the average concentration of dissolved solids in 209 samples obtained from surficial aquifers was 75 parts per million, which is substantially less than the maximum limit of 500 parts per million for public water supply recommended by the EPA. However, the system is often susceptible to contamination because it is shallow and unconfined.

Where the surficial aquifer system is absent in Rhode Island, groundwater may be obtained from crystalline bedrock aquifers. Water well depths in the crystalline bedrock aquifers range between 100 and 400 feet. Well yields range from 1 to 20 gpm and water quality is adequate for most uses. The USGS (1995) indicates that sedimentary bedrock units are not important fresh groundwater resources in Rhode Island.

Groundwater Conditions in the Project Area

The surficial aquifer in the project area occurs at a depth closely corresponding to the water level in the adjacent Providence River. Water levels observed in soil borings and monitoring wells indicate that groundwater occurs at depths of 8 to 20 feet below ground surface at the KeySpan LNG facility site, and at depths of 7 to 10 feet along the pipeline route. Groundwater flow beneath the project area is generally toward the Providence River, and water elevations adjacent to the river reflect tidal variation. Water quality in the surficial aquifer is brackish due to proximity to the Providence River which, at the reach of the project area, is an estuary of the Atlantic Ocean. All groundwater within 0.5 mile of the proposed project is classified by the State of Rhode Island as "GB," which is defined as groundwater known or presumed to be unsuitable for public or private drinking water use without treatment.

Groundwater beneath the KeySpan LNG facility site is contaminated due to historical industrial operations at and near the site, which included a manufactured gas plant from 1910 until 1954. ALNG conducted remedial investigations and remedial actions with DEM oversight, including soil excavations and capping of portions of the site. Various non-chlorinated VOCs were detected in groundwater samples obtained from seven monitoring wells located at and adjacent to the site in September 2003. With the exception of benzene and naphthalene, VOC concentrations were below DEM GB Groundwater Objectives. Benzene was detected in one well at a concentration of 0.219 milligrams per liter (mg/L), 0.079 mg/L above the GB Groundwater Objective of 0.14 mg/L. Naphthalene was detected in one well at a concentration of 14.8 mg/L, 12.04 mg/L above the derived GB Groundwater Objective of 2.76 mg/L. Groundwater remediation has not been required or performed at the site, although three recovery wells were installed to potentially aid in the recovery of light non-aqueous phased liquid (LNAPL) should it be observed above recovery threshold guidelines.

The City of Providence discovered contaminated groundwater along or near Allens Avenue between approximate MP 0.3 and MP 1.1 of the proposed pipeline route (GZA, 2003). LNAPL was observed in 3 of the 14 sampling locations in the area, including 1 location along the western side of Allens Avenue near proposed MP 0.4. Groundwater samples were analyzed for VOCs and metals. VOCs were detected in 8 of the 14 groundwater samples. Benzene was the most commonly detected VOC, occurring in six samples typically at concentrations less than 15 micrograms per liter. Benzene in a sample collected near MP 0.3 was also the only VOC detected at a concentration higher than the Rhode Island Method 1 GB Groundwater Objective.

To further evaluate the potential to encounter contaminated groundwater in the pipeline right-of-way, Algonquin searched environmental regulatory databases including but not limited to the federal Superfund list, DEM Spills List, and the State Leaking Underground Storage Tank database. The initial database searches identified over 290 sites within 0.3 mile of the route where there have been documented releases of oil and/or hazardous materials, cleanup operations, and/or have registered underground or aboveground storage tanks. Based on this initial review, Algonquin reviewed public files pertaining to 21 properties along Allens Avenue with potentially contaminated soil and groundwater. On July 14, 2004, the DEM provided written comments to the Secretary of the Commission identifying known and potentially contaminated sites along the proposed pipeline route. The DEM list of known and potentially contaminated sites was similar to the information obtained by Algonquin, but included five additional

sites not previously identified by Algonquin. Table 4.3.1-1 summarizes information provided by both Algonquin and the DEM regarding known and potentially contaminated sites along or near the pipeline route. Contaminants identified at the various sites include petroleum, VOCs, metals, and PCBs. Given the proximity of these properties to Allens Avenue and the City of Providence investigation results discussed in the preceding paragraph, it is likely that shallow, contaminated groundwater would be encountered during construction of the proposed pipeline.

Sole Source Aquifers

There are no EPA or state designated sole source aquifers in the project area. The EPA defines a sole or principal source aquifer as one that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. EPA guidelines also stipulate that these areas can have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend upon the aquifer for drinking water (EPA, 2004).

Public and Private Water Supply Wells and Springs

Drinking water for the City of Providence is provided by the Providence Water Supply Board (Providence Water), which obtains its drinking water supply from a surface water reservoir located approximately 8 miles west of the project area.

Data contained in the Rhode Island Geographic Information System (RIGIS) databases indicate that there are no potable public or private wells within at least 2 miles of the KeySpan LNG facility or within 0.5 mile of the pipeline route (RIGIS, 2004). KeySpan LNG sent requests to the DEM Water Resources Board, the Rhode Island Department of Health, and Providence Water to determine whether public or private wells exist in the project vicinity. The responses from these agencies indicate that no public or private water resources are known to exist within 8 miles of the KeySpan LNG Project site. The project would not affect any state-designated wellhead protection areas (DEM, 1999).

RIGIS information indicates that there are no springs within 0.5 mile of the proposed project.

Impacts of Project Construction and Operation on Groundwater

LNG Facilities

KeySpan LNG would construct its facility upgrades without excavation into the surficial aquifer, and thus would avoid contact with contaminated groundwater. Deep foundation piles are proposed for the LNG ship mooring and unloading system, and as noted in section 4.1.4.2, KeySpan LNG has stated that it would also use deep foundation piles for heavy equipment to be installed in the LNG process areas in accordance with the findings of its geotechnical analysis. Some pilings would be installed into the shallow water table aquifer at the site. Installation of the piles would not be expected to have any significant, long-term effect on groundwater conditions at the site. As noted previously, KeySpan LNG would submit a RAWP, which would include its draft Soil Management Plan, to the DEM for review and approval prior to construction. By implementing an approved RAWP, KeySpan LNG would avoid or minimize significant impacts on groundwater quality and protect worker health during construction activities in the portion of the site that has a history of contamination. KeySpan LNG would also take precautions to protect and preserve existing monitoring or recovery wells at the site.

TABLE 4.3.1-1

Known and Potentially Contaminated Properties Along the Proposed Pipeline Route

Property Owner Name	Address	Property Location and Pipeline Milepost Reference	Site Type	Known/Potential Contaminants
New England Gas Transmission (formerly Providence Gas Company)	642 Allens Avenue	Property crossed by pipeline route between MP 0.06 and MP 0.28	State Hazardous Waste Site (HWM); multiple spills (SPILLs)	Petroleum, PAHs, VOCs, PCBs
Motiva Enterprises LLC (formerly Texaco/STAR Enterprises)	540 Allens Avenue	Property is located on the eastern side of Allens Avenue near MP 0.28	SPILL; Leaking Underground Storage Tank (LUST)	Petroleum
Motiva Enterprises LLC (Formerly STAR Enterprises)	520 Allens Avenue	Property is located on both sides of Allens Avenue between MP 0.28 and MP 0.58	HWM; SPILLs; Federal Superfund (SFA)	Petroleum
Formerly J. Broomfield & Sons	473 Allens Avenue	Property is located on western side of Allens Avenue near MP 0.45	Three USTs permanently closed	Former tank contents not identified by DEM
Bowen Investments (formerly Mr. Donut)	460 Allens Avenue	Property is located on eastern side of Allens Avenue near MP 0.6	Not identified	Contaminants not identified by DEM but are not subject to DEM remediation regulations
Boliden Metrec Inc.	434 Allens Avenue	Property is located on the eastern side of Allens Avenue between MP 0.6 and MP 0.66	HWM; SFA	PCBs
Warren Oil Co. (formerly Drake Petroleum)	355 - 375 Allens Avenue	Property is located on the western side of Allens Avenue between MP 0.66 and MP 0.73	SPILL; LUST	Petroleum
Walco Electric Co.	303 Allens Avenue	Property is located on the western side of Allens Avenue between MP 0.73 and MP 0.76	SPILLs	Petroleum
Maffeo, Angelo C. (formerly NYNEX/Bell Atlantic)	288 Allens Avenue	Property is located on the eastern side of Allens Avenue between MP 0.83 and MP 0.85	LUST	Petroleum
Dads Realty LLC (formerly Ryder Truck Rental/United Truck Leasing)	287 Allens Avenue	Property is located on the western side of Allens Avenue between MP 0.85 and MP 0.87	LUST	VOCs, PAHs, lead
Spur Track Properties, LLC (formerly Scialo)	257 Allens Avenue	Property is located on the western side of Allens Avenue near MP 0.9	LUST	Contaminant not identified by DEM
Stablex RI Inc. (formerly Northland Environmental, Inc.)	252 & 275 Allens Avenue	Property is located on both the eastern and western side of Allens Avenue between MP 0.88 and MP 0.95	SFA (no further response action planned)	Sept. 1992 Preliminary Assessment-Plus (Final Report) indicates primary hazardous wastes received, treated and stored on site were alkaline, cyanide and acid. No releases from spills and/or leaks to site soil or groundwater, or the atmosphere, requiring further federal or DEM-mandated action were reported in the Sept. 1992 report.

TABLE 4.3.1-1 (cont'd)

Known and Potentially Contaminated Properties Along the Proposed Pipeline Route

Property Owner Name	Address	Property Location and Pipeline Milepost Reference	Site Type	Known/Potential Contaminants
Red Bridge Properties, Inc.	242 Allens Avenue	Property is located on the eastern side of Allens Avenue between MP 0.95 and MP 0.96	HWM	PCBs
Narragansett Improvement Co.	223 Allens Avenue	Property is located on western side of Allens Avenue near MP 1.05	Two USTs permanently closed, two USTs active	Tank contents not identified by DEM
City Tire Co., Inc.	210/230 Allens Avenue	Property is located on the eastern side of Allens Avenue between MP 1.04 and MP 1.06	HWM; LUST	Petroleum
Cargil Inc. (formerly Northeast Petroleum Corp.)	170 Allens Avenue	Property is located on the eastern side of Allens Avenue between MP 1.07 and MP 1.15	LUST; 10 USTs permanently closed	Petroleum
Sprague Energy	144 Allens Avenue	Property is located on the eastern side of Allens Avenue between MP 1.15 and MP 1.33	HWM; LUST	Petroleum
Sterling Offset Neg. Co.	564 Eddy Street	Property is located on Eddy Street approximately 250 feet north-northwest of MP 1.33	LUST	Petroleum
GMCO Acquisition, Inc. (formerly George Mann & Co.)	175 Terminal Road	Property appears to be located across Terminal Road from MP 0	Four USTs permanently closed	Former tank contents not identified by DEM

KeySpan LNG would avoid or minimize the potential for other construction-related activities at the LNG facility to affect groundwater by implementing applicable construction techniques as set forth in the FERC Plan and Procedures. Potential impacts on groundwater associated with the use of oils, lubricants and other hazardous substances during construction and subsequent operation of the LNG Terminal would be minimized by KeySpan LNG's compliance with federal regulations related to fuel transport, handling, and spill response procedures, and its implementation of a project-specific SPCC Plan. Finally, construction and operation of the KeySpan LNG terminal would not require the use of groundwater. Construction and operation water needs would be met by Providence Water, which obtains its water from a surface water reservoir.

Pipeline Facilities

Based on the City of Providence study and the regulatory file reviews performed by Algonquin, it appears likely that contaminated groundwater would be encountered during construction of the proposed pipeline. Algonquin intends to conduct additional field investigations for contamination within the construction right-of-way. Algonquin will prepare and submit a SGMP to the DEM for approval after obtaining and analyzing these additional data. As discussed in more detail in section 4.2.1, Algonquin has met with DEM staff to discuss its field investigation plan and the DEM's requirements for the SGMP. Groundwater extracted during trench dewatering may require treatment prior to discharge to the ground surface or a permitted drainage system. Groundwater extracted from areas where the reintroduction of untreated water could exacerbate undesirable site conditions may be pumped into fractionation tanks for storage pending laboratory analysis. During the preparation of its SGMP, Algonquin plans to discuss with the DEM a protocol for field evaluations to determine the need for fractionation tanks and/or treatment of contaminated groundwater prior to discharge. By conducting site-specific investigations of the right-of-way and implementing DEM-approved methods for managing contaminated groundwater and soil, Algonquin would avoid or minimize the potential to exacerbate existing contamination conditions and would provide for the safety of site workers.

Other pipeline construction activities could result in minor, temporary impacts on shallow groundwater resources in proximity to the proposed pipeline. These impacts could include increased turbidity, groundwater level fluctuations, short-term disruption of recharge, localized flow along the pipeline trench, contamination from a spill or leak of hazardous substances, and decreased water yield. Algonquin would avoid or minimize potential impacts by implementing the construction methods and mitigation measures set forth in its ESCP and SPCC. Finally, construction and operation of the pipeline would not require the use of groundwater. Water needs for construction and operation of the pipeline would be met by the City of Providence public water system, which obtains its water from a surface water reservoir.

4.3.2 Surface Water

Watershed Descriptions

The KeySpan LNG terminal site is located within the Providence and Seekonk Rivers Watershed.[1] This watershed is deemed unsuitable as a water supply due to the urban nature of the area and the high nutrient loads in the Providence River. The closest water supply watershed is the Scituate Reservoir, which is located approximately 8 miles west of the project site within the Pawtuxet River Watershed.

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[1] The Blackstone River is 46 miles long and runs from Worcester, Massachusetts to Pawtucket, Rhode Island, where it becomes the Seekonk River at the Main Street Dam. From that point, the river flows to Narragansett Bay.

The proposed LNG facility upgrade would be located adjacent to the Providence River. The Providence River originates at the confluence of the Woonasquatucket, Moshassuck, and Seekonk Rivers in Providence and discharges to Narragansett Bay. River flow is dominated by the Seekonk River; the Moshassuck and Woonasquatucket rivers only contribute about 5.5 and 9.5 percent of the total flow, respectively. Average yearly discharge from the three rivers is about 869 cubic feet per second (cfs) (USGS, 2004c, 2004d, 2004e), although flows vary seasonally. Monthly mean discharge values for the Seekonk River range from a high of 1,429 cfs in April to a low of 306 cfs in August. Peak discharge from the Moshassuck and Woonasquatucket rivers occurs in March and the lowest flow conditions typically occur in July and August, respectively. Water circulation in the river is dominated primarily by tides. The tide range in the Providence River averages 4.5 feet (NOAA, 2004a).

The federal navigation channel within the Providence River runs from Providence Harbor to Narragansett Bay, has a design depth of 40 feet MLLW, and varies in width from about 1,700 feet at the north end of the Fox Point Reach to about 600 feet downstream of the LNG terminal site. The width of the channel adjacent to the LNG terminal site is about 1,500 feet.

Waterbody Classifications

The Providence River is classified by the DEM as a Class SB1 water. Designated uses for SB1 waters are primary and secondary contact recreation, shellfish harvesting for controlled relay and depuration, fish and wildlife habitat, aquacultural uses, navigation, and industrial cooling. Primary contact recreational activities in SB1 waters may be affected due to pathogens from approved wastewater discharges.

The river waters adjacent to the project site have been assigned a partial use designation by the DEM. A partial use designation is generally assigned where waters are affected by activities such as combined sewer outfalls and concentrations of vessels. A partial use designation indicates that uses such as primary contact recreational activities, shellfishing uses, and fish and wildlife habitat may be restricted.

Surface Water Resources Impacts and Mitigation

LNG Facilities

Construction of the LNG facility upgrade could temporarily affect surface water quality in the Providence River during installation of the marine facilities (i.e., ship mooring facilities, unloading platform, and cement unloading pier) and during the discharge of hydrostatic test water. In addition, without effective mitigation, surface water runoff from clearing and grading at the LNG terminal site or spills of hazardous substances from construction equipment could potentially affect water quality in the Providence River.

Construction of the marine facilities would be completed using pile driving cranes, hammers, and other heavy equipment operated from a work barge moored adjacent to LNG terminal site. The work barge would be stabilized by the use of "spuds," or open steel pipe, which would extend into the river bed to anchor the barge. Following the installation of the piles, the walkways and concrete trestle would be installed. Installation of the spuds and piles would disturb the river bottom and result in suspension of sediment, possibly including contaminated sediment present in this part of the river. However, these impacts would be localized, temporary, and short term, and would not be expected to affect water quality beyond the duration of construction. No dredging would be required to complete the installation. Impacts of the proposed water-based facilities on aquatic resources are discussed further in section 4.6.2.

Construction of the proposed on-shore LNG upgrades could potentially affect water quality in the Providence River due to stormwater runoff. To minimize water quality impacts, KeySpan LNG would implement mitigation measures consistent with those in our Plan and Procedures, and would implement its RAWP as discussed in section 4.2.1. In addition, KeySpan LNG would be required to obtain permit coverage under the Rhode Island Pollution Discharge Elimination System (RIPDES) program for stormwater discharges. Implementation of the measures specified in these plans and permit conditions would control erosion and prevent or minimize stormwater runoff into the river.

A spill of fuel, oil, or other hazardous substance within the Providence River could adversely affect water quality. In accordance with the FERC Procedures, KeySpan LNG would prepare and implement an SPCC Plan that would identify measures related to fuel transport, handling, and spill response procedures.

Operational impacts of the upgraded LNG facility could potentially include temporary increased suspended sediments and turbidity within the navigation channel due to propeller wash from LNG ships and tugboats. KeySpan LNG would develop vessel transport protocols in coordination with the Coast Guard that may include slowing of vessels' propellers in shallower waters to minimize the effects of propeller wash. Water quality might also be affected by the taking on of ballast water during offloading of LNG. Potential impacts of propeller wash and water withdrawals for ballast are discussed further in section 4.6.2.

An LNG spill into the Providence River is another potential impact that could occur during operation of the LNG terminal. We consider an LNG spill into the river to be unlikely, but if such a spill were to occur, the cryogenic liquid would vaporize rapidly upon contact with the warmer air and water. The LNG, which is less dense than water, would float on the surface before vaporizing. Because LNG is not soluble in water and the LNG would completely vaporize shortly after being spilled, there would be no liquid left that could mix with and/or contaminate the water. Therefore, water quality would not be affected by an LNG spill.

Pipeline Facilities

The pipeline facilities would be constructed within existing roadways and industrial properties. The pipeline would not cross any waterbodies. Spoil excavated during pipeline installation would be susceptible to erosion, which could result in sediment being carried by stormwater into the Providence River. Algonquin would obtain and comply with the requirements of an RIPDES construction stormwater permit, and would implement the measures contained in its ESCP to minimize the potential for erosion, especially spoil sidecast on impervious surfaces. These measures include, but are not limited to, installing and maintaining sediment barriers to prevent silt-laden water from entering storm sewers. In addition, Algonquin would restore disturbed areas following construction. Because the majority of the pipeline route would be installed within existing road rights-of-way, restoration would include repaving areas disturbed during construction.

Although Algonquin's ESCP is consistent with the FERC Procedures, Algonquin requested approval to use workspace within less than 50 feet of the Providence River for construction of the meter station and also for use of the staging area on the Boliden Metric property. Algonquin states that the workspace associated with the meter station would be necessary to permit construction of the meter station at the appropriate location within the existing KeySpan LNG facility for interconnection with the other system components. Based on the revised alignment sheets that Algonquin submitted with its comments on the draft EIS, it appears that the construction workspace associated with construction of the meter station and approximately the first 300 feet of pipeline (until the alignment rejoins that shown on the originally submitted alignment sheets) would be located within approximately 15 to 35 feet of the

river. The site is relatively flat, and Algonquin would install erosion and sediment control measures to prevent sediment from entering the river.

Algonquin did not specify a proposed minimum setback at the Boliden Metric property staging area. It appears from the alignment sheet that use of the entire site would potentially result in a setback from the river as little as 10 feet at some locations. If Algonquin were required to comply with the 50-foot setback requirement at this staging area, the setback would potentially reduce this 5.22 acre workspace by up to 1.16 acre, or about 22 percent. Although Algonquin states that its proposed staging areas are the minimum size necessary to conduct the pipeline facilities safely, the company did not provide a further justification in response to our data request for why it could not implement the 50-foot setback.

Our Procedures require the project sponsor to provide a site-specific construction plan and a site-specific explanation of the conditions that will not permit a 50-foot setback. To ensure that appropriate mitigation would be implemented at both locations, and that the less than 50-foot setback is necessary for the staging area, **we recommend that:**

- **Algonquin submit to the Secretary for review and written approval of the Director of OEP additional detail and justification as to why a less than 50-foot setback is necessary at the staging area on the Boliden Metric property and describe what specific measures would be implemented at the staging area and at the meter station site to protect the river from erosion and sedimentation. Algonquin should file this information <u>prior to construction.</u>**

Hydrostatic Testing

<u>LNG Facilities</u>

KeySpan LNG would obtain water for hydrostatic testing of the proposed new process system piping from the City of Providence water distribution system. KeySpan LNG estimates that approximately 100,000 gallons of water would be required to complete the testing. Following the testing, water would be discharged into the Providence River via a new outfall. KeySpan LNG is not expected to require a hydrostatic test water discharge permit because the pipe to be tested would be new pipe and the test water would be from a municipal source. No chemicals would be added to the test water and KeySpan LNG would conduct hydrostatic test water discharges in accordance with the FERC Procedures, which include regulation of discharge rates, use of energy dissipation devices, and installation of sediment barriers as necessary to prevent erosion, streambed scour, or suspension of sediments. Therefore, hydrostatic testing of the LNG facility upgrades would be unlikely to result in adverse impacts on water quality.

<u>Pipeline Facilities</u>

Algonquin would conduct hydrostatic testing of the pipeline using approximately 120,000 gallons of water from either a municipal source (hydrant) or from the Providence River. Algonquin would not use chemical additives in the hydrostatic test water and would conduct testing in accordance with its ESCP, which would include regulating discharge rates and using an energy dissipation device at the discharge point to prevent erosion of land or scouring of the river bottom. If water is appropriated from the Providence River, the intake would be screened with wire mesh to prevent the entrainment or impingement of aquatic species. Algonquin would prepare a hydrostatic test plan prior to construction and obtain the applicable regulatory approvals prior to conducting the hydrostatic test. In its July 14, 2004 letter, the DEM noted that it would need to review and approve Algonquin's plan prior to issuance

of the Water Quality Certification. Because hydrostatic test water would only come in contact with new piping and no chemicals would be added to the test water, we do not expect the discharge of hydrostatic test water to result in adverse impacts on water quality.

4.4 WETLANDS

KeySpan LNG and Algonquin reviewed the RIGIS wetlands data and conducted field reviews for wetlands. These investigations determined that there are no wetland resources within the area that would be disturbed during construction of the proposed LNG facility upgrades or the pipeline facilities (RIGIS, 1988). FERC staff reviewed and concurs with these findings. Because no wetlands are present in the area, the project would not affect wetland resources.

4.5 VEGETATION

Land cover at the LNG terminal site includes paved, concrete, or gravel surfaces such as roads, sidewalks, parking areas, and structures. Adjacent properties where temporary facilities (e.g., offices, staging, and parking areas) would be located during construction are also industrial areas. The sites of the temporary and permanent facilities are, for the most part, devoid of vegetation. Isolated areas within the terminal site contain sparse amounts of vegetation including Bermuda grass, pepperweed, goldenrod, little bluestem, wild carrot, and fox tail grasses. The proposed marine facilities would be located in the Providence River immediately adjacent to the LNG facility. Potential impacts on aquatic resources are discussed in section 4.6.2 of this draft EIS.

The proposed pipeline facilities would be located in a developed commercial/industrial area. The meter station, the permanent access road to the meter station, and the first 0.3 mile of the pipeline route would be constructed within the existing KeySpan LNG facility site and the adjacent industrial NEGC property. The majority of the route, between MPs 0.3 and 1.43, would be within existing road corridors with no vegetation. Between MPs 1.43 and 1.44 and at the tap valve site the route would cross industrial property owned by U.S. Generating, including about 0.17 acre that contains maintained (mowed) herbaceous growth. The four temporary staging areas and ATWS, which include vacant industrial lots and parking lots, do not contain vegetation.

Vegetation Impacts and Mitigation

Due to the lack of significant vegetation at the LNG terminal site, construction and operation of the proposed LNG facility upgrades would not adversely affect vegetation.

Construction impacts on vegetation along the pipeline route would be limited to the 0.17 acre of herbaceous growth located at the end of the route. Permanent impacts would be confined to the approximately 0.08 acre fenced tap valve site. The remainder of the disturbed vegetated area would revert to pre-construction condition following construction. Algonquin would plant shrubs along the boundary of the tap valve site to provide visual screening.

4.6 WILDLIFE AND AQUATIC RESOURCES

4.6.1 Wildlife Resources

The project area is characterized by urban fill soils, industrial development, impervious surfaces, and sparse vegetation. Wildlife that would be expected at the site reflects the urban nature of the general area and includes species that have adapted to an urban setting.

Birds that may be observed in the project area are American robins, black-capped chickadees, blue jays, common grackles, starlings, English sparrows, rock doves, mourning doves, mockingbirds, and other species. Common mammals include the big-brown bat, eastern cottontail, gray squirrel, house mouse, white-footed mouse, Norway rat, raccoon, and striped skunk. An occasional eastern American toad or eastern garter snake may also be seen in this area.

The proposed ship berth and offloading facilities would include the west edge of the Providence River. Section 4.6.2 of this EIS describes fish and other aquatic species known to inhabit this area and potential impacts on aquatic resources.

Wildlife Resources Impacts and Mitigation

Construction of the project would result in localized, short-term, and temporary alteration of urban wildlife habitat. More mobile species such as birds and some mammals would be temporarily displaced from the construction areas to similar adjacent habitats, although the developed nature of the project area limits the habitat value both within and adjacent to the proposed construction areas. Some wildlife displaced by construction would return to the restored areas and adjacent undisturbed habitats soon after completion of construction. Less mobile species, such as small mammals, reptiles, and amphibians could be killed or injured by construction activities.

Operation of the LNG terminal would have minimal impact on terrestrial wildlife. The project would not significantly alter the existing industrial setting and, although activities at the ship berth and unloading area would be heightened during offloading of LNG ships, activities conducted on the site would generally be similar to existing activities. Operation of the pipeline facilities would not likely affect wildlife species given the urban nature of the route and would not involve the type of right-of-way maintenance typically required for cross-country pipelines with maintained rights-of-way.

Given the industrial setting, limited wildlife habitat, and the fact that the species known to be present in the area are habituated to an urban environment, the project would not have a significant effect on terrestrial wildlife. KeySpan LNG and Algonquin would further minimize impacts on wildlife resources by adhering to the FERC Plan and Procedures and Algonquin's ESCP, respectively.

4.6.2 Aquatic Resources

Providence River and Narragansett Bay

The Providence River and Narragansett Bay provide habitat for a diverse community of finfish, shellfish, and other organisms. Because the Providence River is a major tributary to Narragansett Bay and home to the Port of Providence, the aquatic resources within the river and bay are relatively well known and often studied. The DEM, the University of Rhode Island, Save the Bay, and the Manchester Street Power Station have all contributed to an understanding of the aquatic resources of the river.

The Manchester Street electric power station located 1 nautical mile upstream from the proposed LNG facility has funded aquatic resource studies for a number of years as a condition of its intake and discharge permit. These studies began in 1992 and currently include samplings of phytoplankton, periphyton (microflora that grow attached to submerged surfaces), zooplankton, ichthyoplankton, and sessile macroinvertebrate populations in the Providence and Seekonk Rivers. Finfish impingement data at the power station have been monitored since 1975. Information about aquatic resources in the project area that has been gathered from the various studies is summarized below.

Finfish

Adults and Juveniles

Fish impingement studies conducted in 2003 in association with the Manchester Street Station identified a total of 48 finfish species in the river (Marine Research, Inc. (MRI), 2004b). Six species accounted for 94 percent of the fish impinged, with Atlantic menhaden, silver hake, winter flounder, Atlantic silverside, Atlantic herring, and white perch accounting for 49, 24, 10, 4, 4, and 3 percent, respectively. Nine species from the Representative Important Species list were not among the numerical dominants in the 2003 impingement collections. These included tautog, weakfish, alewife, mummichog, blueback herring, black sea bass, striped bass, rainbow smelt, and bay anchovy. Each of these species was represented in the current year's collections although only seven striped bass, seven rainbow smelt, and one bay anchovy were collected. Winter flounder is probably the most important species in the project area because of its year-round residence and its importance to the commercial and recreational fisheries. The 2003 survey conducted by the DEM for juvenile fish in Narragansett Bay, which included two sampling stations in the Providence River, identified a total of 19 and 17 species at Gaspee Point and Conimicut Point, respectively (Powell, 2003), all of which were also identified in the Manchester Street Station impingement studies.

Dam installation during the last century has resulted in the extirpation of local populations of anadromous fish, including American shad, alewives, blueback herring, Atlantic salmon, rainbow smelt, sea-run brook trout, white perch, and shortnose sturgeon. Therefore, Rhode Island has developed an anadromous fish strategic restoration plan to restore anadromous fish species to those Rhode Island coastal streams where habitat was lost. The Providence and Blackstone Rivers support several of the aforementioned anadromous fish species, each of which will likely migrate past the KeySpan LNG site. The strategic plan will potentially restore, establish, or enhance anadromous fish populations through upstream passage for migrating adults and downstream passage for juveniles (Erkan, 2002).

Fish Eggs and Larvae

Ichthyoplankton samples have been collected from the Providence River using bongo net tows on a number of occasions to provide information on abundance, distribution, and seasonal occurrence of eggs and larvae of estuarine fish. Relatively recent studies of the ichthyoplankton found in the Providence River were conducted in 1972-1973 (Bourne and Govoni, 1988), 1989-1990 (Keller et al., 1999), and 1992-present/ongoing (MRI, 2004a).

MRI (2004a) sites are 1 nautical mile upstream, with three Providence River stations near the Point Street Bridge and one Seekonk River station. A total of 29 species of fish were represented in February through October 2003 Providence and Seekonk River ichthyoplankton samples. Numerical dominants among fish eggs collected in 2003 included tautog/cunner, fourbeard rockling, bay anchovy, and Atlantic menhaden. Numerical dominants among fish larvae included winter flounder, grubby, tautog, seaboard goby, Atlantic tomcod, anchovy, Atlantic silverside, rock gunnel, and river herring. The proximity to freshwater tributaries, including the Blackstone, upper Seekonk, Woonasquatucket, and Moshassuck Rivers, was apparent in the occasional but regular appearance of freshwater species such as white sucker and golden shiner (MRI, 2004a).

Ichthyoplankton entrainment sampling for the Manchester Street Station was conducted approximately 25 times a year during each year from 1992 to 2003. The array of species collected in ichthyoplankton entrainment sampling for the Manchester Street Station in 2003, particularly the numerical dominants, indicates that the area around Manchester Street is predominantly marine and estuarine. Occasional but regular appearance of freshwater fish species includes white sucker and golden

shiner. Larval yellow perch, sunfish, crappies, and carp have also appeared in some ichthyoplankton collections at the Manchester Street Station. Species like the silver hake and Atlantic mackerel are more indicative of marine waters and are likely to have drifted up the river with the tide from Narragansett Bay (MRI, 2004c).

Table 4.6.2-1 summarizes fish species identified in the project area as represented by eggs, larvae, juveniles, or adults based on the combined results of several of the studies referenced above.

Benthic Communities

Shellfish (Quahogs)

A total of 30 rocking-chair dredge tows in five Providence River reaches were completed in December 1999 in conjunction with permitting for the Providence River and Harbor Maintenance Dredging Project (Battelle, 2000). Table 4.6.2-2 provides the mean abundance of quahogs collected during these tows. The abundance of quahogs among tows within each surveyed reach varied considerably. As shown in the table, the highest quahog densities were found within the Sabin Point, Rumstick Neck, and Bullock Point Reaches. The maximum densities reported (approximately $0.7/m^2$) were substantially lower than the average value (approximately $7.3/m^2$) reported for the Rumstick Neck Reach area by Gibson in 1999.

Bycatch

In addition to quahogs, bycatch benthos were collected in December 1999 from the 30 rocking-chair dredge tows mentioned above in three Providence River reaches. Among the most abundant non-quahog organisms collected were the dwarf surf clam, blue mussel, and sea stars, although each species was very patchily distributed. Several crustaceans were collected, with spider crabs, blue crabs, and green crabs among the most common. Shell hash was present in most tows and was present in larger quantities in Rumstick Neck and Bullock Point Reaches (Battelle, 2000).

TABLE 4.6.2-1

Ichthyoplankton, Juveniles, and Adults of Selected Taxa Collected in 1999 and 2003

Species (Common and Scientific Names)	1999		2003	
	Ichthyoplankton	Adult/Juveniles	Ichthyoplankton	Adults/Juveniles
African pompano				X
Alectis ciliaris				
Alewife	X	X	X	X
Alosa pseudoharengus				
American eel	X	X	X	X
Anguilla rostrata				
American plaice			X	
Hippoglossoides platessoides				
American sand lance				X
Ammodytes americanus				
American shad		X		
Alosa sapidissima				
Anchovies	X		X	X
Anchoa spp.				
Atlantic cod	X	X	X	
Gadus morhua				
Atlantic herring	X	X	X	X
Clupea harengus				
Atlantic menhaden	X	X	X	X
Brevoortia tyrannus				
Atlantic moonfish		X		X
Selene setapinnis				
Atlantic silverside	X	X	X	X
Menidia menidia				
Atlantic tomcod	X	X	X	X
Microgadus tomcod				
Banded killifish		X		
Fundulus diaphanus				
Bay anchovy	X	X	X	X
Anchoa mitchilli				
Black crappie		X		X
Pomoxis nigromaculatus				
Black sea bass		X		X
Centropristis striata				
Blueback herring	X	X	X	X
Alosa aestivalis				
Bluefish		X		X
Pomatomus saltatrix				
Bluegill		X	X	X
Lepomis macrochirus				
Blue runner		X		
Caranx chrysos				

TABLE 4.6.2-1 (cont'd)

Ichthyoplankton, Juveniles, and Adults of Selected Taxa Collected in 1999 and 2003

Species (Common and Scientific Names)	1999		2003	
	Ichthyoplankton	Adult/Juveniles	Ichthyoplankton	Adults/Juveniles
Brown Trout *Salmo trutta*				X
Butterfish *Peprilus triacanthus*	X	X		X
Conger eel *Conger oceanicus*		X		
Crevalle jack *Caranx hippos*		X		X
Cunner *Tautogolabrus adspersus*	X	X	X	X
Fourbeard rockling *Enchelyopus cimbrius*	X		X	
Fourspine stickleback *Apeltes quadracus*				X
Fourspot flounder *Paralichthys oblongus*	X	X		X
Gizzard shad *Dorosoma cepedianum*		X		X
Goby *Gobiosoma Spp.*				X
Golden shiner *Notemigonus crysoleucas*			X	X
Grubby *Myoxocephalus aenaeus*	X	X	X	X
Hogchoker *Trinectes maculatus*	X	X	X	X
Largemouth bass *Micropterus salmoides*		X		X
Little skate *Raja erinacea*		X		X
Longhorn sculpin *Myoxocephalus octodecemspinosus*			X	
Lookdown *Selene vomer*				X
Lumpfish *Cyclopterus lumpus*		X		
Mullet *Mugil spp.*				X
Mummichog *Fundulus heteroclitus*	X	X		X
Northern kingfish *Menticirrhus saxatilis*	X	X		X
Northern pipefish *Syngnathus fuscus*	X	X	X	X

TABLE 4.6.2-1 (cont'd)

Ichthyoplankton, Juveniles, and Adults of Selected Taxa Collected in 1999 and 2003

Species (Common and Scientific Names)	1999		2003	
	Ichthyoplankton	Adult/Juveniles	Ichthyoplankton	Adults/Juveniles
Northern searobin *Prionotus carolinus*	X			X
Oyster toadfish *Opsanus tau*		X		X
Pollock *Pollachius virens*				X
Pumpkinseed *Lepomis gibbosus*		X		X
Radiated shanny *Ulvaria subbifurcata*	X			
Rainbow smelt *Osmerus mordax*	X	X		X
Rock gunnel *Pholis gunnellus*	X	X	X	
Sand lance *Ammodytes sp.*	X		X	
Scup *Stenotomus chrysops*		X		X
Seaboard goby *Gobiosoma ginsburgi*	X		X	
Seasnail *Liparis atlanticus*	X		X	
Silver hake *Merluccius bilinearis*	X	X		X
Smallmouth flounder *Etropus microstomus*	X	X		X
Spot *Leiostomus xanthurus*				X
Spotted hake *Urophycis regia*		X		X
Striped anchovy *Anchoa hepsetus*				X
Striped bass *Morone saxatilis*		X		X
Striped cusk-eel *Ophidion marginatum*		X		
Striped killifish *Fundulus majalis*		X		X
Striped searobin *Prionotus evolans*	X	X	X	X
Summer flounder *Paralichthys dentatus*	X	X		X
Tautog *Tautoga onitis*	X	X	X	X

TABLE 4.6.2-1 (cont'd)

Ichthyoplankton, Juveniles, and Adults of Selected Taxa Collected in 1999 and 2003

Species (Common and Scientific Names)	1999		2003	
	Ichthyoplankton	Adult/Juveniles	Ichthyoplankton	Adults/Juveniles
Threespine stickleback *Gasterosteus aculeatus*		X		X
Weakfish *Cynoscion regalis*	X	X	X	X
White crappie *Pomoxis anularis*	X			
White perch *Morone americana*	X	X	X	X
White sucker *Catostomus commersoni*	X		X	
Windowpane *Scophthalmus aquosus*	X	X	X	X
Winter flounder *Pleuronectes americanus*	X	X	X	X
Wrasses *Labridae Spp.*	X		X	
Yellowtail flounder *Limanda ferruginea*	X			

Notes:

- Adult and juvenile information summarized from Marine Resources, Inc. ongoing impingement studies at Manchester Street Station and DEM (Powell) summary of species occurrence for 2003.
- Ichthyoplankton information gathered from Marine Resources, Inc. 2004 and Keller *et. al.,* 1999.
- An X indicates the species was present in one of the studies conducted during the referenced year.

TABLE 4.6.2-2

Mean Abundance of Northern Quahog in the Providence River Reaches, December 1999

Station	Mean Number of Clams Collected	Mean Density (Clams/m^2)
Rumstick Neck Reach	19.2	0.14
Conimicut Point Reach	13.8	0.1
Bullock Point Reach	17.6	0.14
Sabin Point Reach	35	0.25
Fuller Rock Reach	0	0
Rumstick Neck Channel	9	0.07
Conimicut Point Channel	9.5	0.05

Previous Studies

Results from earlier studies of the Providence River identified four patterns of distribution of benthic organisms (Pratt, 1997). A group of species including dog welk (*Nassarius sp*.) and polychaetes (*Mediomastus sp*. and *Pectinaria sp*.) was uniformly distributed. Polychaetes *Polydora ligni* and *Eumida sp*. and slipper shell *Crepidula spp*., which made up a second group, were abundant only on shallow or undredged bottom. Species adapted for sandy bottom were polychaetes *Phoronis sp*. and *Phyllodoce arenae* and bivalve *Tellina sp*. Bivalves *Macoma tenta, Mulinia sp*., *Yoldia sp*. and polychaete *Nephtys insisa* were most abundant in the relatively deep waters of the Providence River.

Macroinvertebrates

As part of the Manchester Street Station sampling program, MRI collected sessile macroinvertebrates in the Providence and Seekonk Rivers each year from 1992 to 2003, at monthly intervals from February through November, using Hester-Dendy samplers. A total of 28 different taxa were collected in samplers during this 12-year period. A consistent core group of species has persisted at all stations from 1992 to 2003. The data demonstrate that a stable community exists in the area. Numerically, this community is dominated by crustacean and annelid species. Among the annelids and oligochaetes, two polychaetes (*Polydora ligni* and *Nereis succinea*) have been consistently abundant in both the Providence and Seekonk Rivers. The most numerous and widely distributed crustacean species include balanoid barnacles and a group of gammarid amphipods: *Corophium insidiosum, Gammarus mucronatus, G. fasciatus, Ampithoe valida*, and *Melita nitida. C. insidiosum* is tubiculose whereas the others are epibenthic, semi-pelagic species. The ascidian *Molgula manhattenensis* (sea grape) has been an important member of the epiphyte community at all stations yearly, predominantly in the July-October period (MRI, 2004a).

Impingement sampling at the Manchester Street Station, which includes enumeration of invertebrates, has been conducted annually since April 1992. Results have been highly variable but suggest an increasing trend of abundance for blue crabs and bay shrimp. Other species that have been impinged include green crabs, which have been variable over the sampling period, and lady crabs, which were impinged in 2003 in numbers similar to estimates made for lady crabs in 1993, 1994, 2000, and 2002 (MRI, 2004b).

Aquatic Resources Impacts and Mitigation

LNG Facilities Construction and Operation

The project would involve installation of a new LNG berth and unloading facilities. These marine facilities would be supported by 33 steel pipe columns or piers ranging from 30 to 96 inches in diameter, which would be driven into the river bed. Together these piles would disturb and occupy about 450 ft^2 of the river bed. The piers would support the unloading platform, trestle, and a cement unloading dock, which in total would encompass about 6,480 ft^2 and be about 25 feet above MLLW. The other structures of the terminal that would be supported by the piles, including the breasting dolphins, mooring dolphins, and interconnecting walkways, would encompass 2,823 ft^2 and would have decks made of steel beams and gratings that would be partially open and 22 feet above MLLW. These facilities would shade the water to varying degrees. A small area of water would also be shaded temporarily by the work barge that would be used to construct the terminal facilities.

The water quality of the Providence River is currently degraded by upstream discharges and runoff. As discussed in section 4.3, stormwater runoff from the construction site could also increase suspended sediment and turbidity levels near the site. Disturbance near the water's edge by construction equipment and the resulting temporary increase in turbidity could lower fish usage in the immediate vicinity of the site. Construction of the proposed ship berth and unloading facility would also contribute to further degradation of water quality through increases in turbidity, potential releases of chemical and nutrient pollutants from sediments, and potential introduction of chemical contaminants, such as fuel and lubricants from equipment operating in and over the water. Turbidity resulting from the resuspension of sediments during pile driving could reduce light penetration and the corresponding primary production of aquatic plants, algae, and phytoplankton. Additionally, the resuspension of organic materials and sediments could cause an increase in biological and chemical use of oxygen, resulting in a decrease of dissolved oxygen concentrations in the affected area. Lower dissolved oxygen concentrations could cause a temporary displacement of motile organisms and may stress or kill sessile benthic organisms within the affected area.

The construction of a new ship berth and unloading facility, particularly pile driving, would also propagate underwater noise energy, which could harm fish or temporarily reduce fish usage of the area. Additionally, the piles driven into the riverbed to support the new terminal facilities would permanently affect about 450 square feet of benthic habitat. Benthic invertebrates provide a food source for demersal species of finfish during part or all of their life cycles. Direct alteration of the benthic substrate by pile driving would disturb the existing benthic community and could affect prey species, suitable cover, settlement structure, and/or nursery and spawning areas in the immediate vicinity of the work area.

None of the above described effects would likely be significant because only a small area would be affected by construction. Additionally, the majority of these effects would be short term and limited to the construction period. Pioneering benthic invertebrates would likely recolonize the affected area soon after completion of construction. Aquatic species that are mobile would likely avoid construction activities and temporarily relocate to adjacent areas. There are several piers and other structures both upstream and downstream of the proposed site that could be used as habitat by fish disturbed by construction activities. Additionally, when completed, the new ship berth and unloading facility would provide additional structural habitat in the project area.

Other potential effects on aquatic organisms during construction and operation of the proposed LNG facilities could include entrainment or impingement of fish during water withdrawals, mortality from toxic substances (e.g., fuel spills), increased turbidity and the resuspension of sediments during LNG vessel movements, and the introduction of invasive species by LNG ships.

KeySpan LNG has indicated that it would not use water from the Providence River to hydrostatically test the new LNG facilities. However, about 8 to 11 million gallons of river water would be withdrawn during operations for ship ballast during the unloading of each LNG ship. These withdrawals could entrain and/or impinge larvae and eggs, particularly if the withdrawals occur where a preponderance of larvae or eggs are present. 2003 data from the ongoing Manchester Street station aquatic resource studies indicate that ichthyoplankton are present at the nearest sampling station to the KeySpan LNG facility, which is located about 1 nautical mile upstream of the project site. Based on the 2003 data, ichthyoplankton densities vary seasonally, with the greatest density of eggs occurring during the period between about May and July (eggs produced by winter-spawning species tend to stick to the substrate rather than be suspended in the water column and are therefore neither collected during sampling nor subject to entrainment). Larval densities peak in early spring for winter-spawning species such as winter flounder and in mid-summer for species that spawn in spring.

If we assume that ichthyoplankton densities at the proposed ship berth area are similar to those at the Manchester Street Station sampling location for each of the representative important species studied there, the 2003 data indicate that the number of eggs that might be affected by withdrawals for ship ballast ranges from 0 in late fall and winter to a maximum of 1.3 to 1.8 million eggs in mid-June for withdrawals of 8 to 11 million gallons, respectively. Using the same assumptions, the potential to entrain or impinge fish larvae is greatest from about April through July, and ranges from 0 in late fall and winter to a maximum of about 62,000 and 86,000 larvae during withdrawals of 8 to 11 million gallons, respectively, in July. In 2003, winter flounder larvae were present from late March through early June and constituted between 2 and 99 percent of the total larvae collected during this period. While the above data provide some indication of potential impacts associated with withdrawals for ship ballast, it is important to note that ichthyoplankton densities are difficult to interpret because natural mortality rates are very high, and few eggs or larvae typically survive to become fish.

Studies completed for the Manchester Street Station include annual equivalent adult calculations that convert numbers of fish eggs and larvae entrained and impinged to numbers of adult fish assuming various survival rates for each life stage. These calculations were completed for thirteen representative important species found in the area. In 2003 the estimated potential loss of equivalent adult fish amounted to 70,000 for those key species. Somewhat more than three quarters of that total (79 percent) resulted from entrainment of silversides, a species that completes its life cycle in about 1 year. Scaling directly from mean flow at Manchester Street Station to Providence River ballast water volumes of 8 to 11 million gallons per ship suggests that eggs and larvae entrained as well as any small fish drawn in with the ballast water might result in the loss of 7 to 9 equivalent adult fish. Fifty to 60 ships would equate to an annual total loss of 339 to 559 adult fish. Based on the 2003 collection data, approximately 87 percent of these fish would likely be small forage species like silversides and bay anchovy. The remaining 13 percent might consist of winter flounder, tautog, and weakfish. The relative effect of these losses would be small and would total only about 0.5 to 0.8 percent of the entrained losses measured for the Manchester Street Station.

Table 4.6.2-3 summarizes the number of eggs and larvae potentially entrained or impinged due to LNG ship ballast water withdrawals and the number of age-1 equivalent and equivalent adult fish these numbers represent assuming a maximum of 60 ships annually drawing 11 million gallons per delivery. The actual potential for entrainment or impingement of ichthyoplankton during withdrawals for ship ballast would depend on a variety of factors, including but not limited to the time of year and the distribution of the ichthyoplankton within the water column relative to the intakes for the ballast water.

TABLE 4.6.2-3

Estimated Numbers of Fish Eggs and Larvae, Equivalent Age 1 Fish, and Equivalent Adults Potentially Entrained by LNG Ship Ballast Water Intakes Annually [a/]

Species	Eggs	Larvae	Age 1 Equivalents	Equivalent Adults
River Herring	0	862	<1	<1
Atlantic Menhaden	16,674	18,845	21	1
Atlantic Herring	0	466	2	1
Bay Anchovy	826	190,036	43	43
Rainbow Smelt	0	122	1	<1
Silver Hake	0	0	0	0
Mummichog	0	88	2	<1
Silverside	506	110,376	442	442
Striped Bass	0	0	0	0
Black Sea Bass	0	50	2	<1
Weakfish	0	21,648	3	2
Tautog	9,653,528	81,505	6	4
Winter Flounder	3,979	223,809	550	64
Totals	9,675,514	647,807	1,067	559

[a/] Figures in the table are based on 60 LNG ships per year and 11 million gallons of ballast water per ship. Icthyoplankton densities are based on 2003 data from the Manchester Street Station.

Direct spills of petroleum products into the Providence River from construction equipment working on the berth and unloading facility could be toxic to fish. To reduce the potential for direct surface water contamination during construction and dredging, KeySpan LNG would implement an SPCC Plan. This plan would include provisions that prohibit the storage of fuel and other potentially toxic materials within specified distances of waterbodies and procedures for refueling equipment that are designed to minimize potential spills. The SPCC plan would also outline procedures for containing, cleaning up, and reporting spills.

As noted by the DEM (DEM, 2004c), during operation of the LNG terminal, prop wash from LNG ships and tugboats could also temporarily increase suspended sediments and turbidity within the navigation channel and turning area. As a vessel navigates through a waterway, it generates hydraulic disturbances in the form of waves and currents, mainly drawdown, return current, slope supply currents, wash waves, and jet wash (Wolter and Arlinghaus, 2003). These activities have the potential to resuspend sediments and subsequently deposit them. Impacts associated with prop wash would occur 100 to 120 times a year when ships transit the navigation channel en route to and from the KeySpan LNG facility. Prop wash could affect the substrate within and adjacent to the navigation channel and could limit the recolonization of benthic species in those areas. Potential indirect effects of vessel movement through the waterway could include disturbances preventing fish from nest guarding (Mueller, 1980; cited in Wolter and Arlinghaus, 2003) or feeding (Barrett et al., 1992; cited in Wolter and Arlinghaus, 2003), and dislodgement of eggs and redistribution of eggs and larvae in less suitable habitats (Hofbauer, 1965; Jude et al., 1998; cited in Wolter and Arlinghaus, 2003). Dislodgement and redistribution of eggs into less suitable habitats could lower the reproductive success of affected fish species.

Modeling was conducted for the Boston Harbor Navigation Improvement Project to assess the effect of ship passage on the resuspension of surface sediments in the federal shipping channels. The results of this modeling were included in the Final Environmental Impact Report (FEIR)/FEIS that was prepared by the COE and Massachusetts Port Authority in 1995. The modeling was developed based on the dredged dimensions of the improved channel and information collected during interviews with pilots regarding the operation of various types of vessels. The analysis modeled the effects of an LNG tanker, a

container ship, a 41,000-dead-weight-ton tanker, an ocean tug, and a harbor tug (tractor tugs were not assessed). The modeling assumed a channel depth of 45 feet and varying vessel drafts from 12 to 42 feet. The study concluded that silt, the predominant grain-size of the surface sediments assessed in the model, can be resuspended by currents as slow as 0.65 feet per second. The study also found that bottom velocities generated by cargo vessels passing at slow speeds through the harbor can exceed this value up to 1,312 feet astern of the vessel and that tugs can generate bottom velocities above this value up to 656 feet astern of the vessel. Turning areas were found to be particularly susceptible to this influence. The results indicated that the surface sediments in the federal channels and berth areas are subject to resuspension during virtually every ship passage. However, the results also indicated that ship induced bottom velocities dissipate rapidly following the passage of the ship and that sediments resuspended by these currents settle back to the substrate after being transported relatively short distances (COE, 1995). Once suspended, fine particles may be more susceptible to resuspension as other ships pass through the channel (Schoellhamer, 1996).

Following completion of the Boston Harbor Improvement Project, the COE conducted additional studies to monitor the effect of deep-draft vessel movement on the resuspension of bottom sediments (SAIC, 2000; SAIC, 2001). These studies used static and mobile monitoring techniques to evaluate the impact of the passage of the LNG carrier *Matthew* on bottom sediment resuspension from the confined aquatic disposal (CAD) cells along a portion of the Mystic River downstream of the Distrigas facility as well as material resuspended from other parts of the channel. CAD cell M8-11 was not capped with coarse-textured sediment during these monitoring studies. Therefore, the data for the area surrounding this cell should provide reasonable estimates of the potential resuspension of the fine-textured sediments along the Providence River navigation channel and Providence harbor area, although prop wash and other hydrologic effects associated with the KeySpan LNG Project could be somewhat greater because, due to the depth of the channel and the drafts of the various sized LNG ships, the LNG ships calling on the KeySpan LNG facility may have less clearance between the hull and the seafloor than was the case in the COE study. The COE also observed near-bottom sediment plumes and conducted TSS monitoring at two other locations within the Mystic River navigation channel south of the Inner Confluence.

Depending on the monitoring location and the speed of the LNG ship as it passed the monitoring location, the near-bottom plume widths ranged from about 33 to 164 feet. Near the CAD cell, TSS levels extending up to about 7 feet above the channel bottom ranged from 350 mg/l as measured along the channel bottom at the time of ship passage to 40 mg/l about 3 minutes after ship passage as measured along transects perpendicular to the channel within the plume area. At the Inner Confluence, suspended sediment concentrations in the plumes ranged from 18 to 24 mg/l, almost one-half the levels observed near the uncapped CAD cell. The elevated TSS concentrations returned to near-background levels within about 7 minutes after the ship passed the static monitoring equipment at the bottom of the channel, and were found to have returned to background levels 1 hour after ship passage as measured by the mobile monitoring technique (SAIC, 2000; SAIC, 2001).

Based on observed TSS values in the vicinity of CAD cell M8-11, the authors conservatively estimated that as much as 2.6 cubic yards of sediment could have been mobilized by passage of the LNG tanker. Due to the generally weak near-bottom currents (about 0.16 feet per second) in the Mystic River study area, the authors further estimated that the suspended material could have been moved a distance of about 590 feet in one hour (SAIC, 2000). These studies demonstrate that sediment resuspension due to passage of deep-draft vessels can mobilize bottom sediments, but the volume of sediment resuspended is relatively small and the sediments are not transported far from their original locations. Ship movements within a navigation channel result in short-term water quality effects that generally dissipate within an hour of the vessel passing any particular point along the channel.

The potential for resuspended sediment to impact fish eggs and larvae depends upon the species, the concentration of particles, and the duration of exposure. Demersal eggs such as those of the winter flounder may be partially or completely covered by fine particles as those particles settle back to the bottom. This may slow the exchange of oxygen between the water and egg and therefore slow development or cause eggs to experience higher mortality rates (Wilbur and Clarke, 2001). Current research suggests that winter flounder eggs and larvae exposed to increased levels of sediment adjacent to dredging operations in the Providence River survived at statistically similar rates to controls (Klein-MacPhee et al., 2005). In related work, winter flounder eggs were buried at various depths ranging from 0.5 to 6 egg diameters in fine-grained clean and contaminated sediment (Berry et al., 2005). Hatching success decreased and incubation period increased with increasing burial depth in clean sediment. Conclusions with contaminated sediment were complicated by low control survival but eggs buried to 0.5 diameters fared about as well as controls. Overall results suggested that winter flounder eggs may be more resistant to burial than previously thought.

Exposure to high levels of TSS (between 200 and 500 mg/l) for durations of less than 24 hours has been shown to reduce feeding rates in some fish larvae (Breitburg, 1988). In general, however, exposure to increased turbidity for periods of less than a day appears to have little measurable effect on pelagic fish eggs and larvae (Kiorboe et al., 1981; Wilbur and Clarke, 2001). Based on the results of the Boston Harbor studies, the increased TSS levels resulting from LNG ship passage could result in reduced feeding rates for some fish larvae along the Providence River channel; however, minimal impact from elevated TSS levels would be expected for most pelagic fish eggs and larvae because TSS concentrations should return to background conditions within an hour or less of ship passage. Assuming ships arrive weekly many eggs will hatch before a second exposure and many larvae will develop sufficiently to avoid stressful sediment concentrations, particularly during the warmer months. The measured widths of the resuspended sediment plumes in the Boston Harbor studies suggest that the plumes would remain within the Providence River navigation channel because that channel ranges from 600 to about 1,500 feet in width. Based on the initial monitoring in the Mystic River, the sediment plume did not rise above mid-water elevations (i.e., the plume was not observed at the water surface, and monitoring equipment indicated a maximum water column elevation of about 20 feet above the channel bottom). The dimensions of the monitored plumes in Boston Harbor suggest that impacts to demersal fish eggs and larvae outside the channel by remobilized sediments would likely be limited.

LNG ships that call on the KeySpan LNG terminal would use an existing, dredged federal navigation channel that is maintained specifically for the purpose of allowing passage by large vessels. KeySpan LNG has not proposed any mitigation measures to avoid or minimize impacts that could result from prop wash or other vessel effects. However, in response to our data request on this issue, KeySpan LNG noted that impacts of prop wash could be minimized through management of vessel transit in shallow locations, including slowing vessels' propellers and the use of tugs (which have propellers and thrusters located at shallower depths). Vessel transport protocols would be included in plans to be developed by KeySpan LNG, BG LNG, and the Coast Guard.

LNG ships calling from international ports could potentially introduce aquatic invasive species into U.S. waters. Alternatively, visiting LNG ships could transport native species to other parts of the world. Although the potential for this to occur cannot be entirely eliminated, several factors, both general and specific to the project, tend to mitigate this potential impact. First, the LNG ships would not discharge ballast water into the Providence River or Narragansett Bay, which would significantly reduce the potential to spread invasive aquatic species. Second, the LNG ships that would visit the proposed terminal would arrive from ports located primarily throughout the Atlantic region, which is also where the project is located. Third, Providence is not a new port and ships of all types originating from different ports have visited and will continue to visit Narragansett Bay and enter the Providence River.

Considerable effort and resources are being applied to minimize the movement of nonindigineous species around the globe by the marine industry. In February 2004, a new international convention to prevent the potentially devastating effects of the spread of harmful aquatic organisms carried by ships' ballast water was adopted by the IMO, the United Nations agency responsible for the safety and security of shipping and the prevention of marine pollution from ships. The convention requires all ships to implement a Ballast Water and Sediments Management Plan. All new ships will have to carry a Ballast Water Record Book and will be required to carry out ballast water management procedures to a given standard. Existing ships will be required to do the same, but after a phase-in period. With the adoption of this convention, the IMO has made global provisions to control and manage ships' ballast water and thus prevent, minimize, and eliminate the transfer of harmful aquatic organisms and pathogens.

The Coast Guard has developed responses to exotic invasive organisms associated with foreign vessels. The Coast Guard Office of Operating and Environmental Standards developed *Mandatory Practices For All Vessels with Ballast Tanks on All Waters of the United States*. The mandatory practices include requirements to rinse anchors and anchor chains during retrieval to remove organisms and sediments at their place of origin; remove fouling organisms from hull, piping, and tanks on a regular basis; and dispose of any removed substances in accordance with local, state, and federal regulations. The Coast Guard has also implemented a Shipboard Technology Evaluation Program (STEP) to encourage ship owners and operators along with technology developers to develop prototype treatment systems. To support investment in new technology, experimental treatment systems that function as designed may be deemed to meet future ballast water standards for up to the life of the treatment system or the life of the ship.

The Northeast Aquatic Nuisance Species Panel with its Ballast Water Committee is a regional committee of the Federal Aquatic Nuisance Species Task Force. The task force is an intergovernmental organization dedicated to preventing and controlling the introduction and spread of aquatic nuisance species by implementing the Nonindigenous Aquatic Nuisance Species Prevention and Control Act of 1990. That act was amended in 1996 as the National Invasive Species Act.

On the state level, Rhode Island drafted legislation in 2001 authorizing the Department of Environmental Management (DEM) to commence the process of developing a ballast water management plan for the State. In 2002 DEM produced a white paper summarizing available information on ballast water and its relationship to the introduction of invasive species. Rhode Island's CRMC is currently gathering additional information with the ultimate intent of drafting legislation to make an invasive species management plan mandatory.

Most recently, in February 2005, the Ballast Water Management Act of 2005 was introduced to congress to amend the Nonindigenous Aquatic Nuisance Prevention and Control Act to establish vessel ballast water management requirements. All ships entering U.S. ports would be required to have on board an aquatic species management plan outlining actions to minimize the transfer and introduction of invasive species. The Act details ballast water exchange requirements and subject to an implementation schedule ships will be required to treat ballast water prior to discharge in U.S. waters. Treated ballast water will be required to achieve minimum concentrations of planktonic organisms and indicator microbes.

We believe the measures and efforts described above would minimize the potential for the introduction of non-indigenous attached organisms via ship hulls or the potential to introduce planktonic and nektonic organisms into the Providence River or Narragansett Bay via ballast water.

Pipeline Construction and Operation

Algonquin's pipeline would not cross any waterbodies, but some areas of the construction right-of-way would be close to the Providence River. Potential impacts on fishery resources may include higher sedimentation and turbidity associated with stormwater runoff during construction, and the introduction of water pollutants into the river if there is a hazardous material spill near the river or if contaminated soils are uncovered during construction. Overall, the potential impact of these effects on aquatic organisms would be localized and short term. To minimize these potential impacts, Algonquin would adhere to the protective measures outlined in its ESCP, SPCC Plan, and plan for handling contaminated soils, which would include specifications for erosion controls and procedures for containing and cleaning up spills or discoveries of hazardous materials.

Essential Fish Habitat

The MSA (Public Law 94-265 as amended through October 11, 1996) was established, along with other goals, to promote the protection of EFH in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. EFH is defined in the MSA as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Federal agencies that authorize, fund, or undertake activities that may adversely impact EFH must consult with NOAA Fisheries. Although absolute criteria have not been established for conducting EFH consultations, NOAA Fisheries recommends consolidated EFH consultations with interagency coordination procedures required by other statutes, such as the NEPA, Fish and Wildlife Coordination Act, ESA, or the Federal Power Act (50 CFR 600.920(e)) in order to reduce duplication and improve efficiency. Generally, the EFH consultation process includes the following steps:

1) **Notification** - The action agency should clearly state the process being used for EFH consultations (e.g., incorporating EFH consultation into EIS, section 10 permit, etc.).

2) **EFH Assessment** - The action agency should prepare an EFH Assessment that includes both identification of affected EFH and an assessment of impacts. Specifically, the EFH should include: 1) a description of the proposed action; 2) an analysis of the effects (including cumulative effects) of the proposed action on EFH, the managed fish species, and major prey species; 3) the federal agency's views regarding the effects of the action on EFH; and 4) proposed mitigation, if applicable.

3) **EFH Conservation Recommendations** - After reviewing the EFH Assessment, NOAA Fisheries would provide recommendations to the action agency regarding measures that can be taken by that agency to conserve EFH.

4) **Agency Response** - Within 30 days of receiving the NOAA Fisheries recommendations, the action agency must respond to NOAA Fisheries. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. For any conservation recommendation that is not adopted, the action agency must explain its reason to NOAA Fisheries for not following the recommendation.

FERC staff proposes to consolidate EFH consultations for the KeySpan LNG Project with the EIS procedures required under NEPA. For purposes of reviewing this project under NEPA, the FERC is the lead federal agency. The FERC requests that NOAA Fisheries consider this draft EIS notification of initiation of EFH consultation. We will address the NOAA Fisheries comments and/or conservation recommendations to the draft EIS and the EFH Assessment in the final EIS.

Managed Fish Species

EFH designations tables identify potential EFH within the project area for 16 fish species. None of these managed stocks are endangered or threatened under the ESA. Table 4.6.2-4 summarizes the EFH required by these species by life history stage. This information was primarily obtained from NOAA Fisheries' *Essential Fish Habitat Source Documents* prepared for individual species. The primary categories of EFH for these species include water column, benthic habitats, and man-made structures. Prey for managed fish species comprise a critical component of EFH. Potential effects of the proposed project on these habitats and prey species are discussed below.

Potential Effects on EFH

The project would involve installation of a new LNG berth and unloading facilities as described above. The majority of potential impacts of the proposed activities on EFH would be similar to those impacts previously described in this section and in section 4.3.2. However, a discussion of those impacts directly related to designated EFH is included below. A summary of the impacts on managed fish species is included in table 4.6.2-5.

Water Column

The water column in the vicinity of the proposed LNG terminal serves as EFH for various life stages of several species and their prey by providing habitat for spawning, breeding, feeding, growth, and shelter. All the managed species use water column habitats at some point in their life cycle with the exception of the two species of skate. Additionally, prey species for many of these species also occur within the water column. KeySpan LNG's installation of piles and construction of the new LNG ship berth and unloading facilities would temporarily suspend sediments, increase the turbidity of the water locally, and propagate underwater noise energy. These activities would also potentially release contaminants contained within the sediments into the water column, and reduce dissolved oxygen concentrations by releasing oxygen-demanding materials (decomposing organic materials contained within the sediments). These effects, however, would be of short duration and limited to a relatively small area.

Seasonal migrations by managed fish species and their prey occur within the Providence River and Narragansett Bay. Generally, migratory fish populations can be affected by increased concentrations of suspended sediments, if sediment-disturbing activities occur during migratory periods. High concentrations of suspended sediment may delay or divert migratory passage and in some instances could cause total avoidance of an area by fish. These potential effects could be exacerbated if the migrating fish are in generally poor condition and under stress by other factors. Disturbance of migratory fish patterns, including disturbance of pelagic prey species migrations, could also adversely affect fish and their ability to find food resources. Decreased foraging success could have physiological effects on fish, including lowered reproductive rates, decreased competitive fitness, and increased risk of mortality.

TABLE 4.6.2-4

Summary of Essential Fish Habitat and General Habitat Parameters for the Providence River, Rhode Island [a/]

EFH Species	Life Stage	EFH Characteristics	Occurrence Season	Likelihood of Occurrence in Project Area [b/]
American plaice	Egg [c/]	surface waters <12 C; 30 - 90 m.	March - June	very low
Hippoglossoides	**Larvae**	surface waters <14 C; 30 - 130 m.	April - May	very low
platessoides	**Juvenile**	sand/gravel bottom <17 C, 45-150 m	Jan - Dec	very low
	Adult	sand/gravel bottom <17 C, 45-175 m	Jan - Dec	very low
	Spawning Adult	wide range of bottom types <14 C, < 90 m	March - June	very low
Atlantic herring	Egg	adhere to gravel/sand/cobble bottom <15 C, 20-80 m	July - November	very low
Clupea harengus	**Larvae**	pelagic waters, < 16 C, 50-90 m	August - April	medium
	Juvenile	pelagic waters, < 10 C, 15-135 m	January - December	medium
	Adult	pelagic waters, < 10 C, 20-130 m	January - December	medium
	Spawning Adult	gravel/sand/cobble bottom < 15 C, 20-80 m	July - November	very low
Atlantic mackerel	**Egg**	pelagic waters 5-23 C, shore to 15 m	May-June	medium
Scomber scombrus	**Larvae**	pelagic waters 6-22 C, 10-130 m	May-June	medium
	Juvenile	pelagic waters 4-22 C, shore to 320 m	May - September	medium-low
	Adult	pelagic waters 4-22 C, shore to 320 m	May - October	medium-low
	Spawning Adult	pelagic waters 5-23 C, shore to 15 m	May-June	very low
Black sea bass	Egg	estuaries	May - October	medium-low
Centropristis striata	Larvae	pelagic waters on structured inshore habitat (sponge bed)	May - October	medium-low
	Juvenile	Associated. with rough bottom, shellfish/eelgrass beds > 6 C	May - October	low
	Adult	estuaries or demersal waters, > 6 C	May - October	low
	Spawning Adult		May - October	very low
Bluefish	Egg	pelagic waters > 18 C	April-August	
Pomatomus salatrix	Larvae	pelagic waters > 18 C, >15 m	April- September	very low
	Juvenile	estuarine waters	June-October	very low
	Adult	estuarine waters	June-October	medium
	Spawning Adult	pelagic waters > 18 C	April-August	medium

TABLE 4.6.2-4 (cont'd)

Summary of Essential Fish Habitat and General Habitat Parameters for the Providence River, Rhode Island [a/]

EFH Species	Life Stage	EFH Characteristics	Occurrence Season	Likelihood of Occurrence in Project Area [b/]
Cobia	**Egg**	sandy shoals of capes, offshore bars, rocky bottom, and	June-August	very low
Rachycentron	**Larvae**	barrier island ocean-side waters including high salinity	June-August	very low
canadum	**Juvenile**	bays, estuaries, and seagrass habitat	June-September	low
	Adult		June-August	very low
	Spawning Adult		June-August	very low
Haddock	Egg	surface waters, < 10 C, 50-90 m	March-May	very low
Melanogrammus	**Larvae**	surface waters, < 14 C, 30-90 m	January-July	very low
aeglefinus	Juvenile	pebble gravel bottom, < 11 C, 35-100 m	January - December	very low
	Adult	broken ground/pebbles/smooth hard sand bottom < 7 C, 40-150 m	January - December	very low
	Spawning Adult	pebble gravel/gravelly sand bottom, < 6 C, 40-150 m	January-June	very low
King mackerel	**Egg**	sandy shoals of capes, offshore bars, rocky bottom, and	July - September	very low
Scomberomorus	**Larvae**	barrier island ocean-side waters including high salinity	July - September	very low
cavalla	**Juvenile**	bays, estuaries, and seagrass habitat	July - September	very low
	Adult		July - September	very low
	Spawning Adult		July - September	very low
Little skate	Egg	demersal, mud/sand/gravel, <27 m	April-May, September-November	very low
Leucoraja erinacea	**Juvenile**	demersal, 1-65 m	April-May, September-November	high
	Adult	demersal, 1-75 m		high
	Spawning Adult			very low
Red hake	Egg	surface waters <10 C	May-November	low
Urophycis chuss	**Larvae**	surface waters <19 C, <200 m	May-November	low
	Juvenile	bottom habitats w/ shell fragments <16 C, <100 m	May-November	low
	Adult	sand/mud bottom <12 C, 10-130 m	January - December	low
	Spawning Adult	sand/mud bottom <10 C, <100 m	May-November	low
Scup	**Egg**	estuary 55-73 F	May-August	medium
Stenotomus	**Larvae**	estuary 55-73 F	May-September	medium
chrysops	**Juvenile**	sand/mud/mussel and eelgrass beds in estuaries and bays >45 F	summer-spring	medium
	Adult	estuary >45 F	November-April	medium

TABLE 4.6.2-4 (cont'd)

Summary of Essential Fish Habitat and General Habitat Parameters for the Providence River, Rhode Island [a/]

EFH Species	Life Stage	EFH Characteristics	Occurrence Season	Likelihood of Occurrence in Project Area [b/]
	Spawning Adult		May-August	very low
Spanish mackerel	**Egg**	sandy shoals of capes, offshore bars, rocky bottom, and	August - September	very low
Scomberomerus	**Larvae**	barrier island ocean-side waters including high salinity	August - September	very low
maculatus	**Juvenile**	bays, estuaries, and seagrass habitat	July-October	very low
	Adult		July-October	very low
	Spawning Adult		August - September	very low
Summer flounder	Egg	pelagic/surface waters, 10-110 m	autumn-early winter	very low
Paralichthys	**Larvae**	nearshore 10-70 m	September-February	low
dentatus	**Juvenile**	salt marsh creeks/ seagrass beds/mudflats/ open bays , > 3 C	May - October	medium
	Adult	shallow coastal/estuarine waters	warmer months	low
	Spawning Adult			very low
Windowpane flounder	**Egg**	surface waters, <20 C, <70 m	February-November	medium
Scophthalmus	**Larvae**	surface waters, <20 C, <70 m	May - September	medium
aquosus	**Juvenile**	mud/sand bottom habitat <25 C, 1-100 m	January - December	medium-low
	Adult	mud/sand bottom habitat <26.8 C, 1-75 m	January - December	medium-low
	Spawning Adult	mud/sand bottom habitat <21 C, 1-75 m	February-December	
Winter flounder	**Egg**	sand/mud/gravel bottom <10 C, < 5 m	February-June	medium
Pleuronectes	**Larvae**	pelagic and bottom waters, <15 C, < 6 m	March-July	high
americanus	**Juvenile**	mud/sand bottom habitat, <25-28 C, 0.1-50 m	January - December	high
	Adult	mud/sand/gravel estuarine bottom habitat, <25 C, 1-100 m	January - May, October-December	high
	Spawning Adult	mud/sand bottom habitat, <15 C, <6 m	February-May	medium
Winter skate	Egg	demersal, mud/sand/gravel	June-January	very low
Leucoraja ocellata	**Juvenile**	demersal, 1-75 m	spring-fall	very low
	Adult			very low

TABLE 4.6.2-4 (cont'd)

Summary of Essential Fish Habitat and General Habitat Parameters for the Providence River, Rhode Island [a/]

EFH Species	Life Stage	EFH Characteristics	Occurrence Season	Likelihood of Occurrence in Project Area [b/]
	Spawning Adult			very low

Note: Respective Life Stages in **Bold type** have designated Essential Fish Habitat

[a/] 10' x10' square coordinates: 41° 50.0' N, 71° 20.0 W, 41° 40.0' N, 71° 30.0 W

[b/] Likelihood of occurrence in project area:

Very low = not expected, generally found in deeper, more saline waters than project area.

Low = generally not expected but presence is occasionally recorded in the project area.

Medium-low = present in very low abundance.

Medium = present and moderately abundant.

High = present and abundant

[c/] The Providence River is not designated EFH for this life stage but they have been collected there.

TABLE 4.6.2-5

Summary of Potential Impacts on Specific Life Stages of Federally Managed Fish Species

Species	Suspended Sediments and Turbidity in Water Column	Piling Installation	Terminal/Piling Shading	LNG Ship Traffic During Operation
American plaice *Hippoglossoides platessoides*	Larvae			Larvae
Atlantic herring *Clupea harengus*	Larvae			Larvae
Atlantic mackerel *Scomber scombrus*	Egg, Larvae			Egg, Larvae
Black sea bass *Centropristis striata*		Juvenile, Adult [a/]	Juvenile, Adult [a/]	
Bluefish *Pomatomus salatrix*				
Cobia *Rachycentron canadum*	Egg, Larvae			Egg, Larvae
Haddock *Melanogrammus aeglefinus*	Larvae			Larvae
King mackerel *Scomberomorus cavalla*	Egg, Larvae			Egg, Larvae
Little skate *Leucoraja erinacea*		Juvenile, Adult		
Red hake *Urophycis chuss*	Larvae	Juvenile		Larvae
Scup *Stenotomus chrysops*	Egg, Larvae			Egg, Larvae
Spanish mackerel *Scomberomerus maculatus*	Egg, Larvae			Egg, Larvae
Summer flounder *Paralichthys dentatus*	Larvae	Juvenile, Adult	Juvenile, Adult	Larvae
Windowpane flounder *Scophthalmus aquosus*	Egg, Larvae	Juvenile, Adult	Juvenile, Adult	Egg, Larvae
Winter flounder *Pleuronectes americanus*	Egg, Larvae	Egg, Juvenile, Adult	Juvenile, Adult	Egg, Larvae
Winter skate *Leucoraja ocellata*		Juvenile	Juvenile	

[a/] Note that the terminal and associated pilings may enhance black seabass habitat.

No dredging or other construction activities are proposed that would disturb significant amounts of sediment. We do not believe that the small amount of disturbance that would result from the installation of the ship berth and unloading facility would increase turbidity to a level that would significantly disrupt managed migratory fish or their prey. These fish generally ascend rivers when flows and, consequently turbidity, are high and are quite tolerant of high turbidity conditions. Additionally, the total suspended solids levels associated with suspended sediment plumes are expected to be far below the levels migrating fish can tolerate. Moreover, the sediment plumes are not expected to encompass the width of the entire river, thus migrating fish could and likely would avoid the plumes to reach undisturbed spawning areas upstream of the construction activities.

Benthic Habitats

The benthic habitat that would be disturbed by the project consists of intertidal and subtidal substrates. These subtidal substrates are important feeding habitats for fish and benthic species that feed on polychaete worms, mollusks and other benthic invertebrates inhabiting these areas. Managed species that use benthic habitats for spawning or foraging include windowpane flounder, red hake, winter flounder, black sea bass, scup, summer flounder, little skate, and winter skate, as well as coastal migratory pelagics. Installation of piles for the new unloading pier would disturb the seabed and could displace or kill marine organisms that inhabit the immediate area of disturbance. Pile driving activities could also increase the turbidity and sedimentation, release contaminants and oxygen-consuming substances, and alter hydrologic regimes and physical habitats in and immediately adjacent to the disturbed area. Similar to potential effects of increased suspended sediments on prey species within the water column, displacement or mortality of demersal organisms near the project could reduce the availability of prey species inhabiting benthic communities.

Due to the small footprint of the project, the area exposed to these effects would be relatively small. Mobile species and life stages adjacent to the dredging footprint would likely burrow out of any accumulation of redeposited sediments.

Man-Made Structures

Man-made structures built in aquatic environments often provide new habitat for fish and other aquatic organisms. Man-made structures currently within the project area include an existing pier and mooring dolphins offshore of the LNG terminal site. Of the managed species potentially occurring within the project area, only juvenile and adult black sea bass are likely to use man-made structures regularly. The existing structure would not be removed, but construction of the new unloading facility could temporarily disturb fish using the existing pier habitat. However, this would be a short-term effect that would, upon completion of the new unloading facility, increase the amount of man-made structural habitat in the project area.

Cumulative Impact Analysis

Cumulative impact results when impact associated with a proposed project is superimposed on or added to impact associated with past, present, or reasonably foreseeable future projects within the area affected by the proposed project. Although the individual impacts of the separate projects might be minor, the additive effects from all the projects could be significant.

Existing environmental conditions in the project area reflect extensive changes based on past projects and activities. For example, substantial impacts have occurred and continue to occur because of water quality degradation from point and non-point source pollution along the Providence River. Residential, commercial, and industrial developments are directly affecting EFH by dredging or by affecting the watershed. Point source discharges from industry, combined with septic tank leachates, stormwater runoff, and oil and chemical spills contribute to lower water quality and degraded fishery habitats.

This final EIS provides a detailed environmental analysis of the potential effects of construction and operation of the KeySpan LNG Project and our recommendations to mitigate environmental impact. Construction of the KeySpan LNG Project could adversely affect surface water quality and biological resources within Narragansett Bay and the Providence River. Specific project activities such as installation of the piers, hydrostatic testing, and upland grading could result in a variety of impacts related to aquatic resources that include:

- increased water turbidity and resuspension of sediments;
- propagation of underwater noise energy;
- surface runoff/erosion;
- disturbance to benthic substrates;
- entrainment and impingement of aquatic organisms; and
- potential spills of hazardous substances.

Although mitigation would lessen these impacts, gradual and cumulative impacts that could result from the construction and operation of the proposed project and other projects in the area and within the near future could result in some unavoidable adverse effects on the existing environment. However, the cumulative impact associated with the project would be relatively minor and short term in comparison to available habitats in the bay and river.

Conservation Measures

KeySpan LNG and Algonquin would implement erosion and sediment control measures and specific spill control and containment procedures to minimize the impact of the project. Additionally, as previously mentioned, the addition of the new terminal facilities would increase the amount of man-made EFH habitat in the project area. Together, these measures would minimize impacts on EFH.

Conclusions of the EFH Assessment

Construction and operation of the proposed project facilities could affect water column, benthic substrate, and man-made structure EFH in the project area. Activities within the Providence River and Narragansett Bay also have the potential to affect anadromous fish and shellfish resources, two primary prey groups for managed fish species. However, none of these effects are expected to be significant or detectable due to the small area that would be affected by the project and the relatively short duration of construction, which is when most of the potential effects would be experienced. Additionally, KeySpan LNG's and Algonquin's implementation of the conservation measures discussed above would likely avoid or minimize impacts on managed fish species and designated EFH.

4.7 THREATENED, ENDANGERED, AND SPECIAL STATUS SPECIES

Federal agencies are required by section 7 of the Endangered Species Act (Title 19 USC Part 1536(c)), as amended (1978, 1979, and 1982), to ensure that any actions authorized, funded, or carried out by the agency do not jeopardize the continued existence of a federally listed endangered or threatened species or result in the destruction or adverse modification of the designated critical habitat of a federally listed species. The action agency is required to consult with the FWS and/or NOAA Fisheries to determine whether federally listed endangered or threatened species or designated critical habitat are found in the vicinity of the proposed project, and to determine the proposed action's potential effects on those species or critical habitats.

For purposes of this environmental analysis, special status species of plants and animals include:

- species that are listed by the federal government as endangered or threatened, and

- species listed by Rhode Island as endangered, threatened, or species of concern.

With assistance from KeySpan LNG and Algonquin, we consulted informally with the FWS, NOAA Fisheries, and the DEM to assess potential impacts on special status species or their designated

critical habitats. We also reviewed the RIGIS Data Catalog of rare species and wildlife management areas.

4.7.1 Federally Listed Threatened and Endangered Species

No federally listed species, proposed species, or designated critical habitat under the jurisdiction of the FWS are known to occur in the vicinity of the LNG terminal, along the shipping channel, or in the vicinity of the pipeline route (FWS, 2004a, 2004b). The FWS noted that a peregrine falcon nest is present on the Pell Bridge near the intersection of the shipping channel. The peregrine falcon is not federally listed, but is protected under the federal Migratory Bird Treaty Act (16 USC 703-712). Based on the nature of the proposed activities, the FWS determined that the project would not affect the peregrine falcon (FWS, 2004c). We conclude that the proposed project would not affect any federally listed species under the FWS' jurisdiction.

We received a determination from NOAA Fisheries that no federally listed endangered or threatened species under its jurisdiction are known to occur in the Providence River at the proposed LNG terminal site, and that construction and operation of the proposed facility would not affect listed species (NOAA Fisheries, 2004b, 2004c, 2004d). In an informal consultation, NOAA Fisheries also indicated that the transiting LNG ships would be unlikely to affect listed species under its jurisdiction, noting that the area has only transitory occurrences of sea turtles, which do not specifically frequent any particular locale or habitat within the channel and that LNG ships would be unlikely to affect any special status species in Narragansett Bay because of the relatively low speeds at which the ships would be traveling (Ludwig, 2004).

In its comments on the draft EIS, NOAA Fisheries stated that an increase in vessel traffic in Narragansett Bay could potentially affect federally listed species despite evidence that these species do not regularly occur in the area. Listed whale species have the potential to occur in offshore waters that would be crossed by LNG carriers. Of specific concern is the North Atlantic right whale, a federally endangered species most likely to be encountered by marine vessels entering Narragansett Bay through the eastern end of Long Island Sound.

The North Atlantic right whale population was historically depleted by commercial whaling and has not recovered despite protection from commercial harvest. The current population is thought to number 325 to 350 individuals and thus is considered one of the most critically endangered large whales in the world (Associated Press, 2005; NOAA, 2004e). According to the New England Aquarium, the 2004-2005 calving season resulted in the second highest number of births in a given season since scientists began tracking births in the early 1990s, although the aquarium also noted that the newborns still need to survive their migration to summer habitat and that juvenile whales have a 25 percent mortality rate (Associated Press, 2005). The Mid-Atlantic region of the United States is a principal migratory corridor for right whales that travel between the calving and nursery areas in the southeastern United States to the feeding grounds in the northeastern United States and Canada.

The two most significant human-caused threats to right whales are entanglement in fishing gear and collisions with ships. Because right whales are known to occur in or adjacent to many major shipping corridors along the eastern United States and collisions are known to account for over 50 percent of human-induced mortality in right whales, NOAA Fisheries established a right whale ship strike reduction program. Despite the measures implemented as part of that program (e.g., aerial surveys to notify mariners of whale locations, supporting shipping industry liaisons, mandatory reporting programs, etc.), right whales continue to be killed by vessel strikes. In response to this continuing problem, NOAA Fisheries developed a Strategy to Reduce Ship Strikes of Right Whales (Strategy), which is intended to

minimize the overlap between ships and whales and reduce the likelihood of ship strikes to the extent practicable (NOAA, 2004e).

Although NOAA's Strategy is not yet finalized, the primary regulatory measure proposed to reduce ship strikes in the Mid-Atlantic region is the establishment of uniform speed restrictions within 20 to 30 miles of the approaches of specific ports and areas, including an area south and east of Block Island Sound that would be traversed by LNG carriers visiting the proposed LNG terminal (NOAA, 2004e). NOAA (2004e) indicated that proposed speed restrictions may be in the range of 10 to 14 knots. For the area near Block Island Sound, these speed restrictions would be enforced from March through April and from September through October. We note that the Coast Guard has been coordinating with NOAA Fisheries in ongoing efforts to reduce vessel strikes by issuing periodic notices to mariners regarding ship strikes. The Coast Guard is also a partner with NOAA Fisheries in the Mandatory Ship Reporting System which requires large ships to report course and speed such that potential intersections with known whale locations can be avoided. Additionally, the Coast Guard is currently conducting a Port Access Route Study to analyze potential vessel routing measures and consider adjusting existing vessel routing measures in order to reduce vessels strikes of right whales.

Assuming that up to 60 LNG carriers could unload cargo at the proposed terminal each year, about 20 of those ships would be expected to unload at the terminal during the total 4 months from March to April and from September to October. These 20 vessels approaching and entering the area near Block Island Sound would be in addition to the existing ship traffic entering the bay and visiting various ports along the Long Island Sound and Narragansett Bay. The additional ship traffic likely increases the potential risk of a right whale ship strike. However, adherence of LNG ships to NOAA Fisheries' proposed speed restrictions during the applicable time periods, in addition to other currently required measures, would be expected to effectively minimize the potential for strikes, consistent with NOAA Fisheries' goals of the Strategy. KeySpan LNG has committed to complying with the applicable speed restrictions for incoming and outgoing LNG ships if implemented by NOAA Fisheries. We believe that these measures are important for the protection of right whales from ship strikes, but because the proposed rule has not yet become finalized or implemented, **we recommend that:**

- **KeySpan LNG coordinate with NOAA Fisheries to determine appropriate speed and seasonal restrictions, or other applicable measures, to avoid or minimize impacts on right whales. Results of the coordination, including a discussion of restrictions to be implemented, should be filed with the Secretary, <u>prior to commencing operation of the proposed LNG terminal</u>.**

Although LNG ships servicing the proposed terminal have the potential to strike right whales in the vicinity of Block Island Sound, adherence to restrictions developed through coordination with NOAA Fisheries would minimize the potential for strikes such that the proposed project *is not likely to adversely affect* North Atlantic right whales. Such protective measures may also facilitate avoidance and/or minimization of effects on other federally protected marine animals (i.e., other whale species and sea turtles) with the potential to occur in the general vicinity of the proposed project.

4.7.2 State-listed Species

The DEM noted that as with all shipping traffic, the potential for strikes on marine mammals or sea turtles is a concern (DEM, 2004c). The potential for such strikes was discussed above. The DEM Natural Heritage Program database indicates that no rare or state listed species are known to occur in the project area, and no exemplary natural community types are present area (DEM, 2004a, 2004b). Therefore, the project would not affect state-listed species.

4.8 LAND USE, RECREATION, AND VISUAL RESOURCES

The proposed KeySpan LNG Project would be located within an industrial waterfront area known as Fields Point on the Providence River in Providence. This area is generally characterized by industrial and transportation related land uses such as port facilities, warehouses, and storage yards. Fields Point is occupied by a variety of industrial facilities, including the existing KeySpan LNG plant, St. Lawrence Cement, gas utility facilities, a wastewater treatment plant, and the Port of Providence, which is also referred to as ProvPort, Inc. (ProvPort) since being purchased from the city in 1994.

The KeySpan LNG facility and nearby properties east of Allens Avenue along the western waterfront of the Providence River are zoned by the City of Providence as *Waterfront: Port/Maritime Industrial District* (W3). Petroleum and fuel oil storage tank facilities, including Motiva Enterprises, L.L.C., Northeast Petroleum, Sprague Energy, and a marine salvage yard are located along the western waterfront of the Providence River and adjacent to the proposed pipeline route. Several piers and wharfs are also located on the west bank of the river near the project area, including Harbor Junction Wharf and State Pier No. 1 to the northwest. The U.S. Generating property at the end of the pipeline route is zoned as *Heavy Industrial District* (M-2) (City of Providence, 2004).

4.8.1 Land Use

4.8.1.1 LNG Facilities

The existing KeySpan LNG facility occupies an approximately 17.5-acre parcel on the northeast corner of Fields Point. KeySpan LNG leases the parcel, which is within a larger 42-acre parcel owned by NEGC. The proposed on-land LNG facility upgrades would be contained and operated within the existing LNG plant site with the exception of three mooring dolphins that would be constructed on the adjacent parcel leased from NEGC by St. Lawrence Cement. The marine facilities would be constructed within about 3.5 acres of the Providence River adjacent to the plant site. The 17.5 acres of land are classified by the 1995 RIGIS Land Use Database as "Other Transportation" (terminals, docks, etc.), and the 3.5 acres within the river are classified as "Water." No dredging would be required for construction of the proposed ship berth.

During construction of the proposed upgrades, KeySpan LNG would use up to 2.8 acres of additional land for temporary facilities such as offices, lunchrooms, parking, staging/laydown areas, and utilities. Approximately 0.24 acre of this temporary workspace (washrooms and material staging area) is anticipated to be within the existing LNG facility. The remainder of the temporary workspace would be located on previously disturbed, active industrial lands on NEGC and/or St. Lawrence Cement property outside of but adjacent to the existing KeySpan site. The temporary workspace areas on these adjacent properties are currently used for materials storage by NEGC or St. Lawrence Cement and, similar to the LNG facility, are classified as Other Transportation by the RIGIS Land Use Database. 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.

None of the proposed LNG process equipment would be located within 50 feet of any off-site buildings. The proposed LNG tanker mooring structures would be located within 50 feet of existing structures associated with the St. Lawrence Cement operations on the adjoining property. St. Lawrence Cement shares the existing waterfront on the northeast portion of Fields Point with KeySpan LNG and would also use the proposed berthing facility. As a result, the proximity of these structures is not anticipated to result in conflicting land uses. KeySpan LNG has stated that construction of the mooring structures would occur with the consent of St. Lawrence Cement.

Access during construction and operation of the upgraded LNG facilities would be obtained using existing public and private roads. The LNG facility is located within 0.5 mile of the Interstate 95/Thurbers Avenue interchange. Vehicular access between the site and Interstate 95 is available via Thurbers Avenue and Allens Avenue. Access from the site to southbound Interstate 95 would also require traveling short distances on Ernest Street and Eddy Street. Potential impacts on local traffic are addressed in section 4.9.4. The only permanent roads to be constructed would be occasional-use roads within the existing facility site to provide access to the new LNG processing equipment.

Much of Fields Point was originally created by filling portions of the Providence River to provide a permanent location for ships to offload cargo. In addition, the project site has a history of use by utility companies. As detailed in the report entitled *Environmental Site History – 642 Allens Avenue* (Environmental Site History Report), which was prepared for KeySpan LNG by VHB/Vanasse Hangen Brustlin, Inc. and is included as appendix 1D of KeySpan LNG's Environmental Report (Exhibit F-1 of KeySpan LNG's FERC application), the parcel was the site of a manufactured gas plant that produced coal gas, carbureted water gas, and to a lesser extent, high BTU oil gas beginning in 1910. A toluene facility was also operated at the property in 1918. In 1925, a liquefied petroleum gas distribution plant began operation at the property. By 1954, coal gasification operations had ceased. Several gas transmission and utility companies have leased the eastern and southeastern portions of Fields Point since 1972. The existing LNG facility was initially constructed in the early 1970s by ALNG, which was a subsidiary of Duke Energy Gas Transmission (DEGT). KeySpan LNG acquired the LNG facility from DEGT in early 2003. St. Lawrence Cement has also leased the southeastern section of Fields Point since 1961. The aboveground portions of buildings associated with the former manufactured gas plant were demolished in 1980.

At present, the larger 42-acre NEGC property includes the KeySpan LNG facility and KeySpan LNG distribution center, a NEGC operations center, and remnants of the former manufactured gas plant (e.g., a former coal purifier house, meter house, and washer and tar house) to the west and the existing St. Lawrence Cement cement storage and distribution facility to the south. The Providence River abuts the KeySpan LNG facility to the east and north. Several active natural gas pipelines also cross the NEGC property.

The LNG facility is characteristic of most of the surrounding area. KeySpan LNG's analysis of the land uses within 0.25 mile of the LNG facility indicates that land uses consist of about 46 percent Water, 42 percent Other Transportation, 9 percent Industrial, 2 percent Water and Sewage Treatment, and 1 percent High-Density Residential. Thus, the proposed facility upgrade would be consistent with the current land use and would not alter or significantly affect current land use in the area.

4.8.1.2 Pipeline Facilities

The proposed pipeline facilities and associated land requirements are described in sections 2.2.3 and 2.3.2, respectively, of this EIS. Construction of the proposed pipeline facilities would disturb a total of about 21.0 acres of land, including the pipeline construction right-of-way, ATWS, contractor staging areas, a permanent access road, and aboveground facilities. Of these 21.0 acres, about 1.7 acres would be retained as permanent right-of-way for the pipeline and 0.3 acre would be retained for the aboveground facilities. Algonquin would not establish an easement for the portion of the pipeline installed beneath city roads.

Based on a review of current aerial photographs, USGS topographic maps, NOAA maps, RIGIS land use data, and site visits, land uses that would be affected by the construction and operation of the proposed pipeline facilities are limited to commercial/industrial use, which generally includes uses such as electric power generating stations, aboveground natural gas facilities such as gas processing or

compressor stations, and other manufacturing or industrial plants. For purposes of this assessment, road and railroad rights-of-way are also included in the industrial/commercial category.

The proposed pipeline would be about 1.44 miles long. Approximately 1.14 miles, or 79 percent, of the pipeline would be constructed within existing City of Providence streets (Allens Avenue and Henderson Street). Approximately 0.3 mile of the pipeline would be constructed on private commercial/industrial property owned or leased by KeySpan LNG, NEGC, or U.S. Generating. Aboveground facilities would include a meter station at the beginning of the pipeline (MP 0.0) within the KeySpan LNG facility and a tap valve at the end of the new pipeline where it would tie into Algonquin's existing G-12 Lateral on U.S. Generating property (MP 1.44). The permanent driveway to be constructed for access to the proposed meter station would be located within the existing LNG plant property.

During construction Algonquin would use one 0.3-acre ATWS and four contractor staging areas that total about 7.7 acres. One contractor staging area would be on the NEGC property west of and adjacent to the KeySpan LNG facility. The other three contractor staging areas would be located adjacent to the route at approximate MPs 0.6, 0.8, and 1.1 on properties owned by Boliden Metric, Inc., Walco Electric Company, and Cargil, Inc., respectively. The ATWS and the four staging areas are located within either empty lots or parking lots and would be used for contractor parking, equipment staging, and material storage. Algonquin would use existing public and private roads for construction access.

The most notable impacts of the pipeline on nearby land uses would be temporary construction-related disturbance such as increased noise, dust, traffic, as well as access restrictions. As described in section 2.4.2, Algonquin would implement several measures, including special construction techniques, to minimize disruption to the public and to businesses along the route during construction, to maintain traffic flow, and to provide access to adjacent businesses. In addition, Algonquin would delineate the boundaries of the ATWS and each staging area prior to construction to prevent project-related activities from encroaching onto adjacent properties, to provide adequate site safety, and to prevent trespassing.

Workspace for pipeline construction along Allens Avenue would be limited, and construction would be further complicated by numerous underground utilities present beneath Allens Avenue. Algonquin is currently researching the locations of underground utilities and has indicated that it would file final workspace requirements and updated alignment sheets with the FERC once that information has been gathered. Algonquin has also indicated that it plans to develop specific plans for construction within and/or across roads. Further, **we recommend that:**

- **Algonquin file copies of its specific plans for construction within and across each road and identify how it would either maintain access to each business on Allens Avenue, or provide alternate access, during construction of the proposed pipeline facilities. Algonquin should include documentation of discussions with the City of Providence regarding these plans. Algonquin should file this information with the Secretary <u>prior to construction.</u>**

Operation of the pipeline would not alter or significantly affect existing land uses. Where the pipeline is installed under existing roads, the road surfaces would be restored and the roads would continue to be used as they are now. Land retained as permanent right-of-way would be allowed to revert to former use, with certain restrictions, after construction. Activities such as the construction of aboveground structures or the planting and cultivating of trees would be prohibited within the permanent right-of-way. However, future land use conflicts from these types of activities are unlikely due to the industrial nature of the proposed route. Similarly, the land used for the aboveground facilities would be precluded from development during the life of the project, but given the locations of these facilities on

KeySpan LNG and U.S. Generating industrial properties, this restriction is also unlikely to pose a conflict in the foreseeable future.

4.8.2 Consistency with Land Use Plans, Policies, and Guidelines

We received several comments on the draft EIS expressing concern that the project may not be consistent with various land use and development plans, policies, and guidelines. Our responses to the specific comments are addressed in Appendix F. Because of the number of comments on this issue, we have expanded this section of the EIS to provide further discussion regarding consistency of the KeySpan LNG Project with land use plans, policies, and guidelines applicable to the project area.

Rhode Island State Guide Plan

The Rhode Island Statewide Planning Program (Program) (part of the Rhode Island Department of Administration) is charged by Rhode Island General Laws, Chapter 42-11, with the development and maintenance of the State Guide Plan. The State Guide Plan consists of a series of functional elements that provide a framework of goals and policies to guide public and private sector actions relating to the physical, economic, and social development of Rhode Island.

The Program conducted a review of the project's consistency with what it identified as the relevant components of the State Guide Plan and provided a summary of its findings in its comments on the draft EIS. A copy of the Program's comments and our responses to those comments are included in Appendix F (see comments SA5-4 through SA5-46). Based on our review of the Program's comments, it appears that the project is generally consistent with many of the individual goals, policies, and strategies of the State Guide Plan. However, the Program commented that the draft EIS lacked sufficient information necessary for it to find the project consistent with the State Guide Plan. According to the Program, the most significant issues requiring additional information are the feasibility of upgrading the existing LNG storage facility to meet current seismic standards, a detailed security plan, and a fiscal impact analysis. The Program also recommended that the FERC staff incorporate the findings and recommendations of a recently released report by Sandia National Laboratories into the EIS safety analysis. Section 4.12 includes additional information on safety and security issues associated with the project, including those identified by the Program. Fiscal impacts of the project are discussed in sections 4.9.3 and 4.9.5.

Providence 2000: The Comprehensive Plan

Providence 2000: The Comprehensive Plan (Comprehensive Plan), which was prepared by the City of Providence Planning Department, presents a guide for future growth and change in the city. The plan was approved by the City Planning Commission in December 1992, the Providence City Council in December 1994, and the State of Rhode Island in May 2002. In addition to serving as a key management and planning document for the City of Providence, the plan meets the requirements of the "Rhode Island Comprehensive Planning and Land Use Regulation Act." The Comprehensive Plan divides the Providence waterfront into three distinct parts: the residential/commercial/open space area from the Pawtucket city line to Corliss Landing; the Old Harbor area, which extends from Corliss Landing to the Crawford Street Bridge; and the industrial waterfront from the Narragansett Electric Manchester Street Station to the Cranston city line.

Providence has a long history in shipping and manufacturing. Narragansett Bay and the Providence River provide a safe harbor near major regional transportation routes. Providence, like many areas on the east coast, is dealing with the issues of how to balance the ongoing use of the harbor for shipping and industrial uses with revitalization efforts, including integrating mixed-use development and

waterfront redevelopment. With regard to the Providence waterfront, the main focus of the Comprehensive Plan is to identify ways to maintain the Port of Providence as a viable port while at the same time identifying the potential for a new waterfront experience.

The Comprehensive Plan identifies future land use trends and issues in the waterfront area as follows:

> *More emphasis will be placed on the city's waterfront: from expansion of the industrial waterfront and the City's port, the development of commercial and residential uses, the expansion of public use and access, to the development of conservation and open areas. These competing uses will have to be balanced by the City to insure that the interest of all the city's residents are addressed.* (Section 3.6.4, page 44).

The Comprehensive Plan also states:

> *Most new industrial uses will be "light" rather than "heavy" in character. Any heavy industry will be located only in specific areas prepared for it and in which impacts can be controlled. Light industry will be permitted in a larger number of areas, but with impacts regulated in appropriate ways ... The industrial waterfront area will continue to provide the greatest amount of land for future industrial expansion* (Section 3.6.4, page 43).

The possible revitalization of the waterfront is receiving special attention from the City of Providence as industrial land becomes available or is abandoned. The expansion of the waterfront from solely industrial uses to a mixed-use area with public access as specified in Section 4.1.1, Subsection 4A of the Comprehensive Plan is a goal of many similar cities with industrial waterfronts. However, Subsection 4A Goal E states that the City of Providence should:

> *Encourage the renewal and strengthening of the industrial waterfront by limiting the area to water dependent uses.* (Section 4.1.1, page 130).

The Comprehensive Plan further states:

> *The future development potential of the industrial waterfront from the Point Street bridge southerly to the Cranston/Providence line strongly supports a vision of the Providence Industrial Waterfront as a stable and expanding marine industrial district. This conclusion is the result of analysis of conditions within the area as well as within the region. The industrial waterfront area is uniquely positioned to capitalize on the undersupply of industrial space in the marketplace given its geographic location and physical attributes. At the same time, it is a relatively poor location for residential, retail, hotel and office activities given its land uses context and physical condition.* (Section 4.3.1, page 146).

The proposed KeySpan LNG Project is a water-dependent use of the waterfront, as are many of the industrial (i.e., port) uses adjacent to the existing facility. The Comprehensive Plan indicates that water-dependent port uses should be fostered within the industrial waterfront, identified as between the Narragansett Electric Manchester Street Station south to the Cranston city line, generally along Allens Avenue. The KeySpan LNG facility is located within this industrial waterfront area. The Comprehensive Plan also indicates that:

> *The industrial waterfront must be considered primarily as an economic resource. Activities here are important to the city, the state and to New England. Secondarily the area is important for the public facilities and utilities it contains. Energy is a particularly important industry in the*

industrial waterfront area. Over one-half of Rhode Island's electric power is generated at the Narragansett Electric South Street Plant, and the oil storage tankers in the area contain petroleum products that are distributed all over New England (Section 3.8.2, page 61).

As discussed above, Providence's Comprehensive Plan encourages water-dependent uses in the industrial waterfront area along the Providence River and recognizes the economic importance of energy-related industries in this area. Because the proposed project would involve converting an existing energy-related industry to a water-dependent use in the industrial waterfront area, we believe that the proposed KeySpan LNG Project is consistent with the Comprehensive Plan.

City of Providence Zoning District Designations

The KeySpan LNG facility is currently zoned as W3 Waterfront – Port/Maritime Industrial District. This zone is intended to: promote the Port of Providence and related maritime industrial and commercial uses within Providence's waterfront areas, protect the waterfront as a resource for water-dependent industrial uses, and facilitate the renewed use of a vital waterfront (City of Providence, 2003). Because bulk storage of LNG is not permitted in a W3 district, the existing KeySpan LNG facility is a non-conforming use in this zoning district. Section 201.5 of the Zoning Ordinance prohibits the expansion or intensification of existing non-conforming uses. The applicability of local zoning ordinances to the existing LNG facility was reviewed by the U.S. District Court for the District of Rhode Island. The court ruled on January 7, 2000, that the Providence Zoning Ordinance and any licensing contingent upon compliance with it are preempted by federal law (Algonquin LNG v. Loqa and Napolitano, No. 99-575-t).

Providence 2020 Downtown Investment Strategy

Providence 2020 Downtown Investment Strategy is a redevelopment plan proposed by Mayor Cicilline. Like the former "New Cities" initiative proposed by former Mayor Cianci Jr., the strategy would be essentially a land-use and economic development blueprint and would cover much the same geography as the former "New Cities" plan. The Cicilline administration has hired the consulting firm Sasaki Associates, Inc. (Sasaki) of Watertown, Massachusetts, to do the study and author the new plan. The proposed study area includes Narragansett Landing, the Old Harbor district, India Point, the Jewelry District, Downtown, Capital Center, and Promenade. As part of this study, Sasaki will analyze economic development, urban design, transportation, and public infrastructure. The underlying tasks would be as varied as identifying specific parcels for commercial development to laying out extensions of the street grid through the land to be opened up by the relocation of Interstate 195.

Narragansett Landing encompasses the proposed KeySpan LNG Project area (see figure 4.8.2-1). Originally part of the broader New Cities initiative, the Narragansett Landing Plan has been incorporated into the Providence 2020 Downtown Investment Strategy. Narragansett Landing would involve the redevelopment of 250 acres along the northern portion of the Providence River waterfront between Point Street and Fields Point, adjacent to and east of the Interstate 95 corridor (see figure 4.8.2-2). The design principles for Narragansett Landing include but are not limited to transforming the waterfront image and planning for mixed uses such as residential development, offices, retail, cultural, and institutional. The plan envisions park lands, river walks, waterfront apartments with boat slips, a large marina, hotels, and office buildings. Based on a 2000 study prepared by Sasaki, the Narragansett Landing development plan was originally envisioned to be implemented in five phases over a 25- to 30-year period at a cost (in 2000 dollars) of around $312,000,000. Based on this schedule, it was anticipated that the first phase of the plan (Phase I) would be complete by 2005 and the last phase of the plan (Phase V) would be completed somewhere between 2025 and 2030. Actual implementation of the plan has been slower than originally anticipated. In January 2003, Sasaki prepared an Implementation Study for Phase I of the Narragansett

Landing development plan (Sasaki, 2003). The Implementation Study recommended that Phase I include the northern section of Narragansett Landing between Collier's Point Park and State Pier No. 1, which would encompass the northern part of the proposed pipeline route, and anticipated that Phase I would take approximately 10 years to complete. Phase II, which would extend from State Pier No. 1 to Thurbers Avenue, would follow Phase I and would encompass another segment of the pipeline route. Fields Point, where the KeySpan LNG facility is located, would be part of Phases IV and V, of the development plan. Given the delays in starting Phase I of the plan, it seems likely that the other phases of the plan may also be extended and delayed. Thus, if the plan is ever fully implemented, it seems probable that the start on Phase IV and V of the plan where the KeySpan LNG facilities are located would occur no sooner than 20 to 25 years from now.

The implementation of the Narragansett Landing development plan would involve acquisition of the existing properties, relocation of existing land users, remediation of contaminated sites, and development of the various mixed uses identified above. The specific details for implementing these activities are still conceptual, and it does not appear that funding has been committed at this time or that a specific implementation schedule has been established. If the plans to develop Narragansett Landing are ever realized, the proposed KeySpan LNG Project would not be consistent with the plan's ultimate objectives because the objectives include removal of the existing KeySpan LNG facility from its current location. Additionally, while the pipeline might or might not be compatible with the development plans depending on potential modifications to Allens Avenue and the underlying utilities, it would serve no purpose if the LNG terminal were not at its proposed location.

The inconsistency of the proposed project facilities with Narragansett Landing development plan, however, would not prevent the implementation of the plan. The existing KeySpan LNG facility would need to be acquired and removed regardless of whether the proposed upgrade is constructed. The proposed facilities would add to but not fundamentally change this requirement.

We received several comments expressing concern that the proposed facilities and associated LNG shipping would threaten the development of Narragansett Landing and make it difficult to attract investment money to the project. We do not believe this would be the case. To assess this concern, KeySpan LNG commissioned a market analysis of Charlestown, Massachusetts, which borders the transit route of LNG ships supplying the Distrigas LNG terminal in Everett (KTR Newmark, 2005). Under the Boston Redevelopment Authority (BRA), Charlestown has been undergoing urban redevelopment. One major waterfront redevelopment project associated with the overall redevelopment of Charlestown is known as the Navy Yard. The 135-acre Navy Yard site was formerly one of six naval yards established to build warships for the United States in the 1800s. When the Charlestown Navy Yard closed in 1974, 3 years after the Distrigas LNG terminal began its operations, 98 acres of the Navy Yard site were conveyed to the BRA for redevelopment of a mixed-use project consisting of both new and old construction and the rehabilitation of existing buildings.

The market analysis concluded that the Charlestown Navy Yard redevelopment has attracted hundreds of millions of dollars for revitalization projects in the area and has added approximately 1,100 housing units to the neighborhood. In addition, approximately another 500 housing units are in various stages of redevelopment. Overall, the housing units developed in the Navy Yard range in selling price from the low $200,000 range to above $2 million. Recreational space, marinas, and commercial, retail, and light industrial uses have also been incorporated into the redevelopment plan. Perhaps most importantly, the redevelopment was planned, constructed, and executed directly on a waterway that has been used by ships transporting LNG since the 1970s. Based on this study, the presence of LNG shipping activity does not appear to have had an adverse impact on redevelopment efforts in Charlestown.

Figure 4.8.2-1

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Figure 4.8.2-2

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East Providence Waterfront Special Development District Plan (Waterfront District Plan)

In 2003, the Rhode Island General Assembly enacted enabling legislation to create the East Providence Waterfront Special Development District (the Waterfront District). In 2004, the East Providence City Council adopted the East Providence Waterfront District Plan and a set of accompanying zoning laws that set forth a comprehensive set of development goals and objectives for approximately 500 acres of underdeveloped waterfront stretching the entire length of the City of East Providence (see figure 4.8.2-1). The City of East Providence has expressed concern that the proposed project would adversely affect its development plans for the Waterfront District. We do not believe this is the case.

The Waterfront District Plan was developed while the existing KeySpan LNG facility was in operation within an industrial waterfront area along the opposite shore of the Providence River. The City of East Providence was aware of the land use and visual conditions present along this portion of Providence's waterfront while the Waterfront Plan was being developed. These conditions include the frequent presence of marine vessels transporting, loading, and unloading cargo. In addition, it is well known throughout the region that the COE's maintenance dredging operations were designed and funded to maintain and enhance marine shipping on the Providence River. The proposed facility upgrade would not affect land or water in the City of East Providence or result in any change in existing land use patterns. Additionally, as discussed above in the section on Narragansett Landing, LNG shipping does not appear to have had an adverse impact on the waterfront redevelopment in Charlestown, which is regularly subject to LNG ship traffic to and from the Distrigas LNG terminal.

The primary impact of the project on the riverfront would be the arrival and departure of LNG ships once a week throughout the year. These ships, which would extend out into the federal shipping channel, would be visible from the East Providence shoreline opposite the LNG facility (see section 4.8.6). The security zones around the LNG ships could also have an impact on other shipping and boating activity (see section 4.12.5). However, both of these effects would be temporary and limited to when the LNG ships are berthed at the facility and would not affect the City of East Providence's implementation of the Waterfront District Plan.

Rhode Island Bays, River, and Watersheds Coordination Team

During project scoping, we received a comment from the Rhode Island Department of Attorney General regarding the *Rhode Island Bays, Rivers and Watersheds Coordination Team* (Coordination Team), which was established by the Rhode Island General Assembly in January 2004. The Coordination Team has been tasked with the development and implementation of a system-level plan for the management, preservation, restoration, and monitoring of Rhode Island's bays, rivers, and watersheds, as well as the promotion of sustainable economic development of businesses that rely directly or indirectly on the state's bays, rivers, and watersheds. The system-level plan must be drafted by January 31, 2006, and completed by June 30, 2006; therefore, it is not yet available for review. Based on our review of the legislation that established the Coordination Team (R.I.G.L. § 46-31-1), FERC staff anticipates that the KeySpan LNG Project would not conflict with the goals and intentions of the systems-level plan. As discussed in various sections of this EIS, the project would not affect wetlands, require marine dredging, or prohibit current or future uses of marine resources (i.e., recreational boating, fishing, or commercial shipping). We believe that the project would have minimal impacts on Narragansett Bay and the Providence River if KeySpan LNG and Algonquin implement their proposed mitigation measures and our recommendations and comply with applicable permits. Two of the Coordination Team's member agencies, the DEM and the CRMC, have had and will continue to have opportunities to review the project as part of their respective permitting and authorization activities. In addition, to provide the Coordination Team with an opportunity to comment on the project, we sent each member of the Coordination Team a copy of the draft EIS. The members will also receive a copy of this EIS.

4.8.3 Existing Residences and Planned Developments

4.8.3.1 LNG Facilities

Existing Residences, Schools, and Hospitals

No residences or residential structures (e.g., duplexes, apartments, etc.) are located within 50 feet of the KeySpan LNG facility. Based on a review of aerial photographs supported by a limited field review, we estimate that there are approximately 2,580 residences or residential structures within 1 mile of the site boundaries. The nearest residential area to the LNG facility is in the Washington Park neighborhood, approximately 1,000 feet to the south, measuring from the limits of the nearest project site boundary. The residences in the Washington Park neighborhood are classified by the RIGIS Database as a high density housing area (less than 1/8 acre lots).

During construction of the proposed LNG facility upgrade, potential short-term impacts on neighboring residential and commercial areas could include increased construction-related traffic on local roads, dust generated during site construction, and noise from construction equipment. These effects would be localized in the vicinity of construction activities and would decrease rapidly as the distance from the construction site increases.

As described in more detail in section 4.9.4, KeySpan LNG anticipates that project-related traffic to and from the LNG facility during construction of the proposed upgrades would use a small number of roads that connect the site to Interstate 95. These roads are located within the predominantly commercial/industrial area near the project site and would not require vehicles to cross the Washington Park or other residential neighborhoods. Potential impacts and mitigation measures related to dust and other air emissions are discussed in section 4.11.1 of this EIS, and noise impacts and mitigation are discussed in section 4.11.2.

Operation of the upgraded LNG facility is not expected to affect residential land use because the majority of project-related activities would take place within the existing KeySpan LNG facility. Traffic associated with operation of the upgraded facility is expected to remain approximately the same as the current level because KeySpan LNG would permanently hire only a modest number of new employees and does not propose any changes to the existing LNG truck-loading station. Visual impacts associated with the LNG ships that would transit the Providence River and dock at the LNG terminal are discussed in section 4.8.6.

In addition to residences, several schools and health care facilities are located within 1 mile of the KeySpan LNG facility (see figure 4.8.2-1). Table 4.8.3-1 summarizes the locations of these facilities relative to the site. We also note that the Community College of Rhode Island, Women and Infants Hospital of Rhode Island, Rhode Island Hospital/Hasbro Children's Hospital, Edmund W. Flynn School and Annex, and Bradley Hospital are located within 1.3 miles of the site. Given the distances of these facilities from the project area (all more than 0.5 mile) and the nature and location of construction activities, it is unlikely that they would be affected by the proposed construction.

TABLE 4.8.3-1

Schools and Health Care Facilities Located within 1 Mile of the KeySpan LNG Facility

Facility	Address	Approximate Distance and Direction from KeySpan LNG Facility
Play and Learn Preschool	953 Eddy Street	3,000 feet northwest
Johnson and Wales University, Harborside Campus	265 Harborside Boulevard	3,250 feet south
Broad Street Elementary School	1450 Broad Street	3,920 feet southwest
Alan Shawn Feinstein College	405 Broad Street	3,900 feet south west
Southside Elementary School	Prairie Avenue	4,000 feet west
Mandela Woods School	Prairie Avenue	4,000 feet west
Roger Williams Middle School	278 Thurbers Avenue	4,080 feet west
Washington Park Nursery School	1520 Broad Street	4,160 feet southwest
BJ Clayton Elementary School	672 Prairie Avenue	4,250 feet west
Mary J. Fogarty Elementary School	199 Oxford Street	4,420 feet northwest
Robert L. Bailey IV School	65 Gordon Avenue	4,420 feet west
Bishop McVinney Elementary	155 Gordon Avenue	4,450 feet west
Gordon School	45 Maxfield Avenue	4,580 feet east
Agnes B. Hennessey Elementary	75 Fort Street	4,750 feet northeast
Care New England Health System	45 Willard Avenue	5,000 northwest

These facilities would not be affected by routine operation of the upgraded KeySpan LNG facility. However, during project scoping, we received comments expressing concern about potential impacts on, or disruption of access to, area hospitals, schools, and residences in the event of an accident or incident at the KeySpan LNG facility. These issues and our analysis of safety and security considerations are included in section 4.12.

Planned Developments

According the City of Providence Planning Department (Planning Department) there are no new residential or commercial developments currently planned within 0.25 mile of the KeySpan LNG facility. There is a planned highway project related to the reconfiguration of Interstates 95 and 195, which would be located north of the project area. The planned highway project is described further in section 4.8.3.2 below.

4.8.3.2 Pipeline Facilities

Existing Residences

No residential structures are located within 50 feet of the proposed pipeline route or aboveground facilities. The closest residences are located within a small section of an R3-Residental Three Family Home zoning district about 0.18 mile west of Allens Avenue on the west side of Interstate 95. City tax maps also show some residential properties within an M1-Industrial zoning district, also on the west side of Interstate 95.

Because the closest residences are located west of Interstate 95, it is unlikely that residents would experience any impacts during pipeline construction. As noted previously, construction-related traffic is expected to gain access to the site from Interstate 95 and would not need to cross neighbourhoods west of the Interstate en route to the construction site.

Planned Developments

The Planning Department confirmed that there are currently no planned developments along the length of the pipeline route (Azar, 2004). However, the city of Providence has a long-term development plan for Narragansett Landing which we discuss in section 4.8.2.

We received comments from the City of East Providence expressing concern about potential impacts of the proposed pipeline on its Waterfront District Plan. KeySpan LNG met with representatives of the City of East Providence to discuss the issue prior to filing its application with the FERC. A main concern of city representatives expressed at meetings with KeySpan LNG was that the pipeline from the KeySpan LNG facility would cross the Waterfront District and interconnect with Algonquin's existing G-system east of the Providence River.

Algonquin investigated a number of pipeline routes that crossed the river during the development of its application but opted for the proposed route on the west side of the river in Providence. We have compared the proposed route to a number of different cross-river routes as potential alternatives to the proposed route. Our review, which is summarized in section 3.5, concluded that none of the cross-river routes would be preferable to the proposed route in Providence. Consequently, neither Algonquin nor FERC staff has recommended a pipeline route through East Providence. Therefore, as proposed by Algonquin and recommended by FERC staff, the pipeline would not cross the City of East Providence or adversely affect East Providence's Waterfront District Plan.

RIDOT is currently planning a reconfiguration of Interstate 95 and Interstate 195 in Providence. Algonquin representatives met with engineers from RIDOT on May 20, 2004 to discuss the planned highway improvement project, which is referred to by RIDOT as "Contract 6." Contract 6 includes the reconstruction of Allens Avenue in the Henderson Street area and repaving as far south as Public Street, which encompasses approximately 1,400 feet of the proposed pipeline route in Allens Avenue. RIDOT finished advertising and awarding Contract 6 during the summer of 2004 and anticipates construction on the Contract 6 work will commence before the end of 2004. The entire project is expected to take approximately 4 years to complete. RIDOT did not identify any objections to the proposed pipeline but requested that Algonquin continue to coordinate with RIDOT and its contractor. RIDOT also requested that Algonquin install the proposed pipeline before RIDOT's final paving of Allens Avenue (estimated to occur in 2008). To ensure that this coordination continues and that we are made aware of any conflicts that may arise, **we recommend that:**

- **Algonquin file with the Secretary copies of its ongoing correspondence with the RIDOT regarding the reconfiguration of Interstates 95 and 195 in Providence. Algonquin should include in the filing any conflicts that have been identified between its pipeline and the road project and a description of how these conflicts have been addressed.**

4.8.4 Coastal Zone Management

In 1972, Congress passed the CZMA to "preserve, protect, develop, and where possible, to restore or enhance, the resources of the nation's coastal zone for this and succeeding generations" and to "encourage and assist the states to exercise effectively their responsibilities in the coastal zone through

the development and implementation of management programs to achieve wise use of the land and water resources of the coastal zone" (16 USC 1452, section 303 (1) and (2)).

Section 307 (c)(3)(A) of the CZMA states that "any applicant for a required federal license or permit to conduct an activity, in or outside the coastal zone, affecting any land or water use or natural resource of the coastal zone of that state shall provide a certification that the proposed activity complies with the enforceable policies of the state's approved program and that such activity would be conducted in a manner consistent with the program." In order to participate in the coastal zone management program, a state is required to prepare a program management plan for approval by the NOAA Office of Coast and Ocean Resource Management (OCRM). Once the OCRM has approved a plan and its enforceable program policies, a state program gains federal consistency jurisdiction. This means that any federal action (e.g., a project requiring federally issued licenses or permits) that takes place within a state's coastal zone must be found to be consistent with state coastal policies before the federal action can take place (OCZM, 2002).

The proposed KeySpan LNG Project is subject to a Federal Coastal Zone Consistency Review because it would 1) involve activities within the coastal zone of Rhode Island, and 2) require several federal permits and approvals (see table 1.3-1). Rhode Island has an approved coastal zone management program administered by the CRMC. The CRMC adopted the Rhode Island Coastal Resources Management Program (RICRMP) in 1976 and received its federal program approval pursuant to the CZMA in 1978 (CRMC, 2003). The RICRMP is structured as a strategic plan for the state's coastal areas and is regulatory in nature.

4.8.4.1 LNG Facilities

The CRMC's jurisdiction includes all tidal waters within state boundaries. The seaward extent of Rhode Island's coastal zone boundary is the 3 mile outer limit (CRMC, 2003). The RICRMP is based on six CRMC water types. There are specific polices and prohibitions that apply to each water type. The six water types are:

- Type 1 - Conservation Areas;
- Type 2 - Low Intensity Use;
- Type 3 - High Intensity Boating;
- Type 4 - Multipurpose Waters;
- Type 5 - Commercial and Recreational Harbors; and
- Type 6 - Industrial Waterfronts and Commercial Navigation Channels.

Project activities to be conducted within the Providence River would occur in Type 6 waters. According to the RICRMP, the CRMC's goals for Type 6 Waters and adjacent lands under CRMC jurisdiction are to encourage and support modernization and increased commercial activity related to shipping and commercial fisheries. The highest priority uses of Type 6 waters and adjacent lands are: (a) berthing, loading and unloading, and servicing of commercial vessels; (b) construction and maintenance of port facilities, navigation channels, and berths; and (c) construction and maintenance of facilities required for the support of commercial shipping and fishing activities. The CRMC will prohibit activities that substantially detract from or interfere with these priority uses and will encourage and support port development, modernization, and increased economic activity in the marine industries.

KeySpan LNG submitted a Category B Assent Application (Assent application) and federal consistency certification with the CRMC on August 20, 2004. In the Assent Application, KeySpan LNG asserted that the proposed activities in the Providence River would conform to the CRMC's intended use of a Type 6 water as described above. The Assent application also discussed how the proposed LNG

facility upgrade is consistent with the standards and policies of what KeySpan LNG has identified as the applicable sections of the CRMP including:

- Section 300, which applies to activities In Tidal and Coastal Pond Waters, On Shoreline Features, and Their Contiguous Areas;
- Section 330, Guidelines for the Protection and Enhancement of the Scenic Value of the Coast Region;
- Section 335, Protection and Enhancement of Public Access to the Shore; and
- Section 400, Federal Consistency, under which KeySpan LNG requests a federal consistency determination.

In its Assent Application, KeySpan LNG described the proposed activities; applicable federal, state, and local regulations; the existing environment; potential environmental impacts; and proposed mitigation measures. KeySpan LNG also requested variances to RICRMP setback requirements in order to allow for construction of the proposed project components and to accommodate incorporation of the proposed facility upgrade into the existing facility.

On December 1, 2004, KeySpan LNG withdrew its Assent application. Keyspan LNG stated that it had concluded based on further legal analysis that because the project is within the exclusive jurisdiction of the FERC under Section 3 of the NGA, the CRMC's jurisdiction over the proposed project was limited to a federal consistency determination and a separate Category B Assent was not required. At the same time, KeySpan LNG filed its federal consistency certification with the CRMC, stating that it was seeking CRMC concurrence with the certification. A copy of Keyspan LNG's consistency certification is available in this docket on the FERC website (www.ferc.gov). In a January 31, 2005 response, CRMC officials informed KeySpan LNG that it must also comply with the Category B Assent process. Both KeySpan LNG and the State of Rhode Island have petitioned the U.S. District Court to address jurisdictional and other issues related to the Category B Assent process. As of the time this EIS is being prepared, the above-referenced court cases are pending and the need for a Category B Assent has not been determined.

In order to fulfill the FERC's responsibility under the CZMA, **we recommend that:**

- **KeySpan LNG file documentation of concurrence from the CRMC that the project is consistent with the RICRMP. KeySpan LNG should file this information with the Secretary <u>prior to construction</u>.**

4.8.4.2 Pipeline Facilities

Algonquin submitted its application for an Assent and federal consistency determination from the CRMC for the proposed pipeline on February 8, 2005. However, on March 31, 2005 Algonquin notified the FERC that had reviewed the correspondence between KeySpan LNG and the CRMC and supporting case law, and agrees with KeySpan LNG that a separate Assent certification is not required. Further, Algonquin considers its FERC application a companion to KeySpan LNG's FERC application. Therefore, on April 1, 2005, Algonquin withdrew its Assent application and renewed its request for CRMC concurrence with its consistency certification.

If the proposed pipeline facilities are approved by the CRMC, concurrence from the CRMC that the project is consistent with the RICRMP must be received prior to any issuance of a Notice to Proceed from the Director of OEP. Therefore, **we recommend that:**

- **Algonquin file documentation of concurrence from the CRMC that the project is consistent with the RICRMP. Algonquin should file this information with the Secretary <u>prior to construction</u>.**

4.8.5 Special Use, Recreation, and Public Interest Areas

The KeySpan LNG Project would not affect state forest land, national or state parks or trails, proposed or listed Wild and Scenic Rivers, Indian reservations, or registered national landmarks. Other special use, recreation, and public interest areas in the vicinity of the project are discussed below.

4.8.5.1 LNG Facilities

The existing KeySpan LNG facility is a secure site and does not provide public access to the Providence River waterfront. The facility would continue to operate in this fashion with the addition of the proposed facilities. Consequently, construction and operation of the project would not affect public access to the waterfront. However, the project would affect commercial shipping and recreational boating within Narragansett Bay and the Providence River. The COE currently maintains a federal navigation channel within the Providence River from Upper Narragansett Bay to Fox Point. The COE has been conducting maintenance dredging operations of the navigation channel and harbor immediately adjacent to, and east of, the KeySpan LNG facility to maintain the federally authorized depth of 40 feet MLLW. The navigation channel is about 1,500 feet wide adjacent to the site. The western limit of the channel is located approximately 75 feet east of the existing bulkhead at the KeySpan LNG facility. The proposed berth would be outside of but adjacent to the federal channel and berthed LNG ships would extend into the channel. The channel is used by a variety of vessels but is especially important for oil tankers, other fuel ships, and cargo ships. The open water in and adjacent to the federal channel is also used for recreational fishing and boating, including sailboats, power boats, and large yachts (COE, 2001); for yachting regattas; and for activities such as the parade of Tall Ships held approximately every 4 years at Newport.

Commercial Shipping

Fuel tankers and cargo ships call on various industrial facilities along the waterfront in Providence. A notable example is ProvPort (formerly the Port of Providence), a 105-acre commercial deepwater port facility located on Field's Point south of the KeySpan LNG facility. ProvPort operates a variety of services to support the transshipment of cargos. ProvPort facilities include six deep water berths, three warehouses totaling 300,000 ft^2, over 20 acres of paved open storage area, and on-dock rail access with three rail spurs. ProvPort also owns and operates a petroleum tank farm with storage capacity in 13 aboveground storage tanks and a fuel depot station. ProvPort handles dry and liquid commodities such as cement, chemicals, coal, cobblestone, heavy machinery, liquid petroleum products, lumber, pearlite, salt, scrap metal, and steel products (ProvPort, 2004).

According to the COE (as cited in MNI, 2004), the total number of ships in transit to the Providence Harbor in 2001 was 606. This number was composed of 64 passenger/dry cargo ships, 105 self propelled tankers, 56 dry cargo barges, and 381 tank barges. The majority of traffic was incoming petroleum product cargo. The largest amount of outgoing cargo was cement, and, to a lesser extent, steel scrap. Non-metallic mineral (salt) was the largest incoming cargo. The trend since 1992 has been for the cargo weight through the Providence Harbor to increase by about 1 percent per year, while the cargo ship

traffic decreased by about 3 percent per year. Since 1994, the number of cruise ships transiting Narragansett Bay has also been increasing. Because the cruise ships do not go to Providence, potential ship traffic conflicts between cruise ships and LNG tankers would be limited to a short portion of the East Passage. There have been some proposals made to bring the cruise ships to Providence, but there are no immediate plans to do so.

Construction of the LNG marine facilities would not be expected to affect the federal navigation channel or interfere with commercial ship traffic. The beam dimension of the work barge that would be temporarily moored adjacent to the KeySpan LNG facility is 40 feet. Barges of this size are routinely located along this portion of the Providence River. Transit and mooring of the work barge would occur in accordance with applicable COE and Coast Guard regulations, and the temporary mooring of the work barge would not present a significant obstruction to navigation.

Operation of the LNG terminal between LNG deliveries would not affect commercial shipping in the Providence River. None of the structures to be constructed as part of the ship berth or offloading facilities would be located within the navigation channel. Navigational marking and operation of the structures would be conducted in accordance with applicable Coast Guard and COE regulations.

The existing commercial ship traffic in Narragansett Bay and the Providence River includes LPG carriers and a variety of fuel and oil tankers; thus, the addition of LNG ships would be generally consistent with existing uses. As is currently the case for LPG tankers, the Coast Guard would enforce a security zone around the LNG tankers during transit and berthing, which would increase the frequency with which security zones could affect other marine traffic. Moffatt and Nichol International conducted modeling for KeySpan LNG to assess the potential impact of LNG tankers on existing ship traffic (MNI Traffic Study). This modeling, which is summarized in the Narragansett and Providence River Traffic Study report, indicates that the level of LNG shipping anticipated for the project would result in delays of other marine traffic through the area. Additional information about how the Coast Guard security zones would be implemented and the anticipated effect of the project on ship traffic is discussed in detail in section 4.12.5.

When LNG ships are moored at the LNG facility they would extend into the federal navigation channel for up to about 24 hours at a time. The largest LNG ships anticipated to call at the KeySpan LNG facility would have beam widths of about 140 feet, which would leave the majority of the channel unobstructed. We received comments on the draft EIS from the COE and others expressing concern about how a moored LNG ship and the associated security zone around a moored LNG ship would affect other vessels, including commercial vessels calling on nearby facilities in the Providence Harbor area. In particular, some parties expressed concern that the shipping channel would be blocked off, and that marine traffic would be unable to pass for the duration of the LNG ship berthing cycle.

During a series of security workshops sponsored by the Coast Guard, the Coast Guard expressed its intent to minimize impacts on other users of the waterway. While the security zones around LNG ships would be under Coast Guard control and unauthorized entry by other vessels would be prohibited, the Coast Guard would have the ability to "permission" other vessels through the zone once they have been vetted. Subject to security conditions existing at the time, the Coast Guard has indicated that it anticipates legitimate marine traffic such as commercial vessels serving the port area and scheduled ferries would generally be permissioned through the security zone around berthed LNG vessels. Thus, the channel would not necessarily be blocked off as some commentors have asserted, and berthed LNG tankers are expected to have little impact on the access or operations of other vessels. Additional information regarding the potential impacts of the Coast Guard requirements and potential mitigation measures are discussed in section 4.12.5.2.

Commercial Fishing

The Rhode Island commercial fishery supports approximately 4,500 license holders. The direct dockside value of commercial landings has fluctuated widely over the last 10 years between a high of $86 million recorded in 1999 and a low of $69 million in 2003. Landings of ground fish, shellfish, and lobster provide the mainstay of the industry. The total value of the industry, however, when domestic sales, exports, purchase of supplies and services, and other generators of economic activity are factored in, is estimated to be in excess of $500 million (R.I. Seafood Council as cited in DEMDFW, 2004).

According to a report prepared by the DEM Division of Fish and Wildlife (2004), 4 out of 10 of the state's most valuable species remain overfished, including those generating the highest dockside revenues (lobster, quahog, winter flounder, and bluefish). Rhode Island has exclusive management control only for those species that spend their entire lives in state waters. The Atlantic States Marine Fisheries Commission (ASMFC) manages inshore migratory species along the Atlantic seaboard within 3 miles of the shore. Other species that spend most of their life cycles in federal waters (3 to 200 miles offshore) are managed by the New England Fisheries Management Council and/or the Mid-Atlantic Fisheries Council.

The Rhode Island shellfish industry is dominated by the bay quahog. Shellfish resources are managed by the DEM through designated management areas and a rotational transplant/harvest system (see figure 4.8.5-1). Stock assessments based on fishery landings, fishery effort, and independent survey data indicate that quahog stock biomass is at a relatively low level and below that needed for maximum sustainable yield. The steady decline that occurred between the mid 1980s and mid 1990s has leveled off, however, as the result of improvements in Greenwich Bay water quality and the DEM's rotational harvest/transplant program in the Pottowomut and High Banks Spawner sanctuaries.

The Providence River and Upper Narragansett Bay are permanently closed to shellfishing due to poor water and sediment quality. Other closed areas within the proposed LNG ship route include: the vicinity of Melville east of a line from Coggshall Point; Carr Point to buoy "GrC" located at Fiske Rock; the waters on the east side of Jamestown; East Passage waters and Newport harbor east; and Castle Hill Cove. Additionally, two areas south of Conimicut Point (Conditional Areas A and B) are closed for 50 to 70 percent of the year due to unsuitable conditions (see figure 4.8.5-2). However, these two areas still yield 60 percent of the annual quahog harvest in Rhode Island and continue to be the most heavily shellfished areas within Narragansett Bay (Lynch, 2005). Passage of LNG vessels may inconvenience the commercial harvesting of shellfish as a result of the moving security zones around transiting LNG ships. However, assuming a maximum operating depth range of 26 feet for quahog harvesting by bull rake (Desbonnet and Lee, 1991), there are few areas encompassed by the moving security zone that would be within effective depth ranges harvested by shellfishermen. The few areas that could be affected include the western edge of the west side of the channel in the waters to the west of Hog Island, northeast of Prudence Island, and a small area south of Dyer Island. Shellfishermen in these areas would be required to temporarily avoid or vacate the areas encompassed by the moving security zone during the transit of an LNG ship. Aside from these areas, a majority of the East Passage within the safety zone is not useful for shellfishing due to either permanent closure or depth. Harvesting in waters deeper than 26 feet by hydraulic dredge is not permitted in Narragansett Bay to reduce fishing mortality.

The Rhode Island inshore fishery for American lobster has declined sharply in recent years and both fishery landings and abundance have dropped to low levels. In spite of this decline, fishing for lobster continues to occur year round within the waters of Narragansett Bay. The deep and rocky areas of the bay contain the most abundant populations and provide the best lobster fishing. The most heavily fished areas are the southern coast and the East Passage of Narragansett Bay. The northern limit of the fishery is around Ohio Ledge, located between Rocky Point in Warwick and North Point in Bristol, and the mouth of Mount Hope Bay. Due to the favorable habitat conditions that exist within the shipping channel, many lobstermen set their pots within the channel (Olszewski, 2005).

Figure 4.8.5-1

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Figure 4.8.5-2

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Passage of LNG vessels could inconvenience the commercial harvesting of lobster as a result of the moving security zones established by the Coast Guard. Lobstermen in these areas would be required to avoid or vacate the areas encompassed by the moving security zone. However, this effect would be temporary (up to about 18 minutes, as discussed in more detail in section 4.12.5.2) and limited to periods when the LNG ships are in transit to the facility. Commercial fishermen are trained in the rules, safety procedures, and regulations within the waters of Narragansett Bay. Additionally, they are currently subject to similar restrictions along the channel while other types of commercial vessels are in transit to Providence Harbor and Mount Hope Bay. For these reasons, it is not expected that the transiting LNG ship would cause a significant disruption in the commercial shellfishing industry (Olszewski, 2005). Additional information regarding the potential impacts of the Coast Guard's navigation requirements and potential mitigation measures are provided in section 4.12.5.2. Passage of the LNG vessels could also damage lobster gear that is placed within the shipping channel. However, because the LNG ships would use an existing dredged federal navigation channel and existing shipping route that is maintained specifically to allow passage by large vessels, the placement of lobster gear along this route by lobstermen assumes these inherent risks. Lobstermen who actively fish these areas typically factor in the potential for broken gear in the economics of their operations (Lynch, 2005).

Finfish fisheries in Rhode Island state waters include demersal (bottom-dwelling) and pelagic (water column) fish. The finfish community in Narragansett Bay has changed from an assemblage dominated by demersal species to one currently dominated by pelagic fish species and longfin squid. Important finfish found in the bay include winter flounder, scup, bluefish, striped bass, tautog (blanckfish), and menhaden (EPA, 1992). Trawling for finfish occurs in Narragansett Bay from April through November. Trawling activities are concentrated within the East Passage, within the waters on the northeast side of Jamestown north to Hope Island, and south of Hog Island in the waters west of Prudence Island. As with other commercial fishing activities discussed above, passage of LNG vessels could inconvenience the commercial harvesting of finfish as a result of the moving security zones. However, with the exception of a small area south of Hog Island, most of the trawling activities take place outside of areas that would be affected by the security zones for LNG ships calling on the KeySpan LNG facility. Trawling boats in this area would be required to temporarily avoid or vacate the area during the transit of an LNG ship.

Recreational Boating and Fishing

We received several comments on the draft EIS expressing concern about the potential impacts of the proposed project on recreational boating and fishing activities in Narragansett Bay. The total annual value of all outdoor recreational activities in Rhode Island was estimated to be about $6.7 billion, of which approximately $2 billion was associated with bay-related outdoor recreational activities including recreational boating, fishing, beaches and coastal parks, and recreational diving (Tyrell and Harrison, 1999 as cited in Colt et al., 2000). The net economic value of sailing alone has been estimated at $165 million (Narragansett Bay Summit Report, 2000). On an average annual basis, an estimated 300,000 recreational anglers generate over 1 million fishing trips and spend in excess of $150 million on bail, tackle, boats, and gear.

An estimated 60,000 recreational boaters use Narragansett Bay between late June and September, including trailered boats and regatta boats. During summer months, yachting regattas are held in the bay. Smaller yachts tend to race closer to Newport while larger yachts race further from shore. Several races are scheduled throughout the summer months and about 20 to 30 marine event permits are issued annually. The largest events are focused at Quonset (Air Show), Newport (America's Cup), Breton Reef, north of Conamicut and Barrington Points, Greenwich Bay, and the Wickford and Bristol Bay racing series. Weekend volumes tend to be twice that of weekday volumes. Between May and October 2002,

approximately 25 cruise ships were anchored off Newport. They typically entered the bay in the morning and sailed again later in the same day.

The DEM (2000) reported that in 1999 there were 35,891 registered boats in Rhode Island. According to data from the Narragansett Bay Summit 2000 report, there are more than 13,000 boat slips and moorings on Narragansett Bay. In comments on the draft EIS, the Rhode Island Attorney General indicated that there are currently proposals that would increase the number of boat slips along the East Passage by more than 2,000. By evaluating permit applications submitted to the COE between May 2003 and March 2005, as well as the East Bay Newspapers online edition, we were able to determine that there are proposals for approximately an additional 2,056 boat slips within the entire Narragansett Bay area (COE, 2005; East Bay Newspapers, 2005). The bulk of these slips are associated with a single project, the Weaver Cove Marina in Portsmouth, which was approved in the mid 1990s. Based on a newspaper report, this marina would be the East Coast's biggest; however, no actual docks are yet in place for the project and the marina's eventual size may be smaller (East Bay Newspapers, 2005). Regardless, the data indicate that the number of boat slips on the bay is likely to continue to increase at least in the short term.

Public boat ramps in the vicinity of the proposed project include ramps at Collier's Point Park, Bold Point, Sabin Point Park, and Haines Memorial Park, as well as several additional public launches located along the shipping channel between the project site and the bay. Eight marinas and yacht clubs are located within about 4 miles of the project site, and several more recreational boating facilities are located further downriver between the KeySpan LNG site and Narragansett Bay.

Human activity and noise associated with construction of the proposed LNG marine facilities could potentially affect recreational boating and fishing. However, these impacts would be temporary and localized because the project would not require dredging and the proposed marine facilities would be confined to a small area of the river immediately adjacent to the existing LNG facility.

Operation of the LNG terminal could affect recreational boating and fishing during the weekly transit and unloading of the LNG ships as a result of the safety and security zones anticipated to be required by the Coast Guard. The potential impacts of Coast Guard requirements and potential mitigation measures are discussed in section 4.12.5.2. We received comments regarding the potential for the safety and security zones to extend past the shoreline and affect land-based activities within those areas. There are a few individual areas along the LNG ship transit route where the safety and security zones are expected to extend onto the shore. Along these areas, the Coast Guard has indicated that the application of the safety and security zone on land would have minimal impact. See section 4.12.5 for further discussion of safety and security measures.

India Point Park

Several commentors identified India Point Park as an area of concern. India Point Park consists of 18 acres of open space located at the confluence of the Seekonk and Providence Rivers, about 1.2 miles north of the KeySpan LNG facility. The park also features the Harry Carr Memorial Boathouse, which is used by the Brown University Crew Team and the Community Boating Center (CBC). The sloop *Providence*, a replica of an 18th century ship built by John Brown, docks at India Point Park and offers sailing trips from April through October. Land-based activities at the park include: the use of the park's sport fields; walking and bicycling along the walking paths and trails throughout the park; and special events such as school field trips, festivals, and concerts. Due to the distance of the park from the KeySpan LNG facility, these land-based recreational activities within India Point Park would not be affected by the project. However, the moving security zone around the LNG ship could temporarily affect recreational boats transiting to and from the park during the arrival and departure of ships.

We received comments from the CBC about the potential impacts of the project on its sailing programs. The CBC offers a variety of sailing opportunities in upper Narragansett Bay. A representative of the CBC indicated that the sailing programs use an area of the bay from the northern section of India Point Park south to State Pier No.1, which is located approximately 3,400 feet north of the KeySpan LNG facility (Gengler, 2005). As discussed above, the moving security zone around the LNG ship during transit could temporarily affect recreational boating transiting to and from the park.

Save the Bay

We received comments from Save the Bay regarding the potential impacts of the project on Save the Bay's operations and programs on the Providence River. Save the Bay currently offers classroom programs, coastal field trips, and shipboard outings on and around Narragansett Bay. Save the Bay will be relocating its headquarters to Field's Point in 2005. The new headquarters will be located approximately 1.2 miles south of the KeySpan LNG facility. The new headquarters will house an urban education center, including indoor exhibits, classrooms, and aquaria; and outdoor facilities such as walking trails, docks, exhibits, and picnic areas. The proposed project would not affect Save the Bay's land-based activities. However, operation of the LNG terminal could temporarily affect Save the Bay's marine activities during the weekly transit of the LNG ships as a result of the moving security zones.

Colt State Park

We received a comment regarding the potential impacts of the project on Colt State Park. Colt State Park consists of 464 acres on the eastern side of Narragansett Bay and is located 9.8 miles from the Keyspan LNG facility. Due to the distance of the park from the LNG shipping route, the security zone around the LNG ship while in transit would not affect land-based activities at the park. However, the moving security zone around the LNG ship during transit could temporarily affect recreational boats transiting to and from the park.

4.8.5.2 Pipeline Facilities

A review of RIGIS data (RIGIS, 2004) identified several special land use/open space areas in the vicinity of the proposed pipeline. Most of these areas are on the east side of the Providence River in East Providence and would not be affected by the project. The two special use areas that would be closest to the pipeline route are State Pier No. 1 and Collier's Point Park.

State Pier No. 1

State Pier No. 1 is on the west bank of the Providence River, immediately east of the proposed pipeline route and Allens Avenue. State Pier No. 1 is owned by the State of Rhode Island and is currently under long-term lease by an industrial operation. State Pier No. 1 would not be directly affected by the proposed project, but because access to the facility is from Allens Avenue there may be some temporary access disruption during pipeline construction. As discussed in section 2.4.2, Algonquin would use the stovepipe construction technique along Allens Avenue which would minimize the duration of open trench at any given location and maintain access to adjacent businesses except for the brief period essential for laying the new pipeline.

Collier's Point Park

The nearest public recreation area to the proposed pipeline route is Collier's Point Park, which occupies the southeastern corner of the U.S. Generating parcel at MP 1.44. Although the park is on U.S. Generating property, the Rhode Island Energy Facility Siting Board required public access to the park in a

December 1990 Final Order for the Manchester Street Generating Station. Collier's Point Park facilities include a boat ramp, observation tower, and parking area. The park is also the site of the Russian Submarine Museum. Collier's Point Park is open year round from dawn to dusk, but the peak use period is during the summer between Memorial Day and Labor Day. The park is primarily frequented by recreational boaters and fisherman who use the boat ramp and trailer parking area.

The park facilities would not be directly affected by construction or operation of the proposed pipeline, but access to the park is via Henderson Street, which would be disturbed during construction. To minimize disruption of park access, Algonquin intends to construct the portion of the pipeline along Henderson Street at night. Park users might experience impacts from noise and dust generated during construction of the pipeline and tap valve, but these impacts would be temporary and short term.

4.8.6 Visual Resources

4.8.6.1 LNG Facilities

The degree of visual impact that may result from a proposed project is typically determined by considering the general character of the existing landscape and the visually prominent features of the proposed project. The KeySpan LNG facility upgrade would occur at an existing LNG facility in a location that is surrounded by industrial and waterfront uses. The KeySpan LNG facility is bordered on the north by Providence River harbor; on the east by the Providence River channel; and on the south and west by other industrial waterfront facilities. The terrain in the area of the site is generally flat. The KeySpan LNG facility is primarily visible from the water and from waterfront areas of East Providence (about 2,300 feet away across the Providence River). The site is also visible from certain higher elevations in Providence.

Due to the relative size and location of the existing LNG storage tank and other facilities within and around the LNG plant, the proposed landside modifications (i.e., the new LNG processing equipment, buildings, and certain components of the LNG ship offloading facilities) are not likely to be noticed by the casual observer.

In scoping comments, East Providence asked about potential visual impacts of new lighting that would be installed as part of the project. KeySpan LNG indicated in its application that the lighting associated with the facility upgrade would be designed based on recommended practices of the Illuminating Engineering Society of North America and the recommended illumination levels from API-Recommended Practice 540, Electrical Installations in Petroleum Processing Plants. Certain activity area lighting would only be turned on during specific activities such as ship unloading operations. However, lighting that is needed for safety and security would be on at all times. To minimize visual impacts associated with lighting, KeySpan LNG would use downcast-type outdoor fixtures where practical and/or reflectors to shield and direct light being cast.

The new ship berth and components of the LNG ship offloading facilities that are within or immediately adjacent to the Providence River, such as the offloading platform, trestle, and new jetty building, would be visible to viewers in watercraft on the nearby reach of the Providence River. However, these facilities would be generally consistent with existing industrial and waterfront land uses at and adjacent to the LNG terminal along the river. Therefore, while the ship berth and tanker unloading facilities would constitute a change in the viewshed for this area, they would not create a significant degradation in viewshed.

Ships transporting LNG to the upgraded facility would likely be the most visible aspect of the project. The ships would be most visible from the river and from the East Providence waterfront for

approximately 24 hours at a time, approximately 50 to 60 days of the year. However, as discussed above, the Providence River federal navigation channel is currently used by other cargo ships, tankers, and barges that call on other waterfront facilities in the vicinity of the LNG facility. Although the LNG ships might be larger than other vessels typically seen in the area, the addition of the LNG ships would be generally consistent and visually in character with the existing uses of the river. Thus, we believe that the LNG carriers, although visible, would not result in an adverse visual impact.

4.8.6.2 Pipeline Facilities

Visual impacts associated with the pipeline would primarily be limited to the construction phase of the project and would include views of heavy equipment and personnel conducting the various stages of construction described in section 2.4.2. Because the proposed pipeline route is located in city roadways and on private industrial lands, the visual impacts associated with typical greenfield pipeline construction projects, such as those associated with removal of woody vegetation, would not occur. Following installation of the pipeline within roadways, the surfaces would be restored and the pipeline would not be visible.

The proposed meter station would not result in a significant visual impact because it would be constructed within an industrial area adjacent to similar-looking industrial facilities at the existing KeySpan LNG facility.

The proposed tap valve, which would be constructed at MP 1.44 adjacent to Henderson Street, would be visible to users of Collier's Point Park. To minimize visual impacts, Algonquin would plant shrubs along the boundary of the tap valve facility to provide visual screening for users of the park. Further, **we recommend that:**

- **Algonquin file with the Secretary for review and written approval of the Director of OEP <u>prior to construction</u> a visual screening plan for the proposed tap valve at MP 1.44. Algonquin should include in its submittal documentation of the acceptability of this plan to U.S. Generating.**

4.9 SOCIOECONOMICS

The sections below discuss the existing socioeconomic environment in the project area and potential impacts of the KeySpan LNG Project on population and employment, housing, public services, transportation and traffic, tax revenues, property values, and environmental justice.

4.9.1 Population, Economy, and Employment

The KeySpan LNG facility is located in the northeastern portion of Providence's Washington Park neighborhood. The proposed pipeline would cross the eastern edge of the Lower South Providence neighborhood and the Upper South Providence neighborhood, and extend slightly into the southernmost corner of the Downtown neighborhood (figure 4.9.1-1).

Figure 4.9.1-1

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Table 4.9.1-1 provides a summary of selected demographic and socioeconomic statistics for the state, county, city, and neighborhoods where the proposed facilities would be located. As shown in table 4.9.1-1, the City of Providence is much more densely populated than Rhode Island as a whole. The Washington Park, Upper South Providence, Lower South Providence and Downtown neighborhoods are also more densely populated than the state as a whole, but are less densely populated than the City of Providence as a whole.

TABLE 4.9.1-1

Existing Socioeconomic Conditions for the KeySpan LNG Project

State/County/ City	Population		Population Density [a/]		Per Capita Income (1999)	Civilian Labor Force (2001)	Unemployment Rate (percent) (2000)	Top Two Major Industries
	1990	2000	1990	2000				
Rhode Island	1,003,464	1,048,319	960	1,003	$29,113	568,700	3.6	1. Education, Health, and Social Services 2. Manufacturing
Providence County	596,270	621,602	1,367	1,504	$19,255	301,751	6.2	1. Education, Health, and Social Services 2. Manufacturing
City of Providence	160,728	173,618	8,688	9,384	$15,525	76,727	5.4	1. Manufacturing 2. Education, Health, and Social Services
Washington Park Neighborhood	8,270	7,802	4,780	4,509	$11,769	3,605	12.5	1. Education, Health, and Social Services 2. Manufacturing
Lower South Providence Neighborhood	5,021	5,744	5,705	6,527	$8,062	1,954	15.4	1. Education, Health, and Social Services 2. Manufacturing
Upper South Providence Neighborhood	4,717	4,965	5,683	5,981	$10,072	1,491	17.0	1. Education, Health, and Social Services 2. Manufacturing
Downtown Neighborhood	2,411	2,678	4,727	5,250	$20,884	1,279	17.0	1. Arts, Entertainment, Recreation, Accommodation and Food 2. Finance, Insurance, Real Estate and Rental Leasing.

[a/] Persons per square mile, based on population and land area size: Rhode Island (1,045 sq. mi.), Providence County (436 sq. mi.), City of Providence (18.5 sq. mi.), Washington Park Neighborhood (1.73 sq. mi.), Lower South Providence Neighborhood (0.88 sq. mi.), Upper South Providence Neighborhood (0.83 sq. mi.), Downtown Neighborhood (0.51 sq. mi.).

Sources: U.S. Census Bureau, DP-3 Profile of Selected Economic Characteristics: 2000.
The Providence Plan Neighborhood Profiles, compiled from U.S. Census Bureau, Census 2000 Summary Files.
U.S. Department of Labor, Bureau of Labor Statistics, Local Area Unemployment Statistics.

The main industries in the neighborhoods that would be affected by the project are education, health, social services, and manufacturing and, to a lesser extent, arts, entertainment, recreation, accommodation, and food. The unemployment rates in 2000 for the Washington Park, Upper South Providence, Lower South Providence, and Downtown neighborhoods were 12.5 percent, 17.0 percent,

15.4 percent, and 17.0 percent respectively, which are higher than the unemployment rates for the state (3.6 percent), Providence County (6.2 percent), and the City of Providence (5.4 percent).

KeySpan LNG anticipates that construction of the proposed LNG terminal facilities would require about 4,555 person-weeks of construction employment over a 43-week period, or an average workforce of approximately 106 persons. The workforce would exceed 150 people for approximately 15 weeks. KeySpan LNG estimates that the total construction workforce would be a combination of workers residing in Providence, workers from outside of Providence (including other parts of Rhode Island), and workers that would temporarily relocate to Providence to work on the project. In addition, Algonquin estimates that a workforce of up to 60 to 70 people would be needed for about 18 to 26 weeks to construct the pipeline. Algonquin anticipates that 25 to 30 of these workers would be local hires.

Population impacts within the project area are expected to be temporary and proportionally small. A majority of the impacts would result from the temporary influx of construction personnel. The total population change would equal the total number of non-local construction workers plus any family members accompanying them. This temporary increase in population would not have a significant impact on the population in the project area. The project could also result in a brief decrease in the unemployment rate during construction due to the hiring of local workers for construction and the increased demands on the local economy. However, given the relatively short construction period, the impacts on the economy and employment would be temporary and minimal.

KeySpan LNG intends to hire between 20 and 25 new permanent employees to operate the upgraded LNG terminal. A local pool of workers could fill some of these new positions. However, given the small number of permanent workers, the project would not have a significant impact on the permanent population, economy, or employment.

4.9.2 Housing

Housing is relatively abundant in the vicinity of the project. Table 4.9.2-1 identifies the temporary housing characteristics for the county, city, and neighborhoods in the project area in 2000.

TABLE 4.9.2-1

Temporary Housing Characteristics for the Project Area

County/City/Neighborhood	Total Housing Units	Renter-Occupied Housing	Housing Units Available for Seasonal, Recreational, or Occasional Use	Vacancy Rate (percent)
Providence County	239,936	112,352	1,172	5.2
City of Providence	67,915	140,801	343	8.1
Washington Park Neighborhood	2,324	1,020	9	6.5
Lower South Providence Neighborhood	1,932	1,264	2	8.7
Upper South Providence Neighborhood	1,855	1,344	7	9.6
Downtown Neighborhood	1,552	1,358	7	11.0

Sources: U.S. Census Bureau, DP-1. Profile of General Demographic Characteristics: 2000.
The Providence Plan Neighborhood Profiles, compiled from U.S. Census Bureau, Census 2000 Summary Files.

Providence County had almost 240,000 total housing units in 2000, with about 28 percent of these units existing in the City of Providence. The City of Providence had 140,801 renter-occupied

housing units in 2000, of which 4,986 were located in the four neighborhoods nearest the project site (Washington Park, Lower South Providence, Upper South Providence, and Downtown). Housing units available for seasonal, recreational, or occasional use in the four neighborhoods nearest the project site are scarce (only 25 reported in 2000). However, over 300 units of this type are available in the greater City of Providence area. Vacancy rates within the project area were greater than the state vacancy rate of 5.2 percent. Assuming that local construction workers do not require additional housing and that all non-local workers would relocate to the project area, impacts on the temporary housing conditions within the City of Providence would be minimal given the number of rental units and the vacancy rate. In addition, workers could use hotel/motel rooms and recreational vehicle campgrounds for temporary housing, creating an even greater surplus of available temporary housing. Impacts on temporary housing conditions within the four neighborhoods nearest the project site could occur based on the number of units available for rent. However, we expect that should a shortage of housing arise, workers would find ample temporary housing in the greater City of Providence area as discussed previously.

The operation of the upgraded KeySpan LNG facility is expected to require between 20 and 25 additional full-time workers. Some of these new employees are expected to be local hires, but even if all were non-local hires, impacts on permanent housing conditions within the City of Providence would be expected to be negligible given the number of total housing units available.

4.9.3 Public Services

As shown in figure 4.8.2-1, the Rhode Island Hospital is located at 593 Eddy Street, just over 1 mile from the KeySpan LNG site. This hospital is designated as the Level I Trauma Center for southeastern New England. The Women and Infants Hospital of Rhode Island at 101 Dudley Street, which is one of the nation's leading specialty hospitals for women and newborns, is also just over 1 mile from the site. Bradley Hospital at 1011 Veterans Memorial Parkway in East Providence, which is the nation's first psychiatric hospital devoted exclusively to children and adolescents, is about 1.3 miles from the site. In addition to these facilities, there is a community-owned medical services facility, the Roger Williams Medical Center, at 825 Chalkstone Avenue, about 3.25 miles from the project site. There are also a number of private, not-for-profit hospitals and a Veterans Administration Medical Center in Providence.

The Providence Police Department is headquartered at the Public Safety Complex located at 325 Washington Street. The City of Providence is divided into nine police districts, and police substations have been opened in eight of the nine districts. The Washington Park neighborhood is located in District 3, which includes three substations. The closest of these is located at 1380 Broad Street, about 1 mile from the project site. A lieutenant, 3 sergeants, and 19 police officers staff this district substation. The Upper and Lower South Providence neighborhoods are located in District 2, which contains one substation, at 17 Gordon Avenue, about 1.5 miles from the KeySpan LNG site. A lieutenant, 3 sergeants, and 24 police officers staff this substation. The Downtown neighborhood is located in District 1, which contains one substation at 69 Richman Street about 2 miles from the KeySpan LNG site. A lieutenant, 5 sergeants, and 31 police officers staff this substation.

The Providence Fire Department is headquartered at the Public Safety Complex at 325 Washington Street. The department consists of 15 engine companies and 8 ladder companies. The fire station nearest the project site is at 776 Allens Avenue in the Washington Park neighborhood, approximately 0.5 mile to the southwest of the existing LNG facility.

Because of the limited number of permanent employees that would be hired, the proposed project would not have a long-term impact on public services. However, as is the case for the existing LNG facility, the services of local fire departments and emergency response units would be required if there

were a fire or other emergency at the proposed LNG terminal. We received comments expressing concern about the ability of the local police, fire, and emergency services to handle an incident at the LNG terminal or along the shipping route. KeySpan LNG has had discussions with federal, state, and local representatives regarding roles and responsibilities for responding to an emergency incident associated with the LNG terminal or with LNG ships that would make deliveries to the terminal. At various times prior to and since filing its FERC application, KeySpan LNG has met with representatives of Governor Carcieri's office, the Rhode Island State Police, the State Fire Marshal, the Providence Fire Department, the Providence Police Department, the state and local emergency management agencies, and the Rhode Island Emergency Management Advisory Council. Discussions with state and local entities have continued as part of the formal process in which KeySpan LNG and the Coast Guard are currently engaged to prepare the comprehensive Safety and Security Plan required by the Coast Guard. This process has included a series of workshops to develop mitigation measures and response actions in the event of an incident requiring emergency response.

As local first responders, the Providence Fire Department has requested that KeySpan LNG sponsor specialized firefighter training for the Department. As discussed in more detail in section 4.12.5.2, KeySpan LNG has agreed to sponsor and to conduct certain training activities. As also discussed in section 4.12.5, KeySpan LNG has been providing direct financial assistance to both the State of Rhode Island and the City of Providence to assist each in its evaluation of the project and to assist in the preparation of emergency response plans.

The National Association of State Fire Marshals, the DOT's Office of Pipeline Safety, and the OEP are in the process of developing an LNG safety training module that will be added to the existing firefighter safety program material. The intention is to educate and train the local fire services in the risks associated with LNG so that they will be positioned to take a leadership role in further educating emergency first responders in the communities they serve.

In addition to emergency response services, the project would require federal, state, and local resources to provide security for the LNG ships and terminal. Several commentors expressed concern that local communities would have to bear some or most of the costs of these security resources. Section 4.12.5.2 describes the estimated security costs as determined during the Coast Guard safety and security workshops, and how these costs are anticipated to be covered. As discussed in that section, KeySpan LNG has proposed to fund direct transit-related state and local security costs identified during the workshops, and we have recommended that KeySpan LNG identify funding mechanisms for other potential costs such as capital costs associated with any necessary security equipment. Because KeySpan LNG has committed to direct funding of incremental safety and security costs and in light of our recommendation, we anticipate that the project-related tax revenues would not be offset by security costs to the local communities and that the state and local communities would experience a net gain equal to the anticipated tax revenues associated with the project.

We received comments from the Narragansett Bay Commission (NBC) regarding potential construction and operation impacts on the Fields Point Wastewater Treatment Facility. NBC is Rhode Island's largest wastewater authority and oversees the Fields Point facility, which provides preliminary and primary treatment for up to 200 million gallons of wastewater per day and secondary treatment for up to 91 million gallons of wastewater per day. A primary concern expressed by the NBC was the proximity of the LNG terminal to the NBC treatment facility and the potential disruption of the Coast Guard security zone on the treatment facility. LNG is considered a hazardous cargo, and a security zone would be established around LNG ships traveling in the federal navigation channel as discussed below. However, we do not anticipate that this security zone would affect the operation of the NBC facility or other existing onshore facilities. Our responses to NBC's other comments are provided in Appendix F.

4.9.4 Transportation and Traffic

Vehicle Traffic

No alterations of or improvements to the existing roads surrounding the LNG facility would be required for the project. The KeySpan LNG site is within 0.5 mile of the Interstate 95/Thurbers Avenue Interchange. Vehicles traveling between the site and Interstate 95 would use Terminal Road, Allens Avenue, and Thurbers Avenue. Vehicles leaving the site and needing to go southbound on Interstate 95 would have to travel short distances of 0.28 and 0.34 mile on Ernest and Eddy Streets, respectively, as well as on Thurbers Avenue in order to obtain access to the southbound entrance ramp.

We obtained average daily traffic count data from RIDOT and the Providence Department of Public Works for the roads listed above. The average traffic volume along Thurbers Avenue at the intersection with Allens Avenue is 621 vehicles per hour. The average traffic volume along Allens Avenue at the intersection with Thurbers Avenue is 1,021 vehicles per hour traveling north and 1,357 vehicles per hour traveling south. Further south at the intersection with Terminal Road, the average traffic volume along Allens Avenue is 1,493 vehicles per hour traveling north and 1,428 vehicles per hour traveling south. Average traffic volumes on Ernest and Eddy Streets are 73 and 256 vehicles per hour, respectively. The average number of vehicles traveling east along Terminal Road is 100 per hour.

During construction, workers and equipment delivery persons would obtain access to the site from Terminal Road via Allens Avenue and Thurbers Avenue. KeySpan LNG estimates that the traffic associated with construction employees would be around 170 to 200 vehicle trips to and from the site per day when the peak workforce is employed at the site. It is anticipated that truck traffic related to the delivery of construction materials and equipment would peak at approximately 30 trucks per hour during the early stages of construction. These traffic levels would result in a temporary and localized increase in traffic during the period of construction. The primary impact would be on Terminal Road. There would be less impact on Thurbers Avenue and Allens Avenue because these roads typically carry larger traffic volumes and the incremental effect of the construction-related traffic would be less noticeable. The impact on other area roads would be negligible because the traffic effects of the project would disperse rapidly further away from the LNG terminal site.

During scoping, we received comments about the potential impacts of truck traffic to and from the Port of Providence. According to KeySpan LNG the only equipment and materials that would be delivered to the site from the Port of Providence are the LNG unloading/vapor arms and the ship gangway tower. KeySpan LNG anticipates that moving this equipment from the port to the site may require as many as twelve truck trips. These trucks would travel the interstate highway system without escort to the Thurbers Avenue exit on Interstate 95. Given the relatively minor incremental level of traffic associated with these deliveries compared to the capacity of the roads that would be used, the delivery of materials and equipment from the Port of Providence would not have a significant impact on existing traffic or roadways.

Construction of the pipeline would involve an estimated 60 to 70 workers for 18 to 26 weeks. Each day workers would travel to the construction area and park their vehicles at the temporary staging areas along Allens Avenue. In addition to commuting workers, Algonquin anticipates between 7 and 8 truck trips per day would be necessary to deliver materials and equipment, haul excavated soil, and bring in controlled density fill to the site to backfill the trench. Even if every worker commuted alone, this level of project-related traffic would have only a small incremental impact on existing area roads. Moreover, given the proximity to Interstate 95 and the Thurbers Avenue exit, traffic related to pipeline construction is unlikely to be widespread.

Traffic impacts would include slower speeds and higher congestion due to rough road surfaces, lane closures, and detours. Algonquin has indicated it would schedule road construction in a way that would minimize impacts on commuter traffic to the greatest extent possible. Algonquin has yet to provide a detailed plan of how it would construct the pipeline within or across roadways but has provided general information regarding roadway construction. Signs and safety measures would be developed and employed in compliance with state and local permits. Algonquin would also limit the length of the excavated ditch within the streets to the length of the pipe that would be installed each day. Algonquin would attempt to maintain at least one open lane of traffic when constructing on or across roadways. During the brief period of a few hours when a road is completely cut to install the pipeline across the roadway and detours are in place, steel plates would be available on-site to cover the open area to permit travel by emergency vehicles. Additionally, Algonquin intends to construct the pipeline within Henderson Street during the night when Collier's Point Park is closed and there would be no traffic on the street. Following installation of a pipeline segment each day or night, all excavated areas would be either backfilled or the open trench would be covered with steel plates. Algonquin also stated that throughout construction, traffic and access to businesses would be maintained except for brief periods essential for laying the pipeline. Algonquin would work closely with municipal safety officials and with affected business/land owners to coordinate access to their respective properties. Once the pipeline is installed, all roadway surfaces would be restored to the specifications of the local or state authorities.

While we agree that these measures would likely reduce traffic impacts associated with construction of the pipeline, we also believe more detailed plans are necessary to insure traffic impacts are minimized; therefore, **we recommend that:**

- **Algonquin develop and file with the Secretary <u>prior to construction</u> a detailed construction and traffic plan in consultation with appropriate state and local agencies that includes a construction schedule, proposed time windows for work (e.g., night or day, weekday or weekend), and the specific measures that would be implemented at various locations along Allens Avenue to minimize traffic impacts. This plan should include proposed detours and an assessment of the traffic effects (e.g., delays) to both affected and other nearby roads.**

We received comments regarding the potential for the project to increase or decrease the current level of LNG trucking activities and associated impacts on traffic in the project area. Traffic impacts associated with the operation of the upgraded LNG facility are expected to be minor. KeySpan LNG currently fills the storage tank with LNG delivered by trucks. The amount of trucking varies based on weather and market demand. Between 1980 and 2004, an average of 1,692 trucks per year have made deliveries to the facility and an average of 77 trucks per year have taken deliveries from the facility. However, in 10 of those 25 years, trucking activity at the facility exceeded 2,200 loads per year, and in 6 of those years trucking activity exceeded 2,500 loads. The majority of this trucking occurred during the summer fill season between April and October. There would be little or no need to truck LNG to the facility after the marine terminal facilities are operational. However, depending on regional demand, it is likely that some LNG would be sold in liquid form and trucked to other facilities serving the region.. If the facility is developed into an import terminal, LNG trucks would be loaded at the facility primarily during the same summer period in which the tank is currently filled (from April to October). If BG LNG is able to capture 20 percent of the trucked LNG market, it is estimated that 2,000 truckloads would leave the facility annually. From an operational perspective, it is anticipated that the daily level of LNG trucking to and from the facility would not increase over the current peak levels since the physical ability to load and unload trucks is limited by the design characteristics of the facility. A maximum of 24 trucks per day can be handled at the facility, and the project would not change the existing truck loading and unloading capabilities. Thus the anticipated traffic volume resulting from operation of the LNG terminal,

even during peak operation periods, would not significantly increase the existing traffic volumes on local area roadways or be significantly higher than the present levels.

Operation of the proposed pipeline would not impact traffic along the pipeline route.

We received several comments regarding the potential for the Pell Bridge (also known as the Newport/Pell Bridge or the Claiborne Pell Bridge) to be closed to traffic during LNG ship passage due to security concerns and the potential for these closures to affect the travel between Newport and Jamestown. During the Coast Guard's recent security workshops, workshop participants determined that it would not be necessary to automatically close the bridge for every LNG ship transit and that alternative security measures could be used when the bridge is not closed. The decision to close the bridge would be made by the Rhode Island Bridge and Turnpike Authority in consultation with the Coast Guard and state and local law enforcement authorities, and would depend on conditions at the time of the transit. The anticipated security measures and potential impacts of a bridge closure are discussed in section 4.12.5.2.

Ship Traffic

The proposed project would result in an additional 50 to 60 ships transiting Narragansett Bay to Providence. According to the MNI Traffic Study, the COE data indicate that the number of domestic and foreign ships entering the bay to call on the Port of Providence was 930 ships in 2001 and 945 ships in 2002, or 606 and 630 ships in each year, respectively, if tows and tugs are omitted from the calculation. Not counting tows and tugs, the other ships in descending order of frequency included tanker barges, tankers, passenger and dry cargo carriers, and dry cargo barges. Thus, the proposed project would result in up to a 9.5 percent increase in the total number of commercial ships entering the project area as compared to the 2002 levels, excluding tugs and tows.

There are also several ferries that transit Narragansett Bay and use the Providence River navigation channel. Ferries providing service in areas between Providence and Narragansett Bay include those that provide service between Providence and Newport; Bristol and Prudence Island; Newport and Jamestown; Newport and Block Island; Point Judith and Block Island; and Quonset Point and Martha's Vineyard. All of these ferry routes, with exception of the Point Judith to Block Island route, cross or use the federal channel that would be used by LNG ships to travel to and from the KeySpan LNG facility. The Providence to Newport ferry uses the channel for a significant portion of its route, although it is a shallow draft vessel that is capable of navigating safely outside of the normal ship channel (MNI, 2004). The ferry schedules vary by season and by day of the week (see section 4.12.5 for details).

KeySpan LNG would develop an *LNG Vessel Safety and Security Plan*, which would include cooperation with the management of the ferry companies to identify transit times and possible meeting points. The Northeast Marine Pilots and ferry operators have established plans and procedures, including communications during the transit period, to address navigation issues. These plans and procedures would be part of the *LNG Vessel Safety and Security Plan* and would be modified as necessary to ensure the safe passage of LNG ships and ferries. See section 4.12.5 for additional discussion of shipping safety.

Ships and ferries operating in the federal navigation channel while LNG ships are in transit, and those in the vicinity of the KeySpan LNG terminal while LNG ships are moored, would be affected by Coast Guard-imposed restrictions. However, the Coast Guard has indicated that it would attempt to minimize impacts on other marine traffic, including ferries. Anticipated security measures and potential impacts on other marine traffic are discussed in section 4.12.5.2.

KeySpan LNG submitted a Letter of Intent (LOI) to the Coast Guard in August 2004. The LOI includes KeySpan LNG's evaluation of LNG vessel characteristics; waterway channels that would be

used by LNG ships; the density and character of marine traffic using the waterway; the existing commercial, industrial, and residential areas in and adjacent to the waterway; bridges; physical characteristics and hazards along the waterway; and a navigation simulation study of the proposed ship route prepared by MNI. The navigation simulation study examined several scenarios including the addition of LNG ships from the KeySpan LNG Project alone as well the combined effects of both the KeySpan LNG and Weaver's Cove Energy LNG projects, and added effects if non-LNG traffic were to increase over current levels. The study results provide estimates of the number of vessels likely to experience delays due to the addition of LNG ships to the channel, and the estimated hours per year those delays would entail. The results of the MNI study, including those obtained for the various study cases, are discussed more extensively in section 4.12.5.2. The Coast Guard has noted that one of the assumptions used in the MNI study, that ships traveling in the opposite direction would need to stop when an LNG tanker is moving into Narragansett Bay, is incorrect because it is anticipated that current one-way traffic restrictions associated with the COE dredging of the federal navigation channel will be removed once the dredging project is completed. Therefore, the study may overestimate the actual delays resulting from security restrictions.

Although the Coast Guard has indicated that the existing one-way traffic restriction will be removed after completion of the COE dredging project, the width of the shipping channel in conjunction with the moving security zone would preclude most larger vessels from passing a transiting LNG ship (see section 4.12.5.2 for further discussion). Other large vessels would need to wait at a pier or reach a suitable anchoring location to allow the LNG ship to pass. As the COE suggested in its comments on the draft EIS, we have attempted to estimate the potential cost of ship delays by applying the estimated costs per hour of shipping delays used by the COE for the Providence River Maintenance Dredging EIS (the COE used these costs to evaluate the economic benefits of widening the navigation channel to allow for two-way traffic), and the hours of shipping delays per year due to LNG shipments to the KeySpan LNG facility as estimated in the MNI study. The COE's analysis was based on the annual number of inbound and outbound deep draft vessels using the federal navigation channel and the estimated time needed to transit the channel. By dividing the total hours of inbound and outbound traffic respectively by the total number of navigation hours available per year, the COE estimated the probabilities of vessels transiting the channel in an inbound or outbound direction. The COE indicated that the product of these two probabilities is the probability of a potential pass (the probability of two vessels traveling in opposite directions desiring to use the channel at the same time). The COE then multiplied the maximum wait (the time to transit the channel) by the hourly cost of a ship having to wait by the probability of a passing situation to determine the annual cost of delays associated with one-way traffic.

In its analysis, the COE estimated that the cost of a one hour shipping delay was $1,700. Adjusting this figure upward for inflation at a rate of about 3 percent per year since the COE's analysis, we estimate that the current cost of a one hour shipping delay would be about $2,300. Using 2001 and 2002 shipping data from the COE, the MNI study estimated that approximately 3 percent of ships en route to Providence experience shipping delays due to one-way ship traffic restrictions and that cumulatively the delays for both inbound and outbound traffic are between 14 and 16 hours annually. These estimates result in a maximum existing delay cost of $36,800. The MNI study predicted that the introduction of 52 LNG ships per year transiting to the KeySpan LNG facility in Providence would result in shipping delays for approximately 5 percent of commercial ships transiting Narragansett Bay, and that cumulatively the delays for both inbound and outbound traffic would increase to 61 hours per year (45 to 47 hours above existing delays). By multiplying the anticipated increase in annual shipping delays due to LNG shipping (45 to 47 hours) by the estimated cost per hour of a shipping delay ($2,300), we estimate that LNG shipments to the KeySpan LNG facility could increase the collective cost of shipping to Providence by between $103,000 to $108,000 per year.

Train Traffic

The project would not affect existing train traffic. The proposed pipeline route crosses 11 railroad tracks located within Allens Avenue. These tracks are owned by the Providence and Worcester Railroad but are currently unused. The tracks are part of a freight line that was used during the mid to late 20th century. Algonquin would work with the Providence and Worcester Railroad regarding construction of the pipeline under these tracks and any protection or restoration of the railways that is necessary.

4.9.5 Tax Revenues

Construction and operation of the project would have beneficial impacts on local property tax revenues for the City of Providence, as well as increase state income tax and sales tax revenues. The investment by KeySpan LNG in the facility upgrades would translate into a higher valuation of the taxable property at the LNG facility and higher property tax transfer payments to the City of Providence from KeySpan LNG. In addition, the increases in revenue and associated corporate income resulting from the upgrades would result in higher income tax payments from KeySpan LNG to the State of Rhode Island.

Because the project is still in a development stage, the ultimate capital investment required for the upgrade and associated revenues are still being finalized, and specific discussions of tax-related issues with the State of Rhode Island and the City of Providence have not yet taken place. However, the tax structures in place at the state and local levels (i.e., the tax rates associated with state income and payroll taxes and city property taxes) are clearly defined and can be used to provide estimates based on KeySpan LNG's current investment estimates and revenue streams. Table 4.9.5-1 lists the anticipated capital costs and associated anticipated project revenues that would be realized by the State of Rhode Island and the City of Providence following commencement of operations of the proposed upgrade facility. In 2004, tax payments from KeySpan LNG to the State totaled $233,472, and property tax payments to the City of Providence totaled $215,186. The proposed upgrade would result in higher payments, including an increase of 453 percent to the State and 493 percent to the City of Providence in the first year of operations. In addition, the upgrade project would result in a construction payroll of $5,049,000 and construction sales tax of $200,000.

TABLE 4.9.5-1

KeySpan LNG Estimated Income, Payroll, and Property Taxes

Year	Estimated Corporate State Income Tax for the State of Rhode Island ($USD)	Estimated Payroll Tax to the State of Rhode Island ($USD)	Estimated Property Tax Payment to City of Providence ($USD)
1	1,122,045	171,064	1,293,109
2	1,132,089	177,001	1,309,090
3	1,147,966	183,161	1,331,127
4	1,162,577	189,551	1,352,128
5	1,176,045	196,181	1,372,226
Year 6-25	9,707,351	5,777,364	15,484,715
Total Project Life	15,448,074	6,694,322	39,490,746

Algonquin estimates that tax revenues from pipeline activities (payroll and property taxes) would be $317,830 during construction (2005), $324,187 in 2006, and $330,670 in 2007.

We received several comments expressing concerns that the additional project costs (e.g., sewer, electricity, police, fire, and medical personnel) could negatively affect the state and affected communities and offset project generated tax revenues. Costs for emergency response services and security are discussed in sections 4.9.3 and 4.12.5 and, as noted previously, are not expected to offset project-related tax revenues. The KeySpan LNG Project would involve the construction of a new sewer connection to the existing sewer infrastructure on Terminal Road, as well as the construction of a new electric service to serve the facility. Since the construction and operating costs of these facilities would be borne by KeySpan LNG and paid to NBC (sewer) and Narragansett Electric (electric service), these services are not anticipated to have a financial impact on the State of Rhode Island, City of Providence, or local communities. We also received several comments on the draft EIS that the proposed LNG facility upgrade and associated LNG shipping would have a financial impact on commercial and recreational fishing, shipping and recreational boating, the tourism industry associated with Narragansett Bay, and on the Providence and East Providence future waterfront development plans. We evaluated these potential impacts in sections 4.8.2, and 4.8.5. Based on these analyses, we do not believe the proposed project would have a major financial impact on these activities. Additionally, as discussed in section 4.9.3, the increase in personnel at the facility would have minimal impact on police, fire, and medical services related to the normal operation of the facility. In summary, we anticipate that the project would result in a net financial gain for the State, the City of Providence, and the local communities equal to the tax revenues summarized in table 4.9.5-1.

4.9.6 Property Values

We received comments that the proposed project would adversely affect property values in the surrounding area. Several general and site-specific studies have been conducted to evaluate this issue.

KeySpan LNG commissioned a market analysis to assess what impact, if any, the LNG terminal and shipping associated with the Distrigas LNG terminal in Everett, Massachusetts have had on surrounding property values. The market analysis, conducted by KTR Newmark LLC, reviewed home sales occurring within a 2-mile radius of the existing Everett facility from 1985 to 2004. Thirty-three single family home sales were surveyed in the market area surrounding the facility. The analysis concluded that all properties in the area experienced an average annual appreciation of 14 percent for the period between 1985 and 2004, as compared to 12.8 percent, 17.7 percent and 14.9 percent for Massachusetts, the Boston area, and Middlesex County, respectively. For the period between 1995 and 2004, the average annual price increase in the Everett area was 15.7 percent, which exceeded the average increases of 12.9 percent, 15.6 percent, and 13.4 percent for Massachusetts, the Boston area, and Middlesex County, respectively.

In 2003, Weaver's Cove Energy consulted with real estate experts regarding the impact of the proposed Weaver's Cove LNG terminal and pipelines on property values (Giroux, 2003 and Appraisal Consultants of New England Corporation, 2003, cited in FERC, 2004). As part of this assessment, property values in the area proximate to the existing LNG storage facility on Bay Street in Fall River were studied. The appraisal consultants concluded that the Bay Street LNG facility has not deterred residential development in surrounding areas. Several new homes had been constructed in the vicinity of the Bay Street LNG facility since its activation in 1970 and a condominium project was scheduled to be constructed next to the facility in the near future. Additionally, a survey of recent sales in the area conducted by the appraisal consultants indicated that property values or price increases have not been diminished because of the facility.

A real estate study performed by the Real Estate Counseling Group of Connecticut, Inc. for a planned Granite State Gas facility in Wells, Maine supports the findings of the above studies (Real Estate Counseling Group of Connecticut, 1995). Tax assessors were contacted in four New England

communities in the proximity of LNG storage facilities (Haverhill, Ludlow, and South Yarmouth, Massachusetts; and Tilton, New Hampshire) as well as communities where LNG storage facilities had been recently built (North Carolina, Georgia, and Indiana) and asked: 1) whether they had received property owner requests for lower valuations due to the presence of an LNG facility; and 2) whether the presence of a storage tank was a factor they considered in doing their valuations. The study concluded that in no case did the LNG facilities play a role in the assessment and that no requests for lower valuations had been made and none were granted.

A 1993 study conducted by the Argonne National Laboratory examined the economic impacts of the presence of "noxious" facilities on local wages and property values (Clark and Nieves, 1993). Eight types of facilities were studied, including nuclear power plants; coal-, gas-, or oil-fired power plants; military chemical weapons sites; hazardous waste sites; refineries; chemical weapon storage facilities; former storage sites that are now contaminated; and LNG facilities. The study examined the effects of 262 facilities on standardized 1,000 square-mile areas across the United States. Eleven of these were LNG facilities. Thirteen of the 262 facilities were located in New England. The results of the study concluded that the presence of 5 of the 8 types of "noxious" facilities have a significantly negative effect on property values and a positive effect on wages. However, the study concluded that the presence of an LNG facility did not have a significant positive or negative effect on either wages or property values (Clark and Nieves, 1993).

Another study by McCluskey and Rausser (2001) evaluated the potential for perceived risk to affect property values. This study analyzed the dynamics between media coverage, distance from the facility, and perceived risk and their effect on property values. The results of this study revealed that the greater the perceived risk as generated mainly through media coverage, and the closer the property to the facility or site, the greater the negative impact on property values. This study suggests that a facility like the proposed LNG terminal, which has been covered extensively by the press and is perceived as a safety risk, could impact property values near the facility (McCluskey and Rausser, 2001). However, in the past 6 months, home sales near the facility appear to be comparable both in terms of days on the market and sale price as a percentage of asking price as other homes in the city as a whole (Levell, 2005).

Based on these studies and the fact that 1) the proposed upgrade would be located at an existing LNG facility on an industrially zoned site in a greater industrial area, and 2) the values of properties close to the site may already reflect their location near the current KeySpan LNG storage facility and their location near an industrially zoned area that supports storage and distribution facilities for petroleum products, we conclude that the data do not support the contention that the project would negatively affect property values in the surrounding area. Because the pipeline routes are predominantly located within existing utility corridors, operation of these pipelines is also not expected to have a measurable impact on property values.

4.9.7 Insurance Coverage

During scoping, we received a comment from the owner of a private business near the KeySpan LNG facility expressing concern about the safety of the proposed facility upgrade and how the project might affect the availability of insurance coverage for his business. We contacted the Rhode Island Department of Business Regulation and local insurance providers to determine whether the project would be expected to result in higher insurance rates or reduced availability of insurance for nearby businesses. The Rhode Island Department of Business Regulation stated that a request to increase rates must be actuarially justified, but also noted that carriers may be exempt from certain rate and form requirements set forth in Rhode Island law and may therefore have flexibility in determining whether or not and at what rate businesses along the Providence waterfront would be insured. If businesses are unable to obtain insurance in the voluntary market, insurance coverage may be available through a surplus line broker.

The Insurance Commissioner's office maintains a list of approved surplus line carriers and licensed surplus line brokers. Surplus line carriers are free from rate and form filing requirements (Pallozzi, 2004). The local insurance providers contacted were not aware of any new risks associated with the KeySpan LNG Project and therefore could not speculate on the effect it might have but felt that due to competition between insurance companies, businesses would not be denied insurance and rates would not increase dramatically, if at all (Soares, 2004). Based on these comments and on the fact that the commentor has apparently been able to obtain insurance coverage for his business despite the presence of the existing LNG facility and other commercial and industrial businesses in the project area, we do not believe the project would affect insurance availability or rates for existing businesses.

4.9.8 Environmental Justice

The NEPA review process provides opportunities for effective community participation and involves consultation with affected communities. If the proposed action would result in significant adverse impacts on minority or low-income populations or Native American tribes, the NEPA analysis should address those impacts as part of the alternatives analysis and identify appropriate mitigation measures to address the effects.

As discussed in section 1.5, KeySpan LNG made efforts to work with residents in neighboring communities and to evaluate the potential impacts of the project on those communities. FERC staff issued its NOI and held scoping meetings on June 3 and July 7, 2004 in Providence and on July 8, 2004 in Middletown to receive comments on the project. Interested parties were given opportunities to participate in the NEPA review process by means such as participating in the public scoping meetings for the draft EIS, attending a site visit, submitting written comments on the project to the FERC, and informing the FERC of its interest in receiving copies of public documents related to the project. Based on early scoping comments, KeySpan LNG published Spanish notices of the July 2004 scoping meetings in two Spanish newspapers, *Providence en Espanol* and *Nuevos Horizones,* and a Portuguese notice in the *Portuguese Times*. At the July 2004 scoping meetings, FERC staff provided Spanish and Portuguese handouts describing the scoping process and KeySpan LNG and Algonquin provided Spanish and Portuguese handouts describing the proposed project. KeySpan LNG and Algonquin made available Spanish and Portuguese translators at the July Providence meeting. The comments we received during the scoping process are summarized in the table provided in section 1.5 and are addressed throughout this document.

As detailed in section 1.5, the FERC issued a NOA for the draft EIS on November 30, 2004 and established a public comment period ending on January 24, 2005. The NOA described procedures for filing comments on the draft EIS, and indicated that additional project information could be obtained from the Commission's Office of External Affairs and on the FERC's website. A formal notice was also published in the Federal Register on December 7, 2004, indicating that the draft EIS was available and had been mailed to individuals and organizations on the mailing list prepared for the project. The FERC conducted public comment meetings in Providence and Middletown on January 11 and 12, 2005, respectively. The FERC staff provided Spanish and Portuguese handouts describing the comment process and KeySpan LNG made available Spanish and Portuguese translators. Comments on the draft EIS and the staff's responses to these comments appear in Appendix F and in revised text in the various sections of the final EIS.

Potential Environmental Justice Impacts

In addition to comments regarding opportunities for public participation, we received comments suggesting that the FERC consider the potential impacts of the project on low income or minority populations. To address these concerns, we identified areas in the vicinity of the proposed project that

might cause environmental justice concerns and conducted an analysis of potential impacts that could disproportionately affect these areas.

To identify areas of potential environmental justice concern, we reviewed available state, county, city, and neighborhood statistics regarding median income and poverty levels. Table 4.9.8-1 provides the general ethnic mix of the counties, cities, and neighborhoods in the general vicinity of the proposed project. Table 4.9.8-2 provides the general economic status of the state, counties, cities, and neighborhoods. For the purposes of considering environmental justice, the Washington Park, Upper South Providence, Lower South Providence, and Downtown neighborhoods were viewed as being generally less racially diverse than the City of Providence and Providence County. These neighborhoods have somewhat higher concentrations of Black or African Americans and persons of Hispanic or Latino origin. The median household income in these neighborhoods is lower than the city, county, and state as a whole. Additionally, all four neighborhoods have a higher percentage of families living below the poverty level than the state, county, or city as a whole. The percent of households receiving public assistance is also higher in the Upper South Providence neighborhood than in the state, county, or city as a whole.

TABLE 4.9.8-1

Racial/Ethnic Statistics for the Project Area

State/County/City	Racial/Ethnic Group, 2000 (percent)						Persons of Hispanic or Latino Origin (percent) [a]
	White	Black	Native American and Alaska Native	Asian	Persons Reporting Some Other Race	Persons Reporting Two or More Races	
Rhode Island	85.0	4.5	0.5	2.3	5.0	2.7	8.7
Providence County	76.4	8.5	0.6	2.9	8.0	3.6	13.4
City of Providence	45.8	12.7	0.8	5.9	17.6	6.1	30.0
Washington Park Neighborhood	34.7	19.6	0.8	4.4	1.6	8.9	30.0
Lower South Providence Neighborhood	5.5	30.8	1.6	2.2	1.4	3.5	55.1
Upper South Providence Neighborhood	18.8	34.0	2.6	2.6	24.4	7.8	41.2
Downtown Neighborhood	68.0	11.9	1.1	6.2	1.0	4.0	11.0

[a] People who identify themselves as Hispanic or Latino may be of any race. Thus, the percent Hispanic should not be added to the percentage for racial categories.

Source: U.S. Department of Commerce, U.S. Census Bureau, State and County QuickFacts (www.census.gov).
The Providence Plan Neighborhood Profiles, compiled from U.S. Census Bureau 2000 summary files.

We also reviewed environmental justice maps based on EPA methodologies (see figure 4.9.8-1). We determined from these sources that the closest areas of potential environmental justice concern are located in the City of Providence west of the LNG terminal site.

TABLE 4.9.8-2

Economic Statistics for the Project Area

State/County/City	Median Household Income (1999)	Families Below the Poverty Level (1999) (percent)	Households Receiving Public Assistance (percent)
Rhode Island	$42,936	11.9	2.9
Providence County	$42,036	11.9	3.9
City of Providence	$26,867	23.9	6.5
Washington Park Neighborhood	$32,086	17.4	1.9
Lower South Providence Neighborhood	$20,013	39.5	2.9
Upper South Providence Neighborhood	$19,112	36.4	16.0
Downtown Neighborhood	$18,085	14.0	4.0

Source: U.S. Department of Commerce, U.S. Census Bureau.
U.S. Census Bureau, DP-3 Profile of Selected Economic Characteristics: 2000.

Potential impacts that could disproportionately affect areas of potential environmental justice concern during construction and operation of the project include visual impacts from the presence of the LNG ships, traffic impacts associated with vehicle traffic during construction and operation of the project, air quality and noise impacts, and impacts on public safety from potential incidents at the LNG terminal and in the navigation channel. A summary and analysis of these impacts as they may pertain to environmental justice is presented below. More detailed assessments of visual resources, traffic, air quality and noise, and reliability and safety are included, respectively, in sections 4.8.6, 4.9.4, 4.11, and 4.12 of this draft EIS.

As discussed in section 4.8.6, the primary visual impact of the project on the surrounding areas would result from the addition of buildings and aboveground facilities at the existing LNG plant, the new ship berth in the Providence River, and the LNG ships that would call at the facility. The proposed facilities would be located at an existing LNG facility within a developed industrial waterfront area that is surrounded by other industrial and commercial properties. The new buildings and aboveground facilities would be lower than the LNG tank and many other storage vessels in the area and therefore would not significantly change the visual character of the site or surrounding area. The proposed ship berth would extend further into the river than the existing pier, but would be in a waterfront area dominated by other docks and piers, and therefore would not have a significant visual impact. Other large ships that transit the Providence River in the project area, including occasional LPG ships that call at ProvPort, are within site of the KeySpan LNG facility. However, the LNG ships that call on the site would be large and would have a higher, more visible profile than other ships that currently call at the port or the site. This would change the visual nature of the site when LNG ships are docked at the facility, but this would be a weekly short-duration event.

Figure 4.9.8-1

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Our analysis in section 4.9.4 indicates that the project would result in a small increase in the traffic on area roadways during construction. We have also determined that construction of the pipeline would likely cause traffic delays on Allens Avenue. Vehicular traffic impacts on Thurbers Avenue, Allens Avenue, and Interstate 95 during construction of the LNG terminal and pipeline would affect the area northwest of the project site. The effects of this traffic would be temporary and limited to the period of construction. During operation, LNG trucks, employees, and visitors would use the Terminal Road site entrance at the Allens Avenue/Thurbers Avenue entrance intersection. The anticipated traffic volume resulting from operation of the LNG terminal, even during peak operation periods, would not significantly increase the existing traffic volumes on local area roadways or be significantly higher than current traffic levels. Therefore, the nearby area of potential environmental justice concern is not expected to be disproportionately affected by traffic associated with the project.

Four commentors expressed concern about air quality and related public health impacts, noting that Providence has poor air quality and a high asthma rate. As discussed in section 4.11.1, operation of the proposed project would result in air emissions from LNG ships and tugs and from stationary processing equipment (e.g., boilers, vaporizers, and emergency engines) associated with the LNG facility. However, the regulatory requirements will ensure that the operational air emissions from the LNG terminal would not cause or significantly contribute to a violation of an ambient air quality standard; therefore, the areas of potential environmental justice concern would also not be disproportionately affected by the project.

As discussed in section 4.11.2, sound levels would increase during construction and operation of the LNG terminal facilities and construction of the pipeline. During construction, increases in sound levels would occur primarily during daylight hours close to where construction is taking place. This would be a temporary effect. Because sound attenuates quickly with distance, construction-related noise is not expected to significantly contribute to existing noise levels beyond the immediate area of construction. During operation of the terminal, noise would be generated by stationary equipment such as pumps, compressors, motors, heaters, and fans. The predominant sources of stationary noise would be the WEG heaters and the BOG blowers and compressors. Also, our preliminary noise analysis shows that the project would not result in a perceptible increase in noise at the nearest noise sensitive area.

As discussed in section 4.12, the proposed LNG upgrade would be constructed and operated in compliance with all applicable building and safety codes and thermal radiation and vapor dispersion exclusion zone requirements designed to protect public safety. No prohibited activities would be allowed within these exclusion zones. The facilities would also include fire detection and suppression equipment and would be located within the impoundment system or other areas designed to contain any spill of LNG at the terminal site. As described in section 2.2.2, many safety features and procedures are also included in the design and operation of LNG ships. In spite of all the safety measures that would be incorporated into the design and operation of the facilities and ship, an incident at the LNG terminal or on an LNG ship could still occur. In such an event, it is possible that areas of potential environmental justice concern near the navigation channel and the LNG terminal could be affected. However, this risk would not disproportionately fall on the areas of potential environmental justice concern. As shown on figure 4.9.8-1, LNG ships would pass low-income and minority populations that are within 1 mile of the navigation channel. However, these LNG ships would also pass communities along the navigation channel in Rhode Island that are among the wealthiest in the state. The potential hazards associated with LNG shipping would be borne equally by all communities along the navigation channel; therefore, the areas of potential environmental justice concern in the City of Providence would not be disproportionately affected.

In summary, we do not believe construction and operation of the proposed project would result in disproportionate adverse impacts on environmental justice. The project would involve the upgrade of an existing LNG facility and construction of a 1.44-mile-long pipeline in an industrial area. The proposed

project location is directly tied to the presence of the existing KeySpan LNG facility and was not selected based on racial or ethnic statistics, income levels, or other demographics of the project area. The project would be generally consistent with the current and historic uses of the affected areas. In addition, the project is expected to generate a number of temporary and permanent employment opportunities, taxes and other revenue streams within the Providence area, and would not result in significant adverse impacts on the local environment and natural resources. Although some of the neighborhoods in the vicinity of the LNG terminal have higher concentrations of minority persons and lower incomes than average relative to the city or state, the potential impacts described above would affect all of the communities surrounding the LNG terminal, and would not disproportionately impact only the areas of potential environmental justice concern.

4.10 CULTURAL RESOURCES

Section 106 of the NHPA (16 USC 470) requires the FERC to take into account the effects of its undertakings on properties listed, or eligible for listing, on the NRHP and to provide the ACHP an opportunity to comment on its undertakings. KeySpan LNG and Algonquin, as non-federal parties, are assisting the FERC in meeting its obligations under section 106 and the implementing regulations in 36 CFR 800.

In its January 19, 2005 comments on the draft EIS, the RIHPHC stated that it has reviewed the draft EIS and concluded that this section accurately describes the evaluation of the cultural resources that would potentially be affected by the project and the RIHPHC's conclusion that no historic properties would be affected.

4.10.1 Results of the Cultural Resources Surveys

LNG Facilities

Aboveground Cultural Resources

The terminal site previously was surveyed for aboveground cultural resources in 1996 as part of a project proposed by ALNG, which at that time owned and operated the existing KeySpan LNG facility (FERC Docket No. CP96-517-000). This investigation documented 10 historic structures associated with the Sassafras Point Station, an early to mid-twentieth century gas storage facility. The structures were recommended eligible for listing on the NRHP as a district for their association with the growth of the energy industry in Providence and also as a distinctive example of gasworks structures and buildings. While a number of modern structures were observed during the survey, no other historic aboveground resources were identified.

KeySpan LNG's review of the terminal site indicates that none of the structures associated with the Sassafras Point Station are located within the area that would be affected by its proposed LNG facility upgrades. Therefore, none of these structures would be physically affected by the activities associated with the LNG terminal. KeySpan LNG also concluded that its proposed upgrade would not result in visual impacts to the setting or viewshed of the property because the terminal site is situated in an existing industrial development and because viewshed is not a character-defining feature at this resource. No additional architectural investigations were recommended for the project.

KeySpan LNG submitted a summary report (Brett, 2004) on aboveground resources to the RIHPHC and the FERC. In a letter dated May 7, 2004, the RIHPHC concurred that the project at the LNG facility would not affect aboveground resources, noting that the terminal facilities would "not

detract from the physical setting of the neighboring historic structures associated with the Sassafras Point Station." We concur with the RIHPHC's findings.

To further ensure that the Sassafras Point Station structures are not affected by the project, KeySpan LNG proposes to implement safeguards designed to protect the historic buildings at this site. KeySpan LNG would identify the historic structures as sensitive resources on construction plans and post "No Construction Impact" signs outside each structure. KeySpan LNG also would have an architectural historian conduct a post-construction inspection to verify that the historic structures are not physically affected during construction. We concur with this plan.

Terrestrial Archaeological Resources

KeySpan LNG conducted an assessment of the terminal site to determine its potential for containing intact archaeological resources (Brett, 2004) and submitted a summary report to the RIHPHC and the FERC. A majority of this area previously was examined for archaeological remains in 1996 as part of the aforementioned ALNG project, and no resources were identified. KeySpan LNG assessed the remainder of this area as having a low potential for containing intact archaeological deposits due to previous site disturbance associated with industrial development. No additional archaeological investigations of the terminal site were recommended. In its May 7, 2004 letter, the RIHPHC concurred with KeySpan LNG's results and recommendations "finding that the proposed undertaking will have no effect on historic resources." We have reviewed the summary report and concur with this finding.

Underwater Archaeological Resources

KeySpan LNG conducted an analysis of cartographic and other resources to assess the potential of the underwater component of the project to contain submerged archaeological sites or shipwrecks (Brett, 2004), and submitted a summary report to the RIHPHC and the FERC. This analysis indicated that the underwater portion of the project area was disturbed by previous dredging and construction of a nearby seawall, and thus has a low potential for intact submerged resources. No additional archaeological investigations of the underwater project area were recommended. In its May 7, 2004 letter, the RIHPHC concurred with KeySpan LNG's results and recommendations "finding that the proposed undertaking will have no effect on historic resources." We have reviewed the summary report and concur with this finding.

Pipeline Facilities

Aboveground Cultural Resources

Algonquin conducted background research and a walkover survey to identify aboveground cultural resources that might be affected by the pipeline component of the project. Background research identified two previously documented resources in the vicinity of the proposed pipeline route, the Manchester Street Station and the Sassafras Point Station. Algonquin determined that neither property would be crossed or physically affected by the pipeline right-of-way or proposed extra workspaces. Algonquin also determined that the pipeline would not affect the historic settings or viewsheds of these resources because they are situated in existing industrial developments. No new aboveground cultural resources were identified as a result of the walkover survey, and no additional architectural investigations were recommended.

As part of its application to the FERC, Algonquin submitted a report describing the results of its architectural investigation to the RIHPHC and the FERC. In a letter dated July 16, 2004, the RIHPHC concurred with Algonquin that no aboveground cultural resources, including the Manchester Street

Station and Sassafras Point Station, would be affected by the pipeline. Specifically, the RIHPHC concurred that "the proposed undertaking will have no effect on historic resources." We concur with this finding.

Terrestrial Archaeological Resources

Algonquin conducted background research and a walkover survey to identify any terrestrial archaeological sites that could be affected by construction of the proposed pipeline. The background research indicated that the project area had a very low probability for containing intact archaeological deposits. Cartographic research showed that a majority of the pipeline route was submerged by the waters of the Providence River until at least the late nineteenth or early twentieth centuries when extensive filling was undertaken along the shoreline. Research also showed that a majority of the pipeline route has been previously disturbed by utility construction, including the installation of sewer and water lines at depths ranging from 5 to 30 feet below grade. No previously documented sites were identified within the project area as a result of the background research. Further, no evidence of previously undocumented sites was discovered during the walkover survey. No additional archaeological investigations of the pipeline route were recommended.

Algonquin submitted its survey report describing the results of its investigation to the RIHPHC and the FERC. In its July 16, 2004 letter, the RIHPHC concurred with Algonquin's recommendation that no additional archaeological investigations are warranted and "that the proposed undertaking will have no effect on historic resources." We concur with this finding.

4.10.2 Native American Consultation

KeySpan LNG and Algonquin each contacted the Narragansett Indian Tribe to solicit comments on the proposed LNG terminal and pipeline facilities, respectively. KeySpan LNG and Algonquin also provided the tribe with copies of their respective summary cultural resources reports. The tribe has not responded to KeySpan LNG, but advised Algonquin that it would comment on the pipeline component of the project after it reviews Algonquin's cultural resources survey report. To date, the Narragansett Indian Tribe has not commented on the project.

4.10.3 Unanticipated Discoveries

KeySpan LNG and Algonquin each submitted to the RIHPHC and the FERC a plan for responding to the unanticipated discovery of historic properties or human remains during construction of their respective portions of the project. The RIHPHC concurred with both plans. We also concur with the KeySpan LNG and Algonquin unanticipated discoveries plans.

4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

Climate

The climate of Rhode Island is classified as humid continental. The extremes of winter cold and summer heat that are typically associated with this type of climate are moderated by the Atlantic Ocean and Narragansett Bay (MSN Encarta, 2004). The average temperature in Providence is 73.3° F for the month of July and 28.7° F for the month of January. Annual rainfall and snowfall in Providence are 46.5 inches and 35.5 inches, respectively. The wind direction, based on data from T.F. Green Airport in Warwick, Rhode Island is predominantly southwest but typically ranges from northeast to southwest.

National Ambient Air Quality Standards

The EPA has established National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone, particulate matter less than 10 microns in diameter (PM_{10}), and lead. The EPA is currently working to implement a standard for particular matter less than 2.5 microns in diameter ($PM_{2.5}$). The NAAQS were set at levels the EPA believed were necessary to protect human health (primary standards) and human welfare (secondary standards) and consist of both short-term (1-hour to 24-hour averaging periods) and long-term (quarterly and annual) standards. The averaging periods are used to provide a basis for the standards by setting the time over which the concentration is measured. For example, monitoring station data are logged daily for comparison with the 24-hour PM_{10} standard. If the standard is exceeded more than once per year, ambient air quality in the area of the monitor is in violation of the standard. This allows instantaneous events to occur that may not represent the typical ambient conditions while still protecting human health and public welfare.

Existing Air Quality

The DEM requires compliance with the NAAQS, and has the same criteria pollutant air quality standards as the NAAQS. All of Rhode Island is included in the Metropolitan Providence Interstate Air Quality Control Region (MPAQCR), which is designated "attainment" of the NAAQS for all criteria pollutants except ozone. The MPAQCR is classified as "serious" nonattainment for the 1-hour ozone standard and "moderate" nonattainment for the 8-hour ozone standard. As of June 15, 2005, the 8-hour standard will be the only effective standard because the 1-hour standard will no longer be effective. In addition, the City of Providence, Rhode Island was redesignated in November 1991 from nonattainment for CO to attainment, but is currently classified as a "maintenance" area for this pollutant.

All criteria pollutants, with the exception of ozone, are in attainment of the NAAQS in the project area. Ambient air quality is monitored in Providence by several air quality monitoring stations. Data from these monitoring stations were used to estimate the existing ambient pollutant concentrations in the project area. The existing ambient pollutant concentrations are summarized and compared to the NAAQS in table 4.11.1-1.

Regulatory Requirements for Air Quality

In addition to the new equipment that would be installed as part of the proposed project, certain existing units would undergo re-permitting to revise operational limits (such as hours of operation). The air emissions sources that would be installed or modified as a result of the proposed modification are listed in table 4.11.1-2.

The proposed LNG terminal would generate air emissions through both short-term construction activities and long-term operation of the stationary emission units at the facility. Emissions from all phases of construction and operation of the emission units would be subject to applicable state and federal air regulations.

TABLE 4.11.1-1

Ambient Air Quality Standards and Existing Air Quality

Air Pollutant	Averaging Period	Current Ambient Levels	Primary Standard	Secondary Standard	Percent of NAAQS	Monitoring Location
Sulfur Dioxide (ppm)	3-Hour [a/]	0.057	NA	0.5	11.4	Rockefeller Library
	24-Hour [a/]	0.032	0.14	NA	22.9	Rockefeller Library
	Annual [b/]	0.008	0.03	NA	26.7	Rockefeller Library
Carbon Monoxide (ppm)	1-Hour [a/]	9.0	35	35	25.7	76 Dorrance St.
	8-Hour [a/]	3.8	9	9	42.2	76 Dorrance St.
Nitrogen Dioxide (ppm)	Annual [b/]	0.02	0.053	0.053	37.7	Rockefeller Library
Ozone [c/] (ppm)	1-Hour [a/]	0.128	0.12	0.12	107	64 Bourne Ave.
	8-Hour [a/]	0.108	0.08	0.08	135	64 Bourne Ave.
Particulate Matter less than 10 microns ($\mu g/m^3$)	24-Hour [a/]	51	150	150	34.0	111 Fountain St.
	Annual [b/]	22	50	50	44.0	111 Fountain St.
Particulate Matter less than 2.5 microns ($\mu g/m^3$) [e/]	24-Hour [d/]	31	65	65	47.7	212 Prairie Ave.
	Annual [b/]	12.1	15	15	80.7	212 Prairie Ave.
Lead ($\mu g/m^3$)	Quarterly	NA	NA	NA	NA	NA

[a/] The concentration listed is representative of the second high concentration measured at the Providence monitoring stations between 2001 and 2003.
[b/] The concentration listed is the highest annual average concentration from 2001 to 2003.
[c/] All of Rhode Island is classified as "serious" nonattainment for the 1-hour ozone standard and "moderate" nonattainment for the 8-hour ozone standard.
[d/] Concentration represents the 98th percentile for 2001 through 2003.
[e/] Although these standards for Particulate Matter less than 2.5 microns have not yet been formally implemented, we have included them for the purpose of this analysis.

$\mu g/m^3$ micrograms per cubic meter
ppm parts per million
NA no data available

TABLE 4.11.1-2

Emission Source Information

Air Emission Source (quantity)	Capacity	Proposed Hours of Operation	Energy Source
Water Ethylene Glycol Heaters (5) – New	71.45 MMBtu/hr	4,920	Natural Gas
Emergency Generator (1) – New	150 kW	500	Diesel Fuel
Glycol Reheater (1) – Re-permitted	6.46 MMBtu/hr	2,000	Natural Gas
Glycol Reheater (1) – Re-permitted	3.45 MMBtu/hr	2,000	Natural Gas
Emergency Generator (1) – Re-permitted	141 kW	500	Diesel Fuel

MMBtu/hr million British thermal units per hour
kW kilowatts

Air emission sources in Rhode Island are regulated at the federal level by the Clean Air Act (CAA), as amended, and at the state level by the DEM Air Pollution Control Regulations. The federal regulations established as a result of the CAA that are potentially applicable to the project include:

- New Source Review (NSR)/Prevention of Significant Deterioration (PSD) review;
- Federal Class I Area Protection;
- Title V Operating Permits;
- New Source Performance Standards (NSPS);
- National Emission Standards for Hazardous Air Pollutants (NESHAPs);
- Chemical Accident Prevention Provisions; and
- General Conformity.

New Source Review/Prevention of Significant Deterioration

Title I of the CAA establishes guidelines for the preconstruction/modification review of large air emission sources. Construction of major new sources or major modifications to existing sources in attainment areas must be reviewed in accordance with the PSD regulations. To be classified as a major modification under the PSD rule, the net emission increase for the proposed modification must either be: 1) greater than one of the significant emission rates (SERs) identified in 40 CFR 52.21(b)(23)(i) for an existing major PSD source, or 2) greater than the applicable PSD major source threshold for an existing non-major PSD source. To be classified as a major PSD source, the potential emissions from the source must either be: 1) greater than 100 tpy for any pollutant regulated by the EPA under the CAA for sources that are among the 28 source categories listed in section 169 of the CAA, or 2) greater than 250 tpy for any pollutant regulated by the EPA under the CAA for sources that are not among the 28 source categories listed in section 169 of the CAA.

Fossil fuel boilers (or a combination thereof) totaling more than 250 MMBtu/hr heat input are identified in the list of 28 source categories in section 169 of the CAA; therefore, the applicability threshold for PSD review for the proposed LNG terminal is 100 tpy. The existing LNG plant is a non-major source under the PSD regulations. The potential to emit for the existing KeySpan LNG facility is summarized in table 4.11.1-3.

TABLE 4.11.1-3

Potential To Emit for Existing KeySpan LNG Terminal [a/]

	NO_x tpy	CO tpy	$PM_{10}/PM_{2.5}$ tpy	VOC tpy	SO_2 tpy
Potential To Emit	24.77	61.72	0.86	1.30	0.07
PSD Threshold Criteria	NA	100	100	NA	100
NSR Threshold	50	NA	NA	50	NA

[a/] Emissions of lead, beryllium, mercury, sulfuric acid mist, asbestos, vinyl chloride, fluorides, hydrogen sulfide, total reduced sulfur, reduced sulfur compounds, CFCs, halons, and ozone depleting substances are negligible.

NO_2 nitrogen dioxide
CO carbon monoxide
SO_2 sulfur dioxide
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
VOC volatile organic compound
tpy tons per year

Because the current facility is not a major source under PSD, the proposed modification would be considered a major modification if the net emission increase of any applicable pollutant is greater than 100 tpy.

Construction of air emission sources in nonattainment areas must be reviewed in accordance with the NSR regulations. There are special requirements for sources of VOC and NO_x, the two ozone precursors that are regulated by section 182(f) of the CAA. The NSR provisions in Rhode Island apply to new major sources that emit more than 50 tpy of NO_x or VOC.

Table 4.11.1-4 presents the total potential emissions from the LNG terminal after the completion of the proposed upgrades as well as the relevant PSD and NSR threshold criteria.

TABLE 4.11.1-4

Operating Air Emissions Summary for Proposed LNG Terminal [a/]

Emission Unit (Quantity)	NO_x		CO		$PM_{10}/PM_{2.5}$		VOC		SO_2	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
LNG Vaporizers (3)	17.04	6.02	12.01	4.20	1.09	0.38	0.79	0.28	0.09	0.03
Glycol Reheater (1)	0.72	0.72	0.61	0.61	0.6	0.06	0.04	0.04	4E-3	4E-3
Glycol Reheater (1)	0.39	0.39	0.32	0.32	0.03	0.03	0.02	0.02	2E-3	2E-3
Control Bldg. Heater (1)	0.03	0.15	0.03	0.13	3E-3	0.01	2E-3	0.01	2E-4	9E-4
Equipment Bldg. Heater (1)	0.01	0.04	4E-3	0.02	7E-4	3E-3	5E-4	2E-3	1E-4	4E-4
WEG Heaters (5) [b/]	10.0	24.60	23.16	56.97	0.28	0.70	1.14	2.81	0.17	0.41
Emergency Generator (1) [c/]	2.64	0.66	11.81	2.95	0.02	4E-3	0.11	0.03	7E-4	2E-4
Emergency Generator (1)	8.38	2.10	6.19	1.55	0.12	0.03	1.10	0.27	7E-3	2E-3
Emergency Generator (1)	5.7	1.43	0.19	0.05	0.57	0.14	0.21	0.05	0.92	0.23
Total	44.91	36. 11	54.32	66.80	2.71	1.36	3.41	3.51	1.19	0.68
PSD Threshold Criteria	NA	NA	NA	100	NA	100	NA	NA	NA	100
NSR Threshold	NA	50	NA	NA	NA	NA	NA	50	NA	NA

[a/] Emissions of lead, beryllium, mercury, sulfuric acid mist, asbestos, vinyl chloride, fluorides, hydrogen sulfide, total reduced sulfur, reduced sulfur compounds, CFCs, halons, and ozone depleting substances are negligible.

[b/] The calculations for the WEG heaters assume 1 unit is stand-by; therefore, the emissions are based on a total from four units running 4,920 hours per year per unit.

[c/] Emergency Generator potential emissions calculations based on 500 hour per year operation.

NO_2 nitrogen dioxide
CO carbon monoxide
SO_2 sulfur dioxide
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
VOC volatile organic compound
lb/hr pounds per hour
tpy tons per year

As shown in table 4.11.1-4, the maximum potential to emit (PTE) from the LNG terminal after the proposed modifications would be less than 100 tpy for each of the criteria pollutants. Therefore, the net emission increase for the proposed project would be less than 100 tpy for each criteria pollutant, and the modification would not be subject to PSD review. The NO_x and VOC emissions from the proposed

LNG terminal would not exceed 50 tpy; therefore, the terminal would not be subject to the NSR provisions for this modification.

Federal Class I Area Protection

The U.S. Congress designated certain lands as Mandatory Federal Class I (Class I) areas in 1977. Class I areas were designated because the air quality was considered a special feature of the area (e.g., national parks or wilderness area). These Class I areas, and any other areas that have been redesignated Class I areas since 1977, are given special protection under the PSD program.

As determined previously, the proposed LNG terminal would not be subject to the PSD regulations. Therefore, the Federal Class I area protection provisions would not apply to this project.

Title V Operating Permits

Title V of the CAA requires states to establish an air operating permit program. The requirements of Title V are outlined in 40 CFR 70 and are administered by the DEM for air emission sources in Rhode Island.

If a facility's PTE exceeds the criteria pollutant or hazardous air pollutant (HAP) thresholds, the facility is considered a major source. The major source threshold levels in Rhode Island are 100 tpy for PM_{10}, SO_2, and CO and 50 tpy for NO_x and VOC. The major source HAP threshold levels in Rhode Island are 10 tpy of any single HAP or 25 tpy of all HAPs in aggregate. Potential HAP emissions from the proposed LNG terminal (in aggregate) would be 2.0 tpy, which are well below the major source thresholds.

As shown in table 4.11.1-4, the potential emissions for each pollutant at the LNG terminal after the proposed modification do not exceed the Title V threshold limits. Therefore, the LNG terminal would not be a major source of air emissions and would not require a Title V operating permit. The LNG terminal would, however, require a minor source air permit from the DEM for the commencement of the proposed modifications. This permit may be a new permit or a modification of the existing air permit for the KeySpan LNG terminal.

New Source Performance Standards

NSPS regulations, codified in 40 CFR 60, establish pollutant emission limits and monitoring, reporting, and recordkeeping requirements for various emission sources based on source type and size. The NSPS apply to new, modified, or reconstructed sources.

Subpart Dc of 40 CFR 60 applies to small industrial, commercial, or institutional steam generating units that are modified, constructed, or reconstructed after June 9, 1989 and have maximum heat input rates of more than 10 MMBtu/hr but less than 100 MMBtu/hr. Subpart Dc establishes specific emissions limits for SO_2 (for coal and oil fired units) and PM (for coal fired units). The proposed WEG heaters would not be oil or coal-fired, so the emission limitations would not be applicable. However, Subpart Dc would be applicable for reporting and recordkeeping requirements.

Subpart Ka of 40 CFR 60 applies to any petroleum liquid storage tank that is modified, constructed, or reconstructed after May 18, 1978 and before July 23, 1984. Subpart Kb of 40 CFR 60 applies to any volatile organic liquid (VOL) storage unit that is modified, constructed, or reconstructed after July 23, 1984 and has a capacity of 75 m3 or greater. No new VOL storage tanks would be constructed as part of the proposed project, and the existing tank would not be modified.

National Emission Standards for Hazardous Air Pollutants

The NESHAPs, codified in 40 CFR Parts 61 and 63, regulate HAP emissions. Part 61 was promulgated prior to the 1990 Clean Air Act Amendments (CAAA) and regulates only eight types of hazardous substances (asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride).

The 1990 CAAA established a list of 189 HAPs, resulting in the promulgation of Part 63. Part 63, also known as the Maximum Achievable Control Technology (MACT) standards, regulates HAP emissions from major sources of HAP emissions and specific source categories that emit HAPs. Part 63 defines a major source of HAPs as any source that has the potential to emit 10 tpy of any single HAP or 25 tpy of HAPs in aggregate.

LNG storage and processing facilities are not one of the source categories regulated by Part 61; therefore, the requirements of Part 61 are not applicable to these types of facilities. Part 63 establishes HAP emission standards for marine vessel loading operations (Subpart Y); oil and gas production facilities (Subpart HH); natural gas transmission and storage facilities (Subpart HHH); industrial, commercial, and institutional boilers and process heaters (proposed as Subpart DDDDD); and reciprocating internal combustion engines (Subpart ZZZZ). These subparts establish requirements for major sources of HAPs only. As indicated above, the potential HAP emissions (in aggregate) from the LNG terminal would be 2.0 tpy. The single largest HAP emitted by the terminal would be hexane with a potential to emit of 1.7 tpy. Therefore, the proposed LNG terminal would not be a major source of HAPs and would not be subject to the NESHAPs.

Chemical Accident Prevention Provisions

The chemical accident prevention provisions, codified in 40 CFR 68, are federal regulations designed to prevent the release of hazardous materials in the event of an accident and to minimize potential impacts if a release does occur. The regulations contain a list of substances and threshold quantities for determining applicability to stationary sources. If a stationary source stores, handles, or processes one or more substances on this list in a quantity equal to or greater than specified in the regulation, the facility must prepare and submit a risk management plan (RMP). A facility does not have to prepare an RMP if it does not have a listed substance on-site or the quantity of a listed substance is below the applicability threshold. However, the facility still must comply with requirements of the general duty provisions in section 112(r)(1) of the 1990 Clean Air Act Amendments if it has any regulated substance or other extremely hazardous substance on-site.

Stationary sources are defined in 40 CFR 68 as any buildings, structures, equipment, installations, or substance emitting stationary activities which belong to the same industrial group, which are located on one or more contiguous properties, which are under the control of the same person (or persons under common control), and from which an accidental release may occur. However, the definition also states that the term stationary source does not apply to transportation, including storage incidental to transportation, of any regulated substance or any other extremely hazardous substance. Transportation includes activities subject to oversight or regulation under 49 CFR 192, 193, or 195, or a state natural gas or hazardous liquid program for which the state has in effect a certification to the DOT under 49 U.S.C. section 60105. The only substance that would be potentially applicable to the RMP regulation is the LNG that is stored incidental to transportation. Therefore, an RMP is not required for this facility. However, the facility would meet the goals of the general duty provisions discussed above.

General Conformity

A conformity analysis must be conducted if a federal action will generate emissions that exceed the conformity thresholds levels (*de minimis*) of the pollutant(s) for which an air basin is in nonattainment or is currently a maintenance area. A conformity analysis must show that the emissions will conform to the relevant state implementation plan (SIP), which can be demonstrated through offsets, SIP provisions, or modeling, and will not reduce air quality in the air basin. Emissions from sources subject to NSR or PSD requirements are exempt and are deemed to have conformed. The requirements for a conformity analysis are listed in 40 CFR Parts 6, 51, and 93, and became effective March 15, 1994.

The project area has been classified by the EPA as a "maintenance" area for CO and "serious" nonattainment for the 1-hour ozone standard and "moderate" for the 8-hour standard. It should be noted that determinations regarding federal actions taking place prior to June 15, 2005 are to be made in accordance with the applicability thresholds that apply for the 1-hour ozone designation. The project area is in attainment for all other criteria pollutants. A federal conformity analysis would be required for this project if the combined direct and indirect emissions of either CO, NO_x, or VOCs are equal to or greater than 100 tpy, 50 tpy, and 50 tpy, respectively.

The construction emissions from the project would include CO, NO_x, and VOC from equipment exhaust. The equipment exhaust emissions were quantified using emission factors from EPA's MOBILE6.2 emission estimation program and various nonroad emission factor documents published by the EPA. The construction CO, NO_x and VOC emissions for the project are summarized in table 4.11.1-5. The total operational emissions related to the proposed project are summarized in table 4.11.1-6.

TABLE 4.11.1-5

KeySpan LNG Project Construction Emissions [a/]

Construction Activity	NO_x tpy	CO tpy	VOC tpy
LNG Terminal On-site Work [b/]	26.78	11.81	2.52
LNG Terminal Off-site Work	1.39	9.60	0.72
Pipeline On-site Work	11.20	49.90	0.96
Pipeline Off-site Work	0.19	2.03	0.20
Total Project Emissions	39.56	73.34	4.40

[a/] The estimated construction period for the entire project is less than one year. The emissions above represent the entire project construction emissions and are identified in terms of tons per year to determine applicability under the general conformity regulations.

Tpy tons per year

As shown in table 4.11.1-5, the CO emissions from construction of the project would be less than 100 tpy and the NO_x and VOC emissions would each be less than 50 tpy. The operational emissions from the project would also be below 100 tpy for CO and 50 tpy for NO_x and VOC, as shown in table 4.11.1-6. Therefore, the proposed project is not subject to the general conformity regulations.

TABLE 4.11.1-6

KeySpan LNG Project Operational Emissions [a/]

Emissions Generating Activity	NO_x tpy	CO tpy	VOC tpy
Change in Emissions at LNG Stationary Sources	11. 3	5.1	2.2
Marine Vessels and Tugs	27.3	5.8	0.3
Total Project Emissions	38.6	10.9	2.5

[a/] The stationary source emissions include the potential emissions from the new sources but no credit is taken for the emission reductions for the units that would be re-permitted to reflect reduced operating hours.

Tpy tons per year

The new stationary sources proposed as part of the LNG plant upgrade, with the exception of the emergency generator, would require a minor source air permit prior to construction. As such, the air emissions from these units are presumed to conform to the Rhode Island SIP for the MPAQCR.

State Regulations

In addition to the federal regulations, Rhode Island regulations establish air emission limitations for various pollutants. These air emission limitations would be evaluated and implemented by the DEM during the minor source air permitting process. The minor source air permitting process would require the installation of best available control technology (BACT) for a source with a net emissions increase as a result of the project. At DEM's request, KeySpan LNG prepared and submitted a BACT analysis to assess technologies to control NO_x emissions from the five WEG boilers proposed as a part of this project. KeySpan LNG's analysis dated December 2004 concluded that the combination of Low NO_x burners with flue gas recirculation, which is technically feasible, economically reasonable, and has been approved as BACT in recent DEM permits, be considered BACT for the proposed project. Final approval of the proposed BACT must be obtained from DEM prior to issuing the pre-construction air permit for the project.

Air Quality Impacts and Mitigation

Construction of the proposed LNG terminal and pipeline would have temporary adverse impacts on air quality due to fugitive dust emissions. The amount of fugitive dust would depend on the moisture content and amount of suppressant applied. Algonquin proposes to control fugitive dust from pipeline construction activities by applying water or calcium chloride as necessary to minimize the impact on nearby businesses. Fugitive dust from construction activities at the LNG terminal would be minimized by the application of water as necessary.

Construction of the LNG terminal and pipeline would also result in tailpipe emissions from a variety of sources including loaders, bulldozers, dump trucks, scrapers, and graders. The construction vehicle emissions are subject to the EPA mobile source emission regulations (40 CFR 85). The construction equipment emissions would be limited by compliance with these regulations and by minimizing the amount of idling time when equipment is not in use.

Impacts associated with construction activities and equipment are difficult to estimate based on the time and space variant characteristics of the emissions. Construction impact estimates are complicated by the fact that the construction equipment would regularly change speed and direction. Due to the intermittent and temporary nature of these emissions, their impact on air quality would not be long

term. In addition, diesel engine emission standards and mandatory reductions in diesel fuel sulfur content have been adopted that would reduce emissions from heavy duty construction vehicles. However, the diesel sulfur fuel reductions are not required until mid-2006, and the engine emission standards would be implemented in two stages that are not scheduled to be completed until 2007. To decrease emissions in the immediate future, the EPA has created a voluntary diesel retrofit program to encourage the use of various technologies such as diesel particulate filters and oxidation catalysts. In its comments on the draft EIS, the EPA suggested that KeySpan LNG should implement the same controls that were required by the Connecticut DOT for the I-95 New Haven Harbor Crossing Corridor Improvement Program. These controls require all construction equipment with diesel engines greater than or equal to 60 Hp in size that are on the project for more than 30 days to be outfitted with emission control devices (such as oxidation catalysts) and/or use clean fuels. These controls also limit the idling of diesel vehicles to three minutes or less. Because these control measures have been proven feasible on other projects, **we recommend that:**

- **KeySpan LNG and Algonquin provide a feasibility assessment to the FERC <u>prior to construction</u> determining which, if any, of the emission control strategies used by the Connecticut DOT in the I-95 New Haven Harbor Crossing Corridor Improvement Program can be used during construction of the KeySpan LNG project.**

In addition, because use of low sulfur diesel has been demonstrated to significantly reduce the diesel particulate emissions (a likely carcinogen), **we recommend that:**

- **KeySpan LNG and Algonquin use transportation grade (0.05 weight percent sulfur) or better diesel fuel in all construction equipment for the proposed project.**

Some of the scoping comments noted that Providence has a high asthma rate and expressed concern about potential impacts on public health due to air emissions associated with operation of the proposed facilities. Our analysis of potential air quality impacts indicates that operation of the pipeline would generate a negligible quantity of regulated emissions and would therefore be unlikely to adversely affect public health. Operation of the new LNG terminal equipment would result in air emissions from LNG ships and stationary equipment (heaters, vaporizers, and emergency equipment) associated with the LNG facility. The number of LNG trucks using the facility is not anticipated to increase over the current levels because the number of trucks that can be accommodated is limited by the capacity of the existing truck loading/unloading station. As discussed above, the upgraded LNG terminal would not require a Title V permit and it would not be subject to NNSR or PSD regulations; however, the terminal is subject to permitting requirements under the DEM air pollution control regulations. In order to minimize operational emissions from the proposed LNG terminal, KeySpan LNG would use electric BOG compressors and pumps, install low NOx burners with flue gas recirculation on the natural gas-fired WEG heaters, and take enforceable operating limits on various equipment. As a result of these measures, the emissions from the stationary sources at the proposed LNG terminal are not expected to have a significant impact on air quality.

As part of the permitting process, KeySpan LNG has conducted an air quality analysis and prepared a dispersion modeling report that was submitted to the DEM for review. The January 2005 report documents that the predicted impacts from the LNG terminal stationary sources are well below applicable NAAQS. Additionally, the facility would operate as a closed system. No evaporative losses would occur and natural gas would not be vented to the atmosphere during normal operation. Natural gas would also not be flared.

In its comments, EPA recommended that the tugs and other harbor craft be equipped with engine retrofits to reduce air emissions or, if new vessels are purchased to support the facility, that these vessels

come equipped with these retrofits. In accordance with EPA's recommendation, Keyspan LNG has committed to ensuring that the tugs regularly employed to assist LNG ship berthing and unberthing activities at the proposed terminal meet the new IMO/EPA Tier II Guidelines going into effect in 2007. To implement this measure, KeySpan LNG has committed to working closely with the Port of Providence to verify that new tugs meet the the specified requirements and also to evaluate the engines of existing tugs against the 2007 emissions guidelines and as needed develop a plan to upgrade engines to comply with the IMO/EPA Tier II Guidelines.

EPA also recommended that KeySpan LNG evaluate the requirement for the LNG ships to use lower sulfur fuels when in transit close to land. The fuel used by the LNG ships is not under KeySpan LNG's direct discretion or control, but rather the LNG shipping company, BG LNG. However, KeySpan LNG and BG LNG agreed that they would examine the potential to require LNG ships to use lower sulfur fuels when in transit close to land and would implement this measure where feasible and approved by the Coast Guard.

4.11.2 Noise

Noise Environment

Project-related noise would affect the local environment during construction of the proposed LNG terminal upgrades and pipeline and during operation of the LNG terminal. At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of the day and throughout the week. This variation is caused in part by changing weather conditions and the effects of seasonal vegetative cover. Two measures used by federal agencies to relate the time-varying quality of environmental noise to its known effect on people are the 24-hour equivalent sound level ($L_{eq(24)}$) and the day-night sound level (L_{dn}). The $L_{eq(24)}$ is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period. The L_{dn} is the average of the daytime sound level (L_{day}) and the nighttime sound level (L_{night}) with 10 decibels of the A-weighted scale (dBA) added to the L_{night} to account for greater human sensitivity to sound during nighttime hours. L_{day} is the average sound level from 7 a.m. to 10 p.m. L_{night} is the sound representative of the location between the hours of 10 p.m. and 7 a.m. The City of Providence has noise standards (Section 16-97 and 16-98 of the Providence Municipal Regulations) that limit noise during daytime and nighttime hours. Providence defines daytime hours as 7 a.m. to 8 p.m. and nighttime hours as 8 p.m. to 7 a.m.

In 1974, the EPA published Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. This publication evaluates the effects of environmental noise with respect to health and safety. The document provides information for state and local governments to use in developing their own ambient noise standards. The EPA has determined that in order to protect the public from activity interference and annoyance outdoors in residential areas, noise levels should not exceed an L_{dn} of 55 dBA. The FERC has adopted this criterion for new compression and associated facilities and it is used here to evaluate the potential noise impact from operation of the LNG terminal. An L_{dn} of 55 dBA is equivalent to a continuous noise level of 48.6 dBA for facilities that operate at a constant level of noise. Section 16-97 of the Providence Municipal Regulations restricts noise in residential neighborhoods to 55 dBA during daytime hours and 50 dBA during nighttime hours. Section 16-98 restricts nighttime construction noise levels to 5 dBA above the ambient noise level at the nearest property line.

The immediate vicinity of the LNG terminal site and pipeline route is industrial with some residences in close proximity. The nearest noise sensitive area (NSA) to the terminal site is a residential neighborhood approximately 1,000 feet from the property line. The NSA is shown on figure 4.11.2-1.

Figure 4.11.2-1

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An ambient sound survey was conducted on February 26 and 27, 2004 to document the existing noise environment at the NSA and the LNG terminal site boundary prior to operation of the proposed LNG terminal upgrades. The results of the noise survey are summarized in table 4.11.2-1.

TABLE 4.11.2-1

Existing Noise Levels at the Closest Noise Sensitive Areas

Location	L_{eq} (dBA)	L_{day} (dBA)	L_{night} (dBA)	L_{dn} (dBA)
NW Terminal Site Boundary	52.7	59.6	48.0	59.1
SE Terminal Site Boundary	57.5	63.6	54.3	63.9
NSA	51.4	57.0	48.8	57.8

L_{eq} 24-hour equivalent sound level
L_{day} daytime sound level
L_{night} nighttime sound level
L_{dn} day-night sound level
dBA decibel of the A-weighted scale

Noise Impacts and Mitigation

Construction of the LNG facilities would occur over a period of about 43 weeks. The noise levels associated with these construction activities would vary depending on the type and amount of equipment being used at any given time and location. Construction activities at the LNG terminal and along the pipeline route would generate short-term increases in sound levels predominately during daylight hours when the most significant construction activities would occur. This work schedule would minimize potential noise impacts because activities would not coincide with typical residential sleep patterns and because the ambient noise levels in the project area during work hours would also be elevated relative to nighttime hours.

The most prevalent sound source during the construction activities would be the internal combustion engines on the construction equipment. The most significant noise activity would likely be the driving of piles for the marine construction activities. Distance to receptors and the on-site berm at the LNG terminal would reduce noise impacts; however, KeySpan LNG indicated that it may use additional noise mitigation if necessary. Mitigation may include the use of acoustical blanket shrouds to enclose the hammer and pile during pile driving. The typical noise levels generated by various construction equipment are provided in table 4.11.2-2.

The noise generated during construction of the project would be localized and temporary. Noise from the construction activities would be reduced by barriers such as buildings and berms that occur between the noise generating equipment and the NSAs. Due to the distance between the construction activities and the NSAs, the temporary nature of the noise, the work hours, and the variable location of the noise generating equipment, the noise impacts from the construction activities are not expected to be significant.

TABLE 4.11.2-2

Noise Levels from Various Construction Equipment/Activities

Equipment/Activity [a/]	Noise Level (dBA) at 50 feet
Front-End Loader	78
Backhoe	82
Grader	86
Truck	88
Concrete Mixer	82
Concrete Pump	82
Crane	82
Generator	77
Compressor	81
Jackhammer/Rock Drill	89
Pile Driver	100

[a/] Noise level data from *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances*, USEPA, 1971.

dBA decibels of the A-weighted scale

KeySpan LNG would implement the following measures as necessary to minimize construction noise from the LNG terminal construction activities:

- Maintain exhaust silencers on mobile equipment in working condition.
- Operate noisy equipment during periods when ambient sound levels are high (e.g., during daytime on weekdays) to the extent possible.
- Maintain mechanical equipment such as trucks, compressors, and cranes in good working condition and shut down when not in use, instead of idling.
- Keep noisy equipment as far from site boundaries as possible.
- Utilize noise attenuated air compressors.

To ensure that noise during construction of the proposed upgrades at the KeySpan LNG Facility does not exceed acceptable levels, **we recommend that**:

- **KeySpan LNG prepare a construction noise mitigation plan that specifies which of the noise mitigation measures listed above, including acoustical blanket shrouds for pile driving, will be used during construction activities, and that KeySpan LNG file the plan with the Secretary <u>prior to construction</u> for review and written approval of the Director of the OEP.**

Construction of the proposed pipeline would require operating construction equipment along existing roadways in an industrial area; there are no residences within 50 feet of the pipeline construction workspace. Construction activities would occur mainly during daylight hours. An exception might be construction of the pipeline facilities in Henderson Street, which may be conducted at night to avoid impacts on users of Collier's Point Park during the day. As discussed in section 2.4.2.2, Algonquin anticipates using special construction methods, including the stovepipe and drag-section techniques, that would minimize the duration of construction activities in a single location. Therefore, while receptors in

the immediate vicinity of the construction activities would experience an increase in noise, this effect would be temporary, local, and of short duration. Nighttime noise would not be expected to increase because pipeline construction activities would be limited to daytime hours except under special circumstances such as construction near Collier's Point Park or where additional time is required to complete an activity to minimize a safety hazard prior to leaving the site for the day.

The new stationary equipment would generate noise during operation of the upgraded LNG terminal. The new stationary noise generating equipment at the LNG terminal would include pumps, compressors, heaters, and a generator. The predominant stationary noise source would be the BOG equipment and the WEG heaters. The expected noise levels for each stationary source are listed in table 4.11.2-3 along with the estimated noise reduction that would result from the applicable enclosures.

TABLE 4.11.2-3

Noise Level and Noise Reduction for Proposed LNG Terminal Upgrades

Equipment	Quantity	Reference Distance (feet)	Noise Level (dBA)	Noise Reduction (dBA)	Enclosure
WEG Heater (Blower)	5	5	96	15	Heater Building
WEG Heater (Circ. Pump)	5	3.3	90	15	Heater Building
Warm WEG Circ. Pump	3	3.3	90	15	Heater Building
BOG Blower	3	3.3	95	15	BOG Compressor Building
BOG Compressor	5	3.3	95	15	BOG Compressor Building
LNG Tank Withdrawal Pump	3	3.3	<85	10 [a/]	None/within Containment Berm
LNG High Pressure Sendout Pump	3	3.3	<85	10 [a/]	None/within Containment Berm
Plant/Instrument Air Compressor	2	3.3	80	0	MCC Building
Emergency Generator	1	23	86.1	10 [a/]	None/Near Dock Area, Near Containment Berm

[a/] Noise reduction from berm was assumed only to apply for determining noise impact at NSA.

Much of the new noise generating equipment would be located inside a building, which would significantly reduce noise impacts from the facility. The noise loss from buildings can range from 15 to 65 dBA depending on the building design (Greenberg et al., 1979). The buildings at the LNG terminal would be constructed of 26 to 18 gauge steel sheeting with R11 wall insulation and R13 roof insulation. A 22 gauge steel panel has a sound transmission loss rating of 27 dBA. A 15 dBA sound transmission loss is conservatively assumed for the new LNG terminal buildings, with the exception of the MCC building for which no noise transmission loss is assumed. Effective noise barriers can reduce noise levels by 10 to 15 decibels (FHWA, 2004). The berm would be effective for reducing noise because the berm would be 15 feet tall and the noise source would be 10 feet tall while the nearest NSA would be approximately 2,000 feet from the noise source. Thus, a conservative barrier noise reduction of 10 dBA is assumed. KeySpan LNG estimated noise impacts from the proposed new LNG terminal equipment using spreadsheet-based calculations in which the reference sound levels were decreased with distance from the source to the receptor through geometric spreading and atmospheric absorption. The calculations include anticipated noise reduction from the enclosures and the berm (as indicated in table 4.11.2-3). The results of this analysis are summarized in table 4.11.2-4.

Based on the noise analysis, the impacts from the new LNG terminal equipment would not result in a perceptible increase in noise at the nearest NSA. In addition, the noise attributable to the LNG terminal after the proposed upgrades would be 52.9 dBA L_{dn} at the NSA, which is less than an L_{dn} of 55 dBA, the level that is requisite to protect public health and welfare. The L_{day} and L_{night} would not exceed the Providence noise standards for residential neighborhoods of 55 dBA and 50 dBA, respectively.

The City of East Providence expressed concern about potential noise impacts on NSAs on its waterfront and how the noise might carry over the water as opposed to over land (which attenuates sound more effectively than hard surfaces such as water). The NSAs closest to the East Providence waterfront are considerably further from the LNG terminal than the nearest NSA we evaluated, which is about 1,000 feet from the site. Based on aerial photography, the nearest NSA on the east side of the river appears to be a residence that is about 3,100 feet from the closest point at the LNG terminal. Even the closest recreational area, the East Bay Bike Trail, is more than 2,800 feet from the project site. The noise analysis described above did not assume any noise reduction from land cover; the noise impacts we estimated are a simple function of noise attenuation in air based on distance. Therefore, the potential noise impacts on NSAs along the East Providence waterfront would be less than those identified at the nearest NSA to the LNG facility. Further, we note that KeySpan LNG would be required to verify that noise from the LNG facility does not exceed an L_{dn} of 55 dBA at the nearby residential areas in East Providence.

TABLE 4.11.2-4

Estimated Noise Impact from Proposed LNG Terminal [a/]

Location	Existing Noise Level (dBA)			Level Attributable to Project (dBA)			Total Noise Level Attributable to Upgraded LNG Terminal [b/] (dBA)			Noise Increase (dBA)			Total (dBA)		
	L_{day}	L_{night}	L_{dn}	L_{day}	L_{night}	L_{dn}	L_{day}	L_{night}	L_{dn}	L_{day}	L_{night}	L_{dn}	L_{day}	L_{night}	L_{dn}
NW Boundary	59.6	48.0	59.1	62.5	62.5	68.9	62.7	62.7	69.1	4.7	14.7	10.3	64.3	62.7	69.4
SE Boundary	63.6	54.3	63.9	45.7	45.7	52.1	63.6	63.6	70.0	0.1	0.6	0.3	63.7	54.9	64.2
NSA	57.0	48.8	57.8	39.4	39.4	45.8	46.5	46.5	52.9	0.1	0.5	0.3	57.1	49.3	58.1

[a/] The L_{day} and L_{night} designations in table 4.11.2-4 refer to the City of Providence noise requirements for nighttime and daytime noise. The $L_{eq(day)}$ and $L_{eq(night)}$ used to calculate the L_{dn} is on a different range of hours.

[b/] These noise levels include the total noise attributable to the LNG terminal equipment after the proposed upgrades.

dBA decibels of the A-weighted scale

L_{day} noise level that represents daytime noise as defined by City of Providence standards (7a.m. to 8p.m.)

L_{night} noise level that represents nighttime noise as defined by City of Providence standards (8p.m. to 7a.m.)

L_{dn} day night sound level, as defined by FERC; daytime is between 7a.m. and 10p.m. and nighttime is between 10p.m. and 7a.m.

Because the noise analysis is based on preliminary design, and to ensure that the proposed LNG terminal operates in compliance with these guidelines, **we recommend that:**

- **KeySpan LNG shall file noise surveys with the Secretary no later than 60 days after placing the authorized units at the KeySpan LNG Facility in service. If the noise attributable to the operation of the new units and the station as a whole at full load exceeds an L_{dn} of 55 dBA at any nearby NSA, including the nearby residential areas on the east side of the Providence River, KeySpan LNG shall install additional noise controls to meet that level within 1 year of the in-service date. KeySpan LNG shall confirm compliance with the L_{dn} of 55 dBA requirement by filing a second noise**

survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.

4.12 RELIABILITY AND SAFETY

Three federal agencies share in the oversight of the safety and security of LNG import terminals: the Coast Guard, the Pipeline and Hazardous Materials Safety Administration of the DOT, and the FERC. The FERC authorizes the siting and construction of LNG import terminals and is the lead federal agency under NEPA to analyze the environmental, safety, security, and cryogenic design of proposed facilities. The Coast Guard has authority over the safety of LNG vessels and the marine transfer area. The Coast Guard also has authority over the security of the LNG vessels and the entire LNG facility. The DOT has exclusive authority to promulgate and enforce safety regulations and standards over the onshore LNG facilities beginning at the last valve immediately before the LNG storage tank(s).

In February 2004, the three participating agencies entered into an Interagency Agreement to assure that they work in a coordinated manner to address the full range of issues regarding safety and security at LNG import terminals, including the terminal facilities and tanker operations, and to maximize the exchange of information related to the safety and security aspects of the LNG facilities and related marine operations. The Interagency Agreement ensures a seamless safety and security review by the three federal agencies.

The KeySpan LNG proposal could pose a potential hazard to public safety without strict design and operational measures to control potential accidents. The primary concerns are those events that could lead to an LNG spill of sufficient magnitude to create an offsite hazard. However, it is also important to recognize the stringent requirements for the design, construction, operation, and maintenance of the facility as well as the extensive safety systems to detect and control potential hazards.

The existing KeySpan LNG facility commenced operations in May 1974, prior to the February 1980 Federal LNG Safety Standards in 49 CFR Part 193. During more than 30 years of operation, the facility has provided winter storage services with the tank filled exclusively by LNG truck, except for a single barge cargo in July 1974. The proposed change of the historical mode of operations of the facility to a baseload import terminal, with the LNG storage tank filled weekly by LNG vessels, supports the need for the existing LNG storage tank and facilities to be modified as necessary to meet the current LNG safety standards in 49 CFR Part 193 and NFPA 59A (2001 edition).

With the exception of the October 20, 1944 fire at the LNG facility in Cleveland, Ohio, the operating history of U.S. LNG facilities has been free of LNG safety-related incidents resulting in adverse effects to the public or the environment.[2] More recently, an operational accident occurred in 1979 at the Cove Point LNG facility in Lusby, Maryland, when a pump seal failed, resulting in gas vapors entering an electrical conduit and settling in a confined space. When a worker switched off a circuit breaker, the gas ignited, resulting in heavy damage to the building and a worker fatality. Lessons learned from this accident resulted in changing the national fire codes, with the participation of the FERC, to ensure that the situation would not occur again. The proposed facilities would be designed, constructed, and operated in compliance with these codes.

On January 19, 2004, a blast occurred at Sonatrach's Skikda, Algeria LNG liquefaction facility that killed 27 and injured 56 workers. No members of the public were injured. Preliminary findings of

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[2] For a description of the incident and the findings of the investigation, see "U.S. Bureau of Mines, Report on the Investigation of the Fire at the Liquefaction, Storage, and Regasification Plant of the East Ohio Gas Co., Cleveland, Ohio, October 20, 1944, February 1946."

the accident investigation suggest that a cold hydrocarbon leak occurred at Liquefaction Train 40 and was introduced to the high-pressure steam boiler by the combustion air fan. An explosion developed inside the boiler fire box which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and LPG separation equipment of Train 40, and spread to Trains 20 and 30. Although Trains 10, 20, and 30 had been modernized in 1998-1999, Train 40 had been operating with its original equipment since start-up in 1981.

While there are major differences between the equipment involved in the accident at Skikda and that of the proposal (i.e., high-pressure steam boilers that power refrigerant compressors would not be used here nor are they used at any LNG facility under FERC jurisdiction), the sequence of cascading events identifies potential failure modes that warrant further evaluation. This issue was discussed at the September 9, 2004 cryogenic design and technical review conference conducted for this project in Providence. To ensure that this potential hazard is thoroughly addressed, we have provided a recommendation in section 4.12.2, *Cryogenic Design and Technical Review*, regarding this issue.

A discussion of the principal properties and hazards associated with LNG is presented in section 4.12.1. A summary of our preliminary design and technical review of the cryogenic aspects of the KeySpan LNG terminal is presented in section 4.12.2. Storage and retention systems are discussed in section 4.12.3. An analysis of the thermal radiation and flammable vapor cloud hazards resulting from a credible land-based LNG spill is presented in section 4.12.4, while the safety aspects of LNG transportation by ship are summarized and discussed in section 4.12.5. LNG truck safety issues are examined in section 4.12.6. A discussion on security awareness related to terrorism is presented in section 4.12.7. The reliability and safety issues related to the natural gas pipeline are discussed in section 4.12.8. Additional safety issues identified in scoping are addressed in section 4.12.9. Conclusions on safety issues are in section 4.12.10.

4.12.1 LNG Hazards

LNG's principal hazards result from its cryogenic temperature (-260° F), flammability, and vapor dispersion characteristics. As a liquid, LNG will neither burn nor explode. Although it can cause freeze burns and, depending on the length of exposure, more serious injury, its extremely cold state does not present a significant hazard to the public, which rarely, if ever, comes in contact with it as a liquid. As a cryogenic liquid, LNG will quickly cool materials it contacts, causing extreme thermal stress in materials not specifically designed for ultra cold conditions. Such thermal stresses could subsequently subject the material to brittleness, fracture, or other loss of tensile strength. These hazards, however, are not substantially different from hazards associated with the storage and transportation of liquid oxygen (-296° F) or several other cryogenic gases that have been routinely produced and transported in the United States.

Methane, the primary component of LNG, is colorless, odorless, and tasteless and is classified as a simple asphyxiant. Methane could, however, cause extreme health hazards, including death, if inhaled in significant quantities within a limited time. At very cold temperatures, methane vapors could cause freeze burns. Asphyxiation, like freezing, normally represents a negligible risk to the public from LNG facilities.

When released from its containment vessel and/or transfer system, LNG will first produce a vapor or gas. This vapor, if ignited, represents the primary hazard to the public. LNG vaporizes rapidly when exposed to ambient heat sources such as water or soil, producing 620 to 630 standard cubic feet of natural gas for each cubic foot of liquid. LNG vapors in a 5 to 15 percent mixture with air are highly flammable. The amount of flammable vapor produced per unit of time depends on factors such as wind conditions,

the amount of LNG spilled, and whether it is spilled on water or land. Depending on the amount spilled, LNG may form a liquid pool that will spread unless contained by a dike.

Once a flammable vapor-air mixture from an LNG spill has been ignited, the flame front will propagate back to the spill site if the vapor concentration along this path is sufficiently high to support the combustion process. An unconfined methane-air mixture will burn slowly, tending to ignite combustible materials within the vapor cloud, whereas fast flame speeds tend to produce flash burns rather than self-sustaining ignition.

LNG is not explosive as it is normally transported and stored. However, LNG vapors (primarily methane) can explode if contained within a confined space, such as a building or structure, and ignited. There is no evidence, however, suggesting that LNG is explosive in unconfined open areas. Experiments to determine if unconfined methane-air mixtures will explode have been conducted and, to date, have all been negative. Unconfined methane-air mixtures will burn but will not explode. Nevertheless, a number of experimental programs have been conducted to determine the "amount of initiator charge" required to detonate an unconfined methane-air mixture.

Over the years, various parties have occasionally expressed the energy content of an LNG storage tank or LNG ship in equivalent tons of trinitrotoluene (TNT), as an implied measure of its explosive potential. However, such a simplistic analogy fails to consider that explosive forces are not just a function of the total energy content but also of the rate of energy release. For an explosion to occur, the rate of energy release must be nearly instantaneous, such as with a TNT charge initiated by a blasting cap. Unlike TNT or other explosives which inherently contain an oxidizer, an unconfined vapor cloud must be mixed with oxygen within the flammability range of the fuel for combustion to occur. For a large unconfined vapor cloud, the flammability range tends to exist at the mixing zone at the edges of the cloud. When ignited, flame speeds about 20 to 25 m/sec (66 - 82 ft/sec) and local overpressures up to 0.2 psig have been estimated for methane rich fuels, well below the flame speeds and overpressures associated with explosion.

A rapid phase transition (RPT) can occur when a portion of LNG spilled onto water changes from liquid to gas, virtually instantaneously. Unlike an explosion that releases energy and combustion products from a chemical reaction as described above, an RPT is the result of heat transferred to the liquid, inducing a change to the vapor state. The rapid expansion from the liquid to vapor state can cause locally large overpressures. RPTs have been observed during LNG test spills onto water. In some test cases, the overpressures generated were strong enough to damage test equipment in the immediate vicinity of the LNG release point. The sizes of the overpressure events have been generally small and are estimated to be equivalent to several pounds of TNT. Such a small overpressure is not expected to cause significant damage to an LNG vessel. However, the RPT may increase the rate of LNG pool spreading and the LNG vaporization rate.

4.12.2 Cryogenic Design and Technical Review of the KeySpan LNG Facility

The cryogenic design and technical review emphasizes the engineering design and safety concepts and the projected operational reliability of the proposed facilities. The principal areas of coverage include materials in cryogenic environments, insulation systems, cryogenic safety, thermodynamics, heat transfer, instrumentation, cryogenic processes, and other relevant safety systems.

The facility upgrades would be located within KeySpan LNG's existing LNG facility and in the adjacent waters of the Providence River. No modifications to the existing LNG storage tank are proposed as part of this project. However in section 4.12.3 we evaluated the existing LNG storage tank and

facilities to determine what modifications would be necessary to meet the current LNG safety standards in 49 CFR Part 193 and NFPA 59A (2001 edition).

Study and evaluation of information for the proposed design and installation of the LNG facility upgrades at the existing facility have been performed by the staff. The design and specifications submitted for the proposed facility are considered to be preliminary but would be the basis for any detailed design to follow. A significant amount of the basic design involving final selection of equipment manufacturers, process conditions and resolution of some safety related issues would be completed in the next phase of project development if authorization is granted by the Commission. This information would need to be submitted to the FERC staff for review and approval.

As a result of the technical review of the information provided in the submittal documents, a number of concerns were identified by staff relating to the reliability, operability, and safety of the proposed design. KeySpan LNG responded to several of these questions at the technical review meeting on September 9, 2004. However, several areas of concern are noted that require additional consideration and/or action on behalf of the company. Follow-up on those items requiring additional action should be documented in reports to be filed with the FERC. As a result, **we recommend that:**

The following measures should apply to the LNG terminal design and construction details. Information pertaining to these specific recommendations should be filed with the Secretary for review and approval by the Director of OEP either: prior to initial site preparation; prior to construction of final design; prior to commissioning; or prior to commencement of service. This information should be submitted a minimum of 30 days before approval to proceed is required.

- **<u>Prior to initial site preparation</u>, the existing plant Piping & Instrumentation Diagrams (P&IDs) should be redrawn and integrated with the proposed upgrade P&IDs, using the same legend and pipe specifications as the proposed upgrade to provide a complete facility design and consistent design information for the facility.**

- **<u>Prior to initial site preparation</u>, the existing electrical and instrumentation drawings should be redrawn and integrated with the proposed upgrade drawings, using the same legends as the proposed upgrade, to provide a complete facility design and consistent design information for the facility.**

- **<u>Prior to initial site preparation</u>, the LNG tank contractor should certify that the tank connections and associated tank piping are designed for the proposed service.**

- **KeySpan LNG should provide a technical review of its facility design that:**

  a. Identifies all combustion/ventilation air intake equipment and the distance(s) to any possible hydrocarbon release (LNG, flammable refrigerants, flammable liquids, and flammable gases).

  b. Demonstrates that these areas would be adequately covered by hazard detection devices and indicate how these devices would isolate or shutdown any combustion equipment whose continued operation could add to or sustain an emergency.

  KeySpan LNG should file this review <u>prior to initial site preparation</u>.

- **A complete plan and list of the hazard detection equipment should be filed prior to initial site preparation. The information should include a list with the instrument tag number, type and location, alarm locations, and shutdown functions of the proposed hazard detection equipment. Plan drawings should clearly show the location of all detection equipment.**

- **A complete plan and list of the fixed and wheeled dry-chemical, fire extinguishing, and high expansion foam hazard control equipment should be filed prior to initial site preparation. The information should include a list with the equipment tag number, type, size, equipment covered, and automatic and manual remote signals initiating discharge of the units. Plan drawings should clearly show the planned location of all fixed and wheeled extinguishers.**

- **A complete plan and list of the hand-held fire extinguishers should be filed prior to initial site preparation. The information should include a list with the equipment tag number, type, size, and location. Plan drawings should clearly show the planned location of all hand-held fire extinguishers.**

- **Prior to initial site preparation, KeySpan LNG should provide a complete firewater system design in compliance with NFPA 59A (2001 edition), which includes the design flow rate and operating pressure conditions at the design flow rate for the system; a list of the firewater equipment including capacity and size specifications for storage, firewater pumps, and controls; a list of covered areas with the required and available firewater coverage and the tag number of each monitor, hydrant, deluge, hose, and sprinkler to be used for each area; facility plans showing the piping and valves, location of and area covered by each monitor, hydrant, deluge system, hose, and sprinkler; and P&IDs of the complete firewater system.**

- **The final design of the hazard detection equipment should identify manufacturer and model.**

- **The final design of the hazard detection equipment should include redundancy and fault detection and fault alarm monitoring in all potentially hazardous areas and enclosures.**

- **The final design of the hazard detection equipment should provide flammable gas and UV/IR hazard detectors with local instrument status indication as an additional safety feature.**

- **The final design should specify that open path detectors, when used, should be calibrated to detect the presence of flammable gas and alarm at the lowest reliable set point, in addition to the required 25 percent lower flammability limit set point.**

- **The final design of the fixed and wheeled dry-chemical, fire extinguishing, and high expansion foam hazard control equipment should identify manufacturer and model.**

- **The firewater source should not rely solely on the flow from the municipal supply. The final design of the firewater system should include a secondary source such as river water or a firewater storage tank. In the event that a firewater storage tank is required, the quantity of fire water available from storage should be no less than the capacity required by the firewater system design.**

- **The final design should include remotely operated firewater monitors in locations that may not be accessible in the event of adjacent fire or vapor dispersion conditions.**

- **The final design should include provisions to continuously record municipal water pressure. A low pressure alarm should be provided in the final design to signal supply pressures less than 40 psig.**

- **The final design of the piping systems should allow equipment and piping containing LNG and vapor to be isolated, drained, and depressurized to a safe location.**

- **The final design should include provisions for the LNG pressure-relief valves to discharge into a system designed for the service.**

- **The final design should relocate the 20-inch check valves to between the arms and the pressure safety valves, to avoid relieving through the check valve.**

- **The final design should specify that inlet block valves from the LNG header should be welded to avoid flange leaks.**

- **The final design should include provisions to ensure that hot glycol/water circulation is operable at all times when LNG is present in the LNG booster pump discharge piping or when the temperature in the LNG inlet channel to any vaporizer is below 0 °F.**

- **The final design should specify that the water/ethylene-glycol pump motors should be connected to the 480-volt emergency bus to ensure that water/ethylene-glycol can be circulated in the event of loss of power.**

- **The final design should include detection instrumentation and shut down procedures for vaporizer tube leak, shell side overpressure, or bursting disc failure.**

- **The final design should include low-low temperature vaporization shutdown in the common vaporizer discharge header.**

- **The final design should include automatic isolation valves at the suction and discharge of vapor return blowers and boiloff compressors.**

- **The final design should ensure that air gaps are installed downstream of all seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system. Each air gap should vent to a safe location and be equipped with a leak detection device that: would continuously monitor for the presence of a flammable fluid; would alarm the hazardous condition; and would shutdown the appropriate systems.**

- **The final design should include a fire protection evaluation carried out in accordance with the requirements of NFPA 59A, chapter 9.1.2.**

- **The final design should include details of the shut down logic, including cause and effect lists for alarm and shutdown.**

- **The final design should include emergency shutdown of equipment and systems activated by hazard detection devices for flammable gas, fire, cryogenic spills, and earthquake, when applicable.**

- **The final design should include procedures for offsite contractors' responsibilities, restrictions, limitations, and supervision of the contractors by Keyspan LNG staff.**

- **A flow test of the firewater supply should be carried out at the design flow rate to determine the supply pressure at each independent firewater source prior to and at the design flow rate required by the firewater plan. The results of this test should be filed prior to commissioning.**

- **Security personnel requirements for prior to and during LNG vessel unloading should be filed prior to commissioning.**

- **Operation and Maintenance procedures and manuals, as well as emergency plans, emergency evacuation plan and safety procedure manuals, should be filed prior to commissioning.**

- **Copies of the final Coast Guard security plan, vessel operation plan, and emergency response plan should be provided to the FERC staff prior to commissioning.**

- **The FERC staff should be notified of any proposed revisions to the security plan and physical security of the facility prior to commencement of service.**

- **Progress on the construction of the LNG terminal should be reported in monthly reports filed with the Secretary. Details should include a summary of activities, problems encountered and remedial actions taken. However, problems of significant magnitude should be reported to the FERC within 24 hours.**

In addition, **we recommend that the following measures should apply throughout the life of the facility:**

- **The facility should be subject to regular FERC staff technical reviews and site inspections on at least a biennial basis or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, Keyspan LNG should respond to a specific data request including information relating to possible design and operating conditions that may have been imposed by other agencies or organizations. Up-to-date detailed piping and instrumentation diagrams reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted annual report, should be submitted.**

- **Semi-annual operational reports should be filed with the Secretary to identify changes in facility design and operating conditions, abnormal operating experiences, activities (including ship arrivals, quantity and composition of imported LNG, vaporization quantities, boil-off/flash gas, etc.), plant modifications including future plans and progress thereof. Abnormalities should include, but not be limited to: unloading/shipping problems, potential hazardous conditions from offsite vessels, storage tank stratification or rollover, geysering, storage tank pressure excursions, cold spots on the storage tanks, storage tank vibrations and/or vibrations in**

associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, vapor or liquid releases, fires involving natural gas and/or from other sources, negative pressure (vacuum) within a storage tank and higher than predicted boiloff rates. Adverse weather conditions and the effect on the facility also should be reported. Reports should be submitted within 45 days after each period ending June 30 and December 31. In addition to the above items, a section entitled "Significant plant modifications proposed for the next 12 months (dates)" also should be included in the semi-annual operational reports. Such information would provide the FERC staff with early notice of anticipated future construction/maintenance projects at the LNG facility.

- **In the event the temperature of any region of the outer shell of the storage tank becomes less than the minimum specified operating temperature for the material, the Commission should be notified within 24 hours and procedures for corrective action should be specified.**

- **Significant non-scheduled events, including safety-related incidents (i.e., LNG or natural gas releases, fires, explosions, mechanical failures, unusual over pressurization, and major injuries) and security-related incidents (i.e., attempts to enter site, suspicious activities) should be reported to FERC staff within 24 hours. In the event an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification should be made immediately, without unduly interfering with any necessary or appropriate emergency repair, alarm, or other emergency procedure. This notification practice should be incorporated into the LNG facility's emergency plan. Examples of reportable LNG-related incidents include:**

  a. fire;

  b. explosion;

  c. estimated property damage of $50,000 or more;

  d. death or personal injury necessitating in-patient hospitalization;

  e. free flow of LNG for five minutes or more that results in pooling;

  f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of an LNG facility that contains, controls, or processes gas or LNG;

  g. any crack or other material defect that impairs the structural integrity or reliability of an LNG facility that contains, controls, or processes gas or LNG;

  h. any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes gas or LNG to rise above its maximum allowable operating pressure (or working pressure for LNG

facilities) plus the build-up allowed for operation of pressure limiting or control devices;

i. a leak in an LNG facility that contains or processes gas or LNG that constitutes an emergency;

j. inner tank leakage, ineffective insulation, or frost heave that impairs the structural integrity of an LNG storage tank;

k. any safety-related condition that could lead to an imminent hazard and cause (either directly or indirectly by remedial action of the operator), for purposes other than abandonment, a 20 percent reduction in operating pressure or shutdown of operation of a pipeline or an LNG facility that contains or processes gas or LNG;

l. safety-related incidents to LNG vessels occurring at or en route to and from the LNG facility; or

m. an event that is significant in the judgment of the operator and/or management even though it did not meet the above criteria or the guidelines set forth in an LNG facility's incident management plan.

In the event of an incident, the Director of OEP has delegated authority to take whatever steps are necessary to ensure operational reliability and to protect human life, health, property or the environment, including authority to direct the LNG facility to cease operations. Following the initial company notification, FERC staff would determine the need for a separate follow-up report or follow-up in the upcoming semi-annual operational report. All company follow-up reports should include investigation results and recommendations to minimize a reoccurrence of the incident.

4.12.3 Storage and Retention Systems

KeySpan LNG is not proposing any modifications to the existing LNG storage tank. The existing facility was designed in 1971 and 1972, and following construction was placed into service in 1974. The standards of NFPA 59A (1971 edition) were used to establish design, construction, siting, and safety requirements for the existing facilities. NFPA 59A incorporates several other codes and standards by reference. These include applicable requirements of the American Concrete Institute (ACI), American National Standards Institute (ANSI), American Petroleum Institute (API), American Society of Mechanical Engineers (ASME), American Society for Testing and Materials (ASTM), Tubular Exchanger Manufacturers Association (TEMA) and the Uniform Building Code (UBC).

The existing KeySpan LNG facility was constructed prior to the February 1980 Federal LNG Safety Standards in 49 CFR Part 193 and has operated safely for 30 years under retroactive areas of NFPA 59A and, subsequently, 49 CFR 193 regulations governing operations, maintenance, fire

protection, security, communications, alternative power supply and personnel training and health.[3] Since commencing operations in May 1974, under its initial authorization, the facility has provided winter storage services with the tank filled exclusively by LNG truck, with the exception of a single cargo from the 30,000-barrel LNG Barge *Massachusetts* in July 1974. Consequently, the facility upgrade proposed for the KeySpan LNG Project represents a significant modification to its historical mode of operation. As such, the current proceeding provides the opportunity to re-evaluate the existing facility and to raise the level of safety to that required for new LNG import terminals. Staff's preliminary review of the existing facility found that the following areas do not meet the current version of 49 CFR 193 and NFPA 59A (2001 edition):

1) The LNG storage tank impoundment was designed to 100 percent of the tank contents rather than 110 percent now required.

2) Thermal radiation exclusion zones for the LNG storage tank impoundment: (a) a portion of the 10,000 Btu/hr-ft^2 thermal radiation exclusion zone, required to be within the plant property line, extends approximately 350 feet south of the property line onto the adjacent cement company and liquid storage tanks; (b) the 3,000 Btu/hr-ft^2 zone, which prohibits structures used for occupancies or residences, extends approximately 750 feet south and 300 feet west onto industrial property and the Providence Gas Company site; and (c) the 1,600 Btu/hr-ft^2 zone, which prohibits outdoor assembly areas, extends about 1,050 feet south, about 750 feet west, and about 1,000 feet northwest onto adjacent industrial facilities. Although there are no identified excluded land uses in the 3,000 or 1,600 Btu/hr-ft^2 zones, KeySpan LNG would need to demonstrate legal control of the exclusion zones to comply with Part 193.

   The LNG storage tank design spill, based on a tank with bottom penetrations and internal shut-off valves, would be 676,187 gallons for a 1-hour duration and could be contained by the existing 90-foot by 90-foot sub-impoundment.[4] According to the SOURCE5 model, flammable vapor from this spill would not overtop the dike until approximately 6 hours after the spill. However, DEGADIS modeling indicates a maximum distance of 393 feet to the edge of the ½ LFL gas concentration. This would extend beyond the property line.

   In a Two-Part Report prepared for the Rhode Island Attorney General and filed as comments on the DEIS, Dr. Jerry Havens stated that the calculation of vapor overflow occurring approximately 6 hours after the spill was in error because it assumed that the vapor evolved from the spill was not affected by wind and did not expand due to warming and mixing with air while being evolved. As a result he states that the modeling seriously underestimates the distance to the ½ LFL gas concentration, and that the flammable vapor exclusion zone should be recalculated using the FEM3A code. The issues raised in these comments are addressed in Section 4.12.4, *Vapor Dispersion Zones for Sendout pumps, Vaporizers and Ship unloading line*.

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[3] During the review of the Proposed ALNG Modifications Project in CP96-517-000 in 1996, the Rhode Island Building Code Committee stated that the existing LNG storage tank should be reexamined in accordance with the new seismic provisions of the 1996 National Building Code. The May 6, 1997 Commission Order identified that the project would not be a significant modification to the tank and that the current Part 193 requirements would not apply, and that to increase the seismic design of the existing tank essentially would require its complete reconstruction or replacement. Subsequently, a January 7, 2000 Opinion by the U.S. District Court for Rhode Island determined that the Providence Zoning Ordinance was preempted by federal law. Similar issues have emerged in this KeySpan LNG Project, where several parties (City of East Providence, Rhode Island Attorney General, and Ferguson Perforating and Wire Company) filed comments disagreeing with the grandfather status of the existing facility, stating that the current standards for design and spill containment should be applied.

[4] The draft 2005 version of NFPA 59A proposes to revise the 1-hour spill duration for LNG storage tanks with bottom penetrations and internal valves to a 10-minute duration spill. If this revision is approved by the committee and subsequently incorporated into Part 193 through the rulemaking process, a 10-minute spill scenario could be used for vapor dispersion calculations.

3) The incorporation of the 2001 edition of NFPA into Part 193 by DOT increased the stringency and complexity of the seismic requirements. A detailed evaluation by a seismic consultant would be required to determine if the existing tank would comply with this requirement, or if it could even be modified to comply if needed.

As a result, we recommended in the draft EIS that KeySpan LNG perform an analysis of how its existing LNG storage and sendout facilities would comply with the current Federal Safety Standards, to include, but not be limited to: thermal radiation and flammable vapor exclusion zones; required impoundment capacity; seismic design requirements in the 2001 edition of NFPA 59A; and siting, design, and construction requirements. For those features of the existing facility that would not comply with the current safety standards, KeySpan LNG was instructed to include an evaluation of the design changes or other measures that would need to be applied to comply with current standards, along with a specific discussion of how each of the change(s) would achieve compliance.

In a January 24, 2005 filing, KeySpan LNG provided the following analysis of measures that would be necessary to bring the existing facility into compliance with current Federal Safety Standards as well as the costs and benefits:

- Seismic design of storage tank – KeySpan LNG would need to replace anchors, possibly increase inner tank plate thickness and width, and replace or increase the foundation. This would cost an estimated $12.5 to 15 million and take the facility out of service for two to three heating seasons. KeySpan LNG points out that the tank has already proven itself able to withstand a magnitude 3.5 earthquake near Newport, Rhode Island and a magnitude 6.0 earthquake near Cape Ann, Massachusetts.

- Thermal exclusion zones – KeySpan LNG would need to acquire legal control over eight nearby industrial properties, for which there is no ceiling on the price that could be demanded by the owners. KeySpan LNG notes that no prohibited land uses currently occur in the 3,000 and 1,600 Btu/ft²-hr zones.

- Vapor dispersion zone – KeySpan LNG would need to eliminate nozzles at the bottom of the storage tank and install in-tank pumps and related equipment. This would cost an estimated $17 million and take the facility out of service for one to two heating seasons. KeySpan LNG explains that the 2005 edition of NFPA 59A would reduce the spill time required for this design spill to be consistent with the reaction time used for other design spills. The reduced spill time would produce a smaller spill, which would result in an amount of vapor that would be essentially confined within the impoundment dike.

- Impoundment capacity – KeySpan LNG would need to increase the height of the dike, relocate pipe and modify the access road. This would cost an estimated $0.5 million. KeySpan LNG submits that the existing dike can already contain 102.3 percent of the storage tank capacity, which KeySpan LNG believes should be adequate, especially considering that some of the LNG would "flash" and vaporize during a tank spill event.

- Tank pressure and vacuum relief valves – KeySpan LNG would need to install two additional pressure relief valves and one additional vacuum relief valve. This would cost an estimated $5 million and take the facility out of service for at least one heating season. KeySpan LNG points out that the storage tank already has a 20-inch discretionary vent, in addition to its existing pressure relief valves, that can automatically relieve tank pressure in the amounts required by the new standards.

Based on these findings, KeySpan LNG has indicated that it would not be feasible for the existing facility to meet the Federal Safety Standards intended for new construction projects. Further, KeySpan LNG states that the net advantages of this requirement would be negligible, and it would only serve to deprive the region of a critically needed gas supply. KeySpan LNG also maintains that this requirement would be inconsistent with FERC precedent on similar projects and with the grandfather provisions of 49 CFR 193.

In a March 24, 2005 supplement to its January 2005 comments, KeySpan LNG provided other options for bringing the facility up to current thermal exclusion zone standards by (a) modifying or replacing the existing storage tank, and (b) acquiring additional properties within the exclusion zones.

Under option (a) KeySpan LNG determined that it could retain the 10,000 Btu/hr-ft^2 thermal exclusion zone on the property either by (i) installing in-tank pumps and a new containment system at a cost of $95 million and removing the tank from service for one or two heating seasons; or (ii) completely replacing the tank at a cost of $105 million and removing the tank from service for four or five heating seasons.

Option (b) would require KeySpan LNG to acquire 10 acres on 8 parcels owned by 4 landowners within the 10,000 Btu/hr-ft^2 thermal exclusion zone, and legal covenants or easements on 16 acres on 13 other parcels from 3 landowners within the 3,000 and 1,600 Btu/hr-ft^2 thermal exclusion zones. In this case, KeySpan LNG states that the Commission would have to confirm that it could exercise eminent domain to acquire the properties.

In addition, KeySpan LNG evaluated other options under the "equivalency" section of NFPA 59A that include: (i) the installation of high expansion foam systems at both the sump and entire impoundment area to reduce thermal radiation flux levels by 80 to 90 percent, according to the manufacturers; (ii) the installation of a 6-foot-high vapor fence around the entire impoundment; and (iii) upgrading the existing firewater system.

With respect to the March 2005 supplemental measures offered by KeySpan LNG, we note that Section 3 authorization does not provide eminent domain authority. Further, the mitigation being considered under the "equivalency" section would need a more detailed design evaluation and proposed concurrence with FERC through an applicants request for finding or approval by the agency having jurisdiction, i.e., DOT/OPS.

During more than 30 years of operation, the facility has provided winter storage services with the tank filled exclusively by LNG truck, except for a single barge cargo in July 1974. The proposed change of the historical mode of operations of the facility to a baseload import terminal, with the LNG storage tank filled weekly by LNG vessels, supports the need for the existing LNG storage tank and facilities to be modified as necessary to meet the current LNG safety standards in 49 CFR Part 193 and NFPA 59A (2001 edition). Further, the proposed change in operations for this facility is unique and significant in comparison to the expansions approved at other LNG import terminals.

4.12.4 Current Federal Siting Requirements - Thermal and Dispersion Exclusion Zones for New Facilities

Regulatory Requirements

New LNG facilities must comply with the siting requirements of 49 CFR 193, subpart B. On March 30, 2000, the DOT revised 49 CFR 193 to incorporate NFPA 59A (1996 edition) into the LNG

regulations. On April 9, 2004, the DOT further revised 49 CFR 193 to incorporate the 2001 edition of NFPA. The following sections specifically address offsite hazards:

- **Part 193.2001, Scope of Part**, excludes any matter other than siting provisions pertaining to marine cargo transfer systems between the marine vessel and the last manifold or valve immediately before a storage tank.

- **193.2005(b), Applicability,** states that if an existing LNG facility (or facility under construction before March 31, 2000, is replaced, relocated, or significantly altered after March 31, 2000, the facility must comply with the applicable requirements of this part governing, siting, design, installation, and construction, except that:
  - (1) The siting requirements apply only to LNG storage tanks that are significantly altered by increasing the original storage capacity or relocated, and
  - (2) To the extent compliance with the design, installation, and construction requirements would make the replaced, relocated, or altered facility incompatible with the other facilities or would otherwise be impractical, the replaced, relocated, or significantly altered facility may be designed, installed, or constructed in accordance with the original specifications for the facility, or in another manner subject to the approval of the Administrator.

- **Part 193.2051, Scope**, states that each LNG facility designed, replaced, relocated or significantly altered after March 31, 2000, must be provided with siting requirements in accordance with subpart B and NFPA 59A. In the event of a conflict with NFPA 59A, then Part 193 prevails.

- **Part 193.2057, Thermal radiation protection**, requires that each LNG container and LNG transfer system have thermal exclusion zones based on three radiation flux levels in accordance with section 2.2.3.2 of NFPA 59A.

- **Part 193.2059, Flammable vapor-gas dispersion protection**, requires that each LNG container and LNG transfer system have a dispersion exclusion zone in accordance with sections 2.2.3.3 and 2.2.3.4 of NFPA 59A.

For the following LNG facilities that are proposed for this project, we have identified the applicable siting requirements from Part 193 and NFPA 59A:

- Marine cargo transfer system consisting of two 16-inch-diameter unloading arms, a 24-inch-diameter liquid unloading line, an 8-inch-diameter vapor return line, and a 12-inch-diameter vapor return arm - Parts 193.2001, 2057, and 2059 require thermal and flammable vapor exclusion zones for the transfer system. NFPA 59A does not address LNG transfer systems.

- Three 1768 gpm low-pressure sendout pumps and three 1770 gpm high-pressure sendout pumps - Parts 193.2057 and 2059 require thermal and flammable vapor exclusion zones. NFPA 59A section 2.2.3.2 specifies the thermal exclusion zone and sections 2.2.3.3 and 2.2.3.4 specify the flammable vapor exclusion zone based on the design spill, which is determined in section 2.2.3.5.

- Two 200 MMscfd vertical shell and tube type vaporizers and a smaller 50 MMscfd vaporizer for cooling the BOG compressors and vapor return blowers during ship unloading - Same requirements as for LNG pumps.

The incorporation of the NFPA 59A requirements into Part 193 has resulted in some confusion and possible misinterpretation in applying the siting requirements:

Parts 193.2057 and 2059 require exclusion zones for LNG transfer systems, which are defined to include transfer piping. However, NFPA 59A only requires exclusion zones for "transfer areas" which are defined as the part of the plant where liquids are introduced or removed from the facility such as truck loading or ship unloading areas. The definition of transfer area in NFPA 59A specifically excludes permanent plant piping such as cargo transfer lines. Additionally, NFPA 59A section 2.2.3.1 (2001) specifically excludes transfer areas at the water edge of marine terminals. When the DOT incorporated NFPA 59A into its regulations, it removed the requirement for impounding systems around transfer piping (old Part 193.2149). In the preamble to the final rule, the DOT determined that the most likely sources of leaks within LNG plants are LNG storage tanks, cargo transfer areas, and vaporizers and process equipment, which are all addressed in NFPA 59A section 2.2.1.2. The result is that while Part 193 retains exclusion zones for LNG transfer systems, neither Part 193 nor NFPA 59A requires the impoundment from which to base the calculations. We do not believe that this was the intent, nor do we believe that omitting containment for transfer piping is a sound engineering practice. FERC staff will continue to require containment for all LNG transfer piping within a plant site.

The incorporation of NFPA 59A also changed the way in which design spills and impoundment capacities may be determined. Under section 2.2.2.2, the capacity of impounding areas for vaporization, process, or LNG transfer areas must equal the greatest volume during a 10-minute period from any single accidental leakage source or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to the authority having jurisdiction. Similar criteria appear in section 2.2.3.5 for determining the design spill used in thermal and flammable vapor exclusion zone calculations. Prior to the incorporation of NFPA 59A, the design spill in Part 193 assumed the rupture of a single transfer pipe with the greatest overall flow capacity, for not less than 10 minutes (old Part 193.2059(d)). As a result, the spill rate for vaporization, process, or LNG transfer areas may be assumed to be a single accidental "leakage source" rather than a full pipe rupture; however, the spill duration must be 10 minutes unless the authority having jurisdiction (i.e., DOT's OPS) determines that a shorter time is acceptable. Again, given the confusion in applying the two requirements, FERC staff will continue to utilize the 10-minute spill criteria at the maximum flow possible for containment sizing. This will ensure that impoundments are sized for a catastrophic failure, while recognizing that less conservative spill scenarios may be appropriate to calculate flammable vapor exclusion zones. In giving recognition to the integrity of all-welded transfer piping, the determination of the single accidental leakage source should be based on an evaluation of all small diameter attachments to the transfer piping for instrumentation, pressure relief, recirculation, etc, and any flanges that may be used at valves or other equipment, in order to determine the largest spill rate. This approach is the result of discussions with DOT OPS concerning the basis for design spills and application to exclusion zone determinations for proposals before the Commission.

Impoundment Systems and Sizing Spills

The existing LNG storage tank impoundment system consists of an earthen dike and includes a storage tank design spill sub-impoundment. Previously, low spots were found along the top of the earthen dike wall during a survey. Remediation work has restored the capacity of the earthen dike to 102.3 percent of the LNG storage tank contents. The existing LNG storage tank sub-impoundment, with a capacity of approximately 97,500 ft^3 (729,350 gallons) would accommodate potential spills associated with the proposed facilities, including spills from the transfer piping (marine transfer pipe and LNG tank withdrawal header), the process/vaporization area leakage source, and the marine transfer area leakage source. KeySpan LNG is proposing to install a "leakage source" sump within the LNG storage tank sub-impoundment to accommodate smaller spills from these areas. This sump is designed to hold 29,600 gallons, as indicated in the revised sump design recently filed by KeySpan LNG.

In the case of the proposed KeySpan LNG facility upgrades, the maximum spill rate would occur from a full rupture of the 24-inch-diameter ship unloading line. The resulting volume for the 10-minute spill would be 51,650 ft^3 (386,370 gallons) including the volume of the spill plus the volume of the 24-inch-diameter line. The existing LNG tank sub-impoundment would accommodate this scenario.

Curbed concrete pads would be installed beneath the high-pressure sendout pumps, vaporizers, BOG condenser, and all LNG-containing piping. A sloped concrete trench would be used to drain spills into the "leakage source" sump, which then would overflow into the tank sub-impoundment.

Within the marine transfer area, curbed concrete decking would be installed beneath the LNG unloading arms and associated piping, and a sloped concrete trench would be used on the jetty to drain spills into the sub-impoundment. Table 4.12.4-1 presents the impounding area and spill size volume for each of the 10-minute full-flow spills.

TABLE 4.12.4-1

Impoundment Areas

Source	Spill Size (gallons)	Impoundment System	Impoundment Size (gallons)
Sendout pumps and vaporizers	28,900	Sub-Impoundment Sump	29,600
Ship Unloading Line	386,400	Sub-Impoundment	730,000

Thermal Exclusion Zones for Sendout Pumps, Vaporizers, and Ship Unloading Line

If a large quantity of LNG is spilled in the presence of an ignition source, the resulting LNG pool fire could cause high levels of thermal radiation. Exclusion distances for various flux levels were calculated according to 49 CFR 193.2057 and section 2.2.3.2 of NFPA 59A, using the "LNGFIRE III" computer program model developed by the Gas Research Institute. NFPA 59A establishes certain atmospheric conditions (0 mph windspeed, 70 °F, and 50 percent relative humidity) which are to be used in calculating the distances. However, Part 193.2057 supersedes these requirements and stipulates that wind speed, ambient temperature, and relative humidity which produce the maximum exclusion distances must be used, except for conditions that occur less than 5 percent of the time based on recorded data for the area. For its analysis, KeySpan LNG selected the following ambient conditions to produce the maximum distances: windspeeds of 20 mph; ambient temperature of 20 °F; and 50 percent relative humidity. These conditions yield longer distances than the 0 mph wind speed, 70 °F ambient temperature, and 50 percent relative humidity specified in NFPA 59A. KeySpan LNG's selection of atmospheric conditions is appropriate.

The application for the proposed LNG terminal contained a thermal radiation analysis for a 10-minute design spill into the "leakage source" sump within the sub-impoundment. KeySpan LNG selected design spills based on an accidental release from a broken 1-inch-diameter instrument connection for both the discharge header of the high-pressure sendout pumps and the discharge header of the unloading arms. The design spill sizes, flowing at full capacity for 10 minutes, for these accidental releases are 17,700 gallons and 3,500 gallons, respectively.

KeySpan LNG calculated the maximum distance for an incident flux level of 1,600 Btu/ft^2-hr from the originally-sized "leakage source" sump as 112 feet. The 1,600 Btu/ft^2-hr flux level is associated with an exposed person experiencing burns within about 30 seconds. This modeled exclusion zone would remain entirely within the existing main dike.

However, staff performed a preliminary evaluation of any small diameter attachments to the transfer piping for instrumentation, pressure relief, recirculation, etc., and any flanges that may be used at valves or other equipment, and determined that a design spill from the 3-inch-diameter recirculation line on the ship unloading line would be more appropriate as the single accidental leakage source. This design spill size for this accidental release would be 28,900 gallons and would have overflowed the original "leakage source" sump into to the existing sub-impoundment. This design spill would represent the worst case scenario in determining the exclusion zone.

Staff calculated the maximum distance for an incident flux level of 1,600 Btu/ft^2-hr from a fire in the sub-impoundment to be 445 feet for the same weather conditions used by KeySpan LNG. However, this calculation did not take into account the presence of the earthen dike wall, which would reduce the radiant heat from a fire in the sub-impoundment. Nevertheless, it appeared that this exclusion zone might extend beyond the southern edge of the plant boundary. Therefore, we recommended in the draft EIS that KeySpan LNG re-evaluate the design of the "leakage source" sump and provide revised thermal radiation calculations to verify that the exclusion zone does not extend beyond the property line.

In response, KeySpan LNG increased the capacity of the "leakage source" sump design to 29,600 gallons. This sump would contain the entire design spill from the 3-inch diameter recirculation line without any overflow into the sub-impoundment. The maximum distance to an incident flux level of 1,600 Btu/ft^2-hr for a fire in this sump would be 145 feet, which would remain within the plant boundaries.

Vapor Dispersion Zones for Sendout Pumps, Vaporizers, and Ship Unloading Line

A large quantity of LNG spilled without ignition would form a flammable vapor cloud that would travel with the prevailing wind until it either dispersed below the flammable limits or encountered an ignition source. Sections 2.2.3.3 and 2.2.3.4 of NFPA 59A and Part 193.2059 require that provisions be made to minimize the possibility of flammable vapors from reaching a property line that can be built upon and that would result in a distinct hazard. Part 193.2059 requires that dispersion distances be calculated for a 2.5 percent average gas concentration (one half the lower flammability limit of LNG vapor) under meteorological conditions which result in the longest downwind distances at least 90 percent of the time. Alternatively, maximum downwind distances may be estimated for stability Class F, a wind speed of 4.5 mph, 50 percent relative humidity, and the average regional temperature. The section allows the use of the DEGADIS Dense Gas Dispersion Model, or the FEM3A model, to compute dispersion distances. Design spills into impounding areas serving LNG containers, transfer systems and piping are to be determined in accordance with section 2.2.3.5 of NFPA 59A.

The application for the proposed LNG terminal contained a vapor dispersion analysis for a 10-minute spill into the sub-impoundment sump. As previously discussed, KeySpan LNG selected design spills of an accidental release from a broken 1-inch-diameter instrument connection for both the discharge header of the high-pressure sendout pumps and the discharge header of the unloading arms. The 10-minute design spill size for these accidental releases is 17,700 gallons and 3,500 gallons, respectively. However, our evaluation of all small diameter attachments to the transfer piping for instrumentation, pressure relief, recirculation, etc, and any flanges that may be used at valves or other equipment determined that a design spill from the 3-inch-diameter recirculation line on the ship unloading line would be more appropriate as the single accidental leakage source. This design spill size for this accidental release would be 28,900 gallons. Since all of these spills would be directed to the sub-impoundment sump, the largest spill would represent the worst case scenario in determining the exclusion zone.

Using the same cold vapor to liquid volumetric ratio of 1:235 as did KeySpan LNG, staff calculated that 907,568 ft^3 of cold vapor would result from the vaporization of a spill through the 3-inch-

diameter recirculation line. Based on the same assumptions made by KeySpan LNG, the entire volume of cold vapor would be contained within the main LNG storage tank impoundment, occupying about 30 percent of its 2,899,345 ft^3 capacity, and the vapor exclusion zone would not extend beyond the LNG terminal site.

In the previously referenced Two-Part Report prepared for the Rhode Island Attorney General and filed as comments on the DEIS, Dr. Jerry Havens disputed the assertion that the entire volume of cold vapor would be contained within the main dike impoundment because it would be physically impossible for the vapor from the spill to fill the impoundment without warming and mixing with air while being evolved. As a result he states that the flammable vapor exclusion zone for this design spill should be recalculated using the FEM3A model as authorized by Part 193.

The effects of provisions for containing vapors as a means of mitigating flammable vapor hazards are permitted to be considered in the calculations by NFPA 59A section 2.2.3.3. Increasing the vapor detention capacity can reduce the vapor source strength and correspondingly reduce the downwind distance to the ½ LFL. It is acknowledged that the calculations of vapor overflow rates do not account for the mixing of evolved vapor that is likely to occur over extended periods of time. This can be especially problematic for certain sump/impoundment configurations which allow for longer term vapor retention.

To account for this phenomenon, FEM3A has been recommended as the proper methodology for calculating exclusion zones. However, the actual ability to apply the model at this time is the subject of an ongoing technical dispute in another Commission proceeding.[5] Issues have been raised concerning the availability of the model in the public domain; validation of the model for the low wind speed and stable atmospheric conditions specified in Part 193; and its performance as a unique terrain model that is significantly different than DEGADIS. Regardless of the debate in that proceeding, it must also be noted that the model has not been used in any of the myriad proposals before the Commission. While the issues concerning the model may ultimately be resolved in the proper forum of the technical standards committee or the DOT regulatory process, the model should be viewed as a potential long term solution, rather than in the timeframe of this project.

On April 25, 2005, David Costa, Chief of the Providence Fire Department supplemented his comments on the DEIS in response to KeySpan LNG's supplemental comments filed on March 24, 2005. The filing included an appendix prepared by Jerry Havens and Tom Spicer, to address the issue of vapor holdup and mixing with air. The appendix cites the 1987 "Falcon" field tests sponsored by DOT and GRI at the DOE Nevada Test Facility to determine the effectiveness of vapor fences to decrease downwind flammable vapor cloud travel distances. "Moderate-scale spills," ranging in size from about 5,500 to 17,500 gallons, were released into a 10-meter-high (32.8 feet) vapor containment fence with a containment volume of 38,720 m^3. The cold vapor volumes resulting from the spills ranged from 14 to 46 percent of the containment capacity; however, vapors overflowed the fence rather than being entirely contained and resulted in ½ LFL concentrations at downwind distances up to 790 feet. While the "Falcon" field tests cannot be directly compared with the impoundment configuration of the proposal, the results would appear to refute the previous assumption that the 20-foot-high KeySpan LNG storage tank berm would completely contain the cold vapor from the design spill.

This issue is particularly troublesome for the existing KeySpan LNG site in that the property line is adjacent to the base of the LNG storage tank impoundment on the north and south sides and less 50 feet from the top of the berm. The property line on the east side is only marginally farther at less than 75 feet

[5] Similar comments have been filed by Dr. Jerry Havens in the Weaver's Cove LNG Project (CP04-36-000) and responses filed on those comments.

from the base of the impoundment resulting in only a short buffer area with adjacent properties. As a result, if the LNG vapors are not fully contained within the 20-foot-high storage tank impoundment as has been assumed, but rather mix with air and overflow the berm as the "Falcon" field tests would suggest, then the flammable vapor exclusion zone would extend off site and not meet the requirements of Part 193.2059. Therefore **we recommend that**

- **KeySpan LNG provide a revised flammable vapor exclusion analysis for design spills that considers the effects of mixing with air on LNG vapors evolving from a spill within the impoundment in order to verify compliance with 49 CFR Part 193.2059. KeySpan LNG should file the revised analysis with the Secretary <u>at least 30 days prior to initial site preparation</u> for review and approval by the Director of OEP.**

A secondary issue that needs to be addressed is distance from potential spill locations at the ship unloading area to the earthen dike. While it is an appropriate design philosophy to direct potential spills away from equipment to remote impoundments, it is also relevant to consider the control of vapors produced in the channels or trenches leading to these impoundments. Long trenches increase the surface area available for heat transfer and, correspondingly, increase vapor generation. A number of vapor control options are available including: vapor fences, fixed high expansion foam generators, reduced trench lengths and/or surface area, and additional sumps at intermediate locations along transfer piping. As a result, **we recommend that:**

- **KeySpan LNG examine provisions to retain any vapor produced along the transfer line trenches and other areas serving to direct LNG spills to associated impoundments. Measures to be considered may include, but are not limited to: vapor fencing, intermediate sump locations, or trench surface area reduction. KeySpan LNG should file final drawings and specifications for these measures with the Secretary <u>at least 30 days prior to initial site preparation</u> for review and approval by the Director of OEP.**

4.12.5 Marine Safety[6]

The February 2004 Interagency Agreement provides the framework for the participating agencies to work in a coordinated manner to address the full range of issues regarding safety and security at LNG import terminals. The FERC closely coordinates its pre-certificate review of the proposal with the Coast Guard which has authority over the safety of LNG vessels and the marine transfer area, as well as the security of the LNG vessels and the entire LNG facility.

The hazards associated with the marine transportation of LNG differ from land-based hazards. Whereas the land-based facilities have features to both limit the duration of LNG spills and contain credible spill volumes, an LNG spill on water may be unconfined and may vaporize rapidly due to heat input from the water.

The history of LNG shipping has been free of major incidents, and no incidents have resulted in significant quantities of cargo being released (see section 4.12.5.3). No incidents have occurred at existing LNG terminals during the 50 years of operation that resulted in any significant quantities of cargos being released. However, the possibility of an LNG spill from a ship over the duration of the

[6] This section was written with the cooperation and assistance of the U.S. Coast Guard, Marine Safety Office Providence.

proposed project must be considered. Historically, the events most likely to cause a significant release of LNG were a ship casualty such as:

- a vessel colliding with an LNG ship in transit;
- an LNG ship alliding[7] with the terminal or a structure in Narragansett Bay or Providence Harbor;
- a vessel alliding with an LNG ship while moored at the terminal; or
- a grounding sufficiently severe to puncture an LNG cargo tank.

However, the attacks on September 11, 2001, have made the public keenly aware of additional risks that must be considered in the evaluation of marine safety and security:

- a deliberate attack on an LNG ship by a terrorist group.

Any of the above events would have to occur with sufficient impact to breach the LNG ship's double hull and cargo tanks. Previous incidents with LNG ships have primarily involved grounding, and none of these have resulted in the breach of the double hull and subsequent release of LNG cargo.

The following discussion provides a chronology of the LNG ship voyage from the liquefaction facility to the import terminal, disclosing the risks at each step and how they are managed. Details and analysis are provided in subsequent sections.

LNG Vessels and Ocean Voyage

Imported LNG could be obtained from exporting terminals throughout the world and delivered by LNG ships to the proposed terminal. In 2003, LNG imports to the United States included: 72 percent from Trinidad, 12 percent from Nigeria, 10 percent from Algeria, 3 percent from Qatar, 2 percent from Oman, and 1 percent from Malaysia. KeySpan LNG anticipates that the proposed marine terminal would receive LNG from Trinidad, Equatorial Guinea, Nigeria, and Egypt.

The LNG ships used to import LNG to the United States would be constructed and operated in accordance with the IMO Code for the Construction and Equipments of Ships Carrying Liquefied Gases in Bulk, the International Convention for the Safety of Life at Sea (SOLAS), and 46 CFR 154, which contain the U.S. safety standards for vessels carrying bulk liquefied natural gas. Foreign flag LNG ships are required to possess a valid IMO Certificate of Fitness and a Coast Guard Certificate of Compliance.

In 1993, amendments to the IMO's Code for the Construction and Equipments of Ships Carrying Dangerous Chemicals in Bulk require all tankers to have monitoring equipment with an alarm facility which is activated by detection of over-pressure or under-pressure conditions within a cargo tank. In addition, the cargo tanks are heavily instrumented, with gas detection equipment in the hold and inter-barrier spaces, temperature sensors, and pressure gauges. Fire protection must include the following systems:

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[7] "Allision" is the action of dashing against or striking upon a stationary object (e.g., the running of one ship upon another ship that is docked) – distinguished from "collision," which is used to refer to two moving ships striking one another.

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

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

- a dry chemical fire extinguishing system for hydrocarbon fires; and

- a carbon dioxide system for protecting machinery including the ballast pump room, emergency generators and compressors.

As a result of September 11, 2001, the IMO agreed to new amendments to the 1974 SOLAS addressing port facility and ship security. The International Ship and Port Facility Security Code was adopted in 2003 by the IMO. This code requires both ships and ports to conduct vulnerability assessments and to develop security plans. The purpose of the code is to prevent and suppress terrorism against ships, improve security aboard ships and ashore, and reduce the risk to passengers, crew, and port personnel on board ships and in port areas, for vessels and cargos. All LNG vessels as well as other cargo vessels 300 gross tons and larger and ports servicing those regulated vessels must adhere to these IMO and SOLAS standards. Some of the IMO requirements are as follows:

Ships:

- Ships must develop security plans and have a Ship Security Officer.

- Ships must be provided with a ship security alert system. These alarms transmit ship-to-shore security alerts to a competent authority designated by the Administration, which may include the company that identifies the ship, its location, and an indication that the security of the ship is under threat or it has been compromised.

- Ships must have a comprehensive security plan for international port facilities, focusing on areas having direct contact with ships.

- Ships may have certain equipment onboard to help maintain or enhance the physical security of the ship.

Port facilities:

- The port facility must have a security plan and a Facility Security Officer (FSO); and

- Certain security equipment may be required to maintain or enhance the physical security of the facility.

Both ships and ports must:

- Monitor and control access;
- Monitor the activities of people and cargo;
- Ensure security of communications and that they are readily available; and
- Complete a Declaration of Security.

LNG Vessel Transit in Narragansett Bay

An internationally recognized Traffic Separation Scheme established by the IMO serves vessel traffic in the approach to Narragansett Bay through Rhode Island Sound. This provides inbound and outbound routes which are separated by a central buffer zone. All foreign-registered and many U.S. flagged large ships entering Narragansett Bay are boarded by a pilot from the Northeast Marine Pilots who directs the entire transit to one of the destination docks at Davisville/Quonset, Newport, Providence, Somerset, and Fall River.

LNG ships would access the LNG terminal site via the East Passage of Narragansett Bay and the Providence River federal navigation channel. One pilot would direct the LNG ship throughout the entire transit of Narragansett Bay. The LNG ships would travel the Providence River in a northwest course towards the main harbor of the Port of Providence (see figure 4.12.5-1). During these maneuvers, the pilot would be on board and would oversee the navigation and berthing of the ship. The vessel master would be on the bridge monitoring the pilot's commands and would retain overall responsibility for the safe navigation of the LNG ship. The Coast Guard would have a security boarding team onboard during the transit if required by the Vessel Transit Security Plan. Other security measures during the transit would be carried out in accordance with the Vessel Transit Security Plan (see section 4.12.5.2).

KeySpan LNG proposes to schedule LNG ship transits in the early morning or at night to avoid the normal peak periods of waterway usage by recreational boaters. The Coast Guard and the Northeast Marine Pilots would determine the best time to bring the LNG ship to port based on security concerns, impacts on other boaters, and other factors. Docking, LNG cargo unloading, and undocking would take less than 24 hours in most cases, weather permitting. In addition to the Northeast Marine Pilots, the Coast Guard would control the transit of the LNG vessel through the harbor and while unloading cargo. Typical Coast Guard requirements for other LNG import terminals include 96- and 24-hour advance notification of the vessel arrival at which time Coast Guard personnel would board the LNG vessel off the Rhode Island sea coast to conduct an inspection of the ship's safety systems and perform a security sweep. Other requirements would include a Coast Guard escort through Narragansett Bay to the dock, establishment of a moving safety and security zone around the vessel while en route and during unloading operations, an inspection of the dock safety systems prior to commencing cargo transfer, and monitoring all operations until the vessel departs. Maintaining security of the dock and vessel would be the responsibility of the facility in cooperation with other federal, state, and local partners as described in the Facility Security Plans (see section 4.12.7).

LNG Vessel Casualties

The operational controls by the Coast Guard and the Northeast Marine Pilots, as well as the characteristics of Narragansett Bay, minimize the possibility of an LNG cargo spill from groundings, collisions, and allisions. The Coast Guard would enforce a moving safety and/or security zone around the LNG vessel that would clear the channel of all vessels in the vicinity of the LNG vessel to reduce the likelihood of any collisions, including those of the tonnage and speed required to cause an LNG spill (see section 4.12.5.3). The segment of the transit from the mouth of Narragansett Bay through the East Passage to Sandy Point is relatively wide and deep. From Sandy Point up the Providence River to the LNG terminal site, the federal navigation channel has an authorized depth of 40 feet and a minimum width of 600 feet. The generally even and soft bottom makes an LNG spill from cargo tanks highly unlikely in a grounding incident. Shoal areas adjacent to the navigation channel are well marked. To minimize the potential of an inbound LNG vessel alliding with the bridges or other fixed structures, BG LNG is conducting a navigation simulation study at the Marine Safety International (MSI) vessel simulator facility in Newport (see *Navigation Simulation Studies* in section 4.12.5.1).

Figure 4.12.5-1

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Deliberate Attack on an LNG Vessel

In addition to addressing the potential hazards from LNG vessel casualties, the possibility of a deliberate attack on an LNG ship by a terrorist group was a concern of several commentors and must also be considered. Security of the LNG vessel is the responsibility of the owner/operator and the master of the vessel. Security of the facility is the responsibility of the owner/operator of the facility. Protection of the LNG vessel and the import terminal would involve personnel from the Coast Guard, KeySpan LNG security staff, and state and local law enforcement. The Coast Guard would establish a safety and security zone around the LNG vessels in transit and while docked. Only personnel or vessels authorized by the Captain of the Port would be permitted in the safety and security zone.

KeySpan LNG would provide security for the marine terminal according to a Facility Security Plan prepared under 33 CFR 105 and approved by the Coast Guard Captain of the Port (see section 4.12.7). Some of the requirements include:

- a Facility Security Assessment to identify site vulnerabilities, possible security threats, consequences of an attack, and facility protective measures;
- a Facility Security Plan with procedures for responding to security incidents;
- a designated Facility Security Officer responsible for implementing and periodically updating the Facility Security Plan and Assessment;
- scalable security measures to provide increasing levels of security at increasing Maritime Security (MARSEC) levels;
- security exercises at least once each calendar year and drills at least every 3 months; and
- mandatory reporting of all breaches of security and security incidents.

Security at the facility would be provided by both active and passive systems. The entire site is surrounded by a protective enclosure (i.e., a fence) that is illuminated with not less than 2.2 lux between sunset and sunrise. Intrusion detection systems and day/night camera coverage identify unauthorized access. KeySpan LNG would be required to submit their Facility Security Plan to the Captain of the Port at least 60 days prior to commencement of operations. KeySpan LNG has not indicated that it would hire a separate security staff to conduct periodic patrols of the plant, screen visitors and contractors, and assist in maintaining security of the marine terminal during cargo unloading. We believe that the responsibilities of this security staff should be expanded to enhance overall security. Therefore, **we recommend that:**

- **KeySpan LNG provide a separate security staff and coordinate with the Coast Guard to define the responsibilities of KeySpan LNG security staff in supplementing other security personnel and in protecting the LNG ships and terminal.**

A Threat Analysis was prepared by Project Technical Liaison Associates, Inc. for the Project. In addition, a detailed vulnerability assessment was prepared by Lloyd's Register North America for the proposed Weaver's Cove Project in Fall River, Massachusetts (see section 4.12.5.3). These analyses provide a basis for estimating the potential magnitude of a hazard from a successful terrorist attack and for developing LNG vessel and waterfront security plans. In addition, the DOE released a study by Sandia National Laboratories, *Guidance on Risk Analysis and Safety Implications of a Large Liquefied*

Natural Gas (LNG) Spill Over Water (Sandia Report) in December 2004. The report included an LNG cargo tank breach analysis using modern finite element modeling and explosive shock physics modeling to estimate a range of breach sizes for credible accidental and intentional LNG spill events. The analysis of accidental events found that groundings and low speed collisions could result in minor ship damage but not a cargo spill; while high speed collisions could cause a 0.5 to 1.5 m^2 cargo tank breach area. For intentional scenarios, the size of the cargo tank hole depends on the location of the ship and source of threat. Intentional breach areas were estimated to range from 2 to 12 m^2. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 m^2, which is a more appropriate range to use in calculating potential hazards from spills. These hole sizes are equivalent to circular hole diameters of 2.5 and 3 meters.

The methodology described in the ABSG Consulting Inc. (ABSG) study, *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers,* and revised in staff's responses to comments on the report (issued June 18, 2004), was used to calculate the thermal radiation distances for several holes ranging in diameter from 1 meter to 3.9 meters. Using the methodology, we have estimated distances for nominal 2.5-meter and 3-meter diameter holes to range from 4,340 to 4,810 feet for a thermal radiation of 1,600 Btu/ft^2-hr, the level which is hazardous for persons located outdoors and unprotected; from 3,330 to 3,701 feet for 3,000 Btu/ft^2-hr, an acceptable level for wooden structures; and from 1,970 to 2,174 feet for 10,000 Btu/ft^2-hr, a level sufficient to damage process equipment for these size holes, respectively.

These intentional breach scenarios provide guidance in developing the operating restrictions for LNG vessel movements through the East Passage of Narragansett Bay and the federal navigation channel in the Providence River, as well as in establishing potential impact areas for emergency response and evacuation planning. The inbound transit through the East Passage of Narragansett Bay would pass through the Pell Bridge by Newport and Middletown on the east side, and Jamestown to the west. After turning at Sandy Point, the LNG vessels would enter the Providence River federal navigation channel and travel along the Providence River in a northwest course towards the main harbor of the Port of Providence. Some areas of development along the shoreline in these communities would be within a potential transient hazard area during the LNG vessel transit, while parts of Providence would be exposed to a potential hazard while the LNG vessel is at the dock and unloading cargo (see *Hazards* in section 4.12.5.3). Assuming an LNG vessel would transit the Providence River at 10 knots, the adjacent communities would be exposed to a potential transient hazard for an estimated 8 minutes. In addition, a temporary hazard would exist around the slip during part of the 15-hour period while the LNG vessel is at the dock and unloading cargo. The operational restrictions to be imposed by the Northeast Marine Pilots on LNG vessel movements through this area, as well as the requirements that the Coast Guard would impose in its operating plan would minimize the possibility of a hazardous event occurring along the vessel transit.

Emergency Response and Evacuation Planning

Prior to commencing service, KeySpan LNG would prepare emergency procedures manuals, as required by 49 CFR 193.2509, that provide for: (a) responding to controllable emergencies and recognizing an uncontrollable emergency; (b) taking action to minimize harm to the public including the possible need to evacuate the public; and (c) coordination and cooperation with appropriate local officials. Specifically, section 193.2509(b)(3) requires "Coordinating with appropriate local officials in preparation of an emergency evacuation plan…" Typically, the manuals are prepared at the later stages of the construction process and submitted to FERC as a requirement <u>prior</u> to placing the facility in service.

While the worst-case scenarios evaluated for the onshore facility in section 4.12.3 and for marine spills in 4.12.5 provide guidance on the maximum extent of potential hazards, they should not be assumed

to represent the evacuation zone for *every* potential incident. As with any other fuel or hazardous material, the actual severity of the incident would determine what area needs to be evacuated, if any, rather than a worst-case maximum zone. It is anticipated that the emergency evacuation plans would identify evacuation distances based upon increasing severity of events.

A number of organizations and individuals commented on the need to consider emergency response procedures. In addition, the mayor of Providence has expressed his view that KeySpan LNG must bear the costs incurred by the city for the resources needed to participate in developing an Emergency Response Plan for this project. It is the responsibility of the facility operator, as required by 49 CFR 193.2509, to cooperate and coordinate with local officials to develop an Emergency Response Plan specific to the operation of the facility. Although the FERC does not establish funding mechanisms for this activity, the process may involve discussions between the operator and the affected local agencies to determine where funding would be appropriate. KeySpan LNG and BG LNG are providing direct financial assistance to both the State of Rhode Island and the City of Providence to assist each entity in its evaluation of the project, as well as to assist in the preparation of emergency response plans. Both the state and the city have retained experts to assist them in this process and the project sponsors are directly supporting these efforts.

While recognizing that preparing emergency procedures typically occurs at the end of the construction phase rather than at the draft EIS stage, there remain a number of issues concerning the viability of emergency evacuation that have not been satisfactorily resolved. Therefore **we recommend that:**

- **KeySpan LNG develop emergency evacuation routes for the areas along the route of the LNG vessel transit in conjunction with the local emergency and town officials and file the routes with the Commission for review and approval by the Director of OEP prior to initial site preparation.**

In addition, **we recommend that:**

- **KeySpan LNG develop an Emergency Response Plan (including evacuation) and coordinate procedures with local emergency planning groups, fire departments, state and local law enforcement, and appropriate federal agencies. This plan should include at a minimum:**

  a. designated contacts with state and local emergency response agencies;

  b. scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;

  c. procedures for notifying residents and recreational users within areas of potential hazard;

  d. evacuation routes for residents along the route of the LNG vessel transit;

  e. locations of permanent sirens and other warning devices; and

  f. an "emergency coordinator" on each LNG vessel to activate sirens and other warning devices.

The Emergency Response Plan should be filed with the Commission for review and approval by the Director of OEP <u>prior to commencement of service</u>. KeySpan LNG should notify FERC staff of all meetings in advance and should report progress on its Emergency Response Plan at 6-month intervals starting at the commencement of construction.

4.12.5.1 Narragansett Bay and the Port of Providence

The East and West Passages of Narragansett Bay and Providence Harbor combine to form a sizable body of navigable water open to the sea and accessible to large oceangoing vessels of varying types and sizes up to 100,000 tons.

An internationally recognized Traffic Separation Scheme established by the IMO serves vessel traffic in the approach to Narragansett Bay through Rhode Island Sound. This provides inbound and outbound routes which are separated by a central buffer zone. All foreign-registered and many U.S. flagged large ships entering Narragansett Bay are boarded by a pilot from the Northeast Marine Pilots, who directs the entire transit to one of the destination docks at Davisville/Quonset, Newport, Providence, Somerset, and Fall River.

Commercial marine traffic generally enters Narragansett Bay via the inbound separation lane from Rhode Island Sound that leads to the East Passage, past the City of Newport. A number of vessels, mainly car carriers, proceed to Davisville/Quonset; naval vessels proceed to their base at Newport; and in the summer season, cruise ships proceed to an anchorage off Newport. Ships in transit through Narragansett Bay are destined to one of three principal public ports: Port of Providence, Port of Fall River, and the Port of Quonset/Davisville. Several smaller, privately operated facilities also exist in the harbors of the region, mainly for the receipt of refined petroleum products. There are two federal navigation channels in Narragansett Bay. One is the Providence River navigation channel, which goes to the Port of Providence, and the second is the Mt. Hope-Fall River Harbor Channel. Another main shipping channel, but not a federal navigation channel, leads to the port facility at Quonset/Davisville. Most commercial traffic proceeds into Upper Narragansett Bay to the Port of Providence.

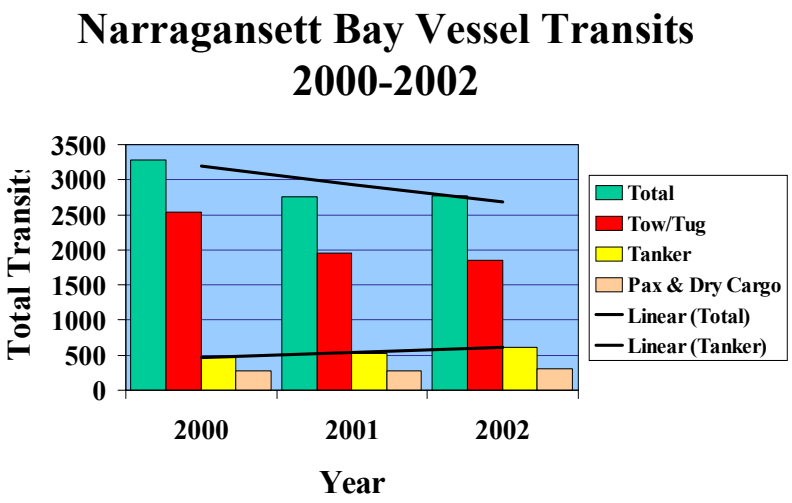
LNG ships in transit to the LNG facility would approach from Rhode Island Sound and begin the transit to Providence Harbor in Narragansett Bay. The ships would travel about 11 nautical miles through the relatively deep waters of the East Passage of Narragansett Bay to the entrance of the Providence River. The Providence River is a COE federal navigation project extending 14.2 nautical miles from its entrance just southeast of Sandy Point on Prudence Island to the northern end of Fox Point Reach. KeySpan LNG anticipates that it would take the LNG ships less than 3 hours to reach the LNG facility from the channel entrance. Providence Harbor, which is adjacent to the LNG facility, is near the head of the navigation channel. The Providence River Channel consists of the entrance channel and six reaches: the Rumstick Neck, Conimicut Point, Bullock Point, Sabin Point, Fuller Rock, and Fox Point Reaches (the location of the KeySpan LNG facility). The width of the channel ranges from 600 to 1,700 feet in the entrance channel, 600 feet in the Rumstick Neck, Conimicut Point, Bullock Point, and Sabin Point Reaches, from 600 to 1,000 feet wide in the Fuller Rock Reach, and from 600 to 1,700 feet wide in the Fox Point Reach. The channel design depth is 40 feet, but surveys conducted from May through August 1999 found that depths of the channel at Mean Lower Low Water (MLLW) ranged from 33 to 40 feet. The COE is currently dredging the channel to a depth of 40 feet at MLLW with 2 feet of overcut. This dredging project is expected to be complete by the summer of 2005.

En route to the LNG terminal, LNG ships would pass under the Pell Bridge. The horizontal clearance is 1,500 feet and the vertical clearance of the center span of the bridge is 194 feet.

Currently, there is only one tug available in the Providence Harbor with sufficient power to effectively and safely assist with the turning and maneuvering of the LNG ships. BG LNG plans to contract for the use of two additional new tractor tugs of sufficient bollard pull rating and horsepower to assist with the turning and berthing of the LNG ships. While under charter, BG LNG would have first right to these tugs. However, when not engaged in assisting the berthing and unberthing of LNG ships, these tractor tugs would be available to other port users to provide a higher level of ship maneuvering assistance capability than currently available in the Port of Providence.

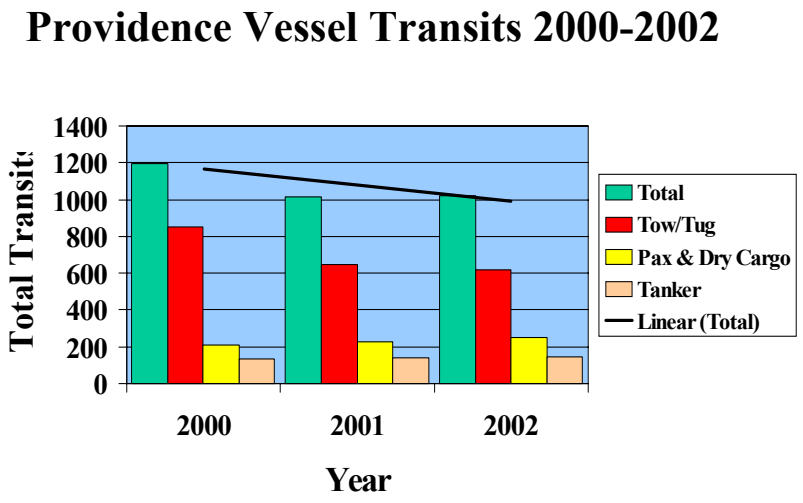
Current Traffic

Data regarding shipping activity in Narragansett Bay are available from multiple sources. The Northeast Marine Pilots, Coast Guard, COE, and Massachusetts Highway District 5 each record various ship movements within the bay. Generally accepted statistics are those provided through the COE's Navigation Data Center annual data for Waterborne Commerce. These statistics were used by the Coast Guard and a cross-section of waterways users during a formal Ports and Waterways Safety Assessment of Narragansett Bay conducted in September of 2004. The statistics below account for both inbound and outbound transits of the federal navigation channels in Narragansett Bay.



PAWSA Narragansett Bay, September 2004

The majority of Narragansett Bay traffic is destined for Providence, as captured in the COE's Waterborne Commerce statistics below:



PAWSA Narragansett Bay, September 2004

Note that the COE Navigation Data Center for Waterborne Commerce statistics only records trips in waterways and channels maintained by the COE; therefore, the data do not capture Narragansett Bay traffic proceeding to Newport or Davisville/Quonset because this traffic does not pass any channels that are maintained by the COE. Currently, vessel traffic destined for Davisville/Quonset is limited primarily to car carriers delivering automobiles; these vessels transit Narragansett Bay approximately 60 times per year (accounting for both inbound and outbound transits).

Vessels proceeding to Providence enter a separate navigation channel north of Sandy Point. In 2001, the COE reported a total of 930 inbound vessels proceeding to Providence. This total comprised 64 dry cargo and passenger vessels, 105 tankers, 324 tugs, and 437 non-self propelled barges. The vast majority of the vessels were non-self propelled barges, either towed by tugs or integrated tug-barge units carrying petroleum and petroleum products in domestic trade.

There are several passenger ferry, cruise ship, and water taxi services operating within Narragansett Bay. These vary from year to year depending upon demand and economic conditions. There are no specific data available on the density of recreational traffic in the Narragansett Bay area but the bay is a yachting center and contains many marinas, including three marinas upriver of the LNG terminal site and five marinas/yacht clubs located within 3.5 miles and downriver of the project site along the Fuller Rock Reach of the Providence River.

In conclusion, the shipping data collected from a number of sources produced considerable variation. However, the data do indicate that commercial traffic entering Narragansett Bay averages roughly two to three commercial vessels per day. Traffic in the Providence River also averages two to three vessels per day. In addition, the following details and trends were identified and were supported by information on transit schedules provided by Northeast Marine Pilots:

- *Tankers* - Most vessels entering Narragansett Bay are typically 40,000-ton domestic tankers, self and non-self propelled, carrying petroleum products to Providence and East

Providence. The trade is evenly spread throughout the year, vessels transit by day and night, and only a few deeper draft vessels require tidal lift.

- *LPG Ships* - An average of 10 to 12 ships per year typically unloaded 20,000 to 30,000 metric tons of LPG per visit at Providence, with most visits occurring from fall to late winter. All transits entering from Narragansett Bay are subject to special safety and security measures imposed by the Coast Guard.

- *Car Carriers* - Car carriers transit lower Narragansett Bay and then turn west to offload at Davisville; therefore, they do not proceed towards either Providence or Mount Hope Bay. In 2002, a total of 55 car carriers offloaded at Davisville. These carriers typically berthed after 6:00 a.m. and departed in the afternoon of the same day.

- *Passenger/Cruise Ships* - A total of 34 cruise ships anchored off Newport between the months of May and October. These ships typically entered Narragansett Bay in the morning and sailed again in late afternoon the same day.

- *General cargo* - In 2002, general cargo and dry bulk vessels visited Providence throughout the year at an average of five per month. The largest cargos were about 40,000 tons, which consisted of scrap iron loaded in Providence.

- *Tugs* - The large number of tugs indicated in the COE data is most likely the result of tugs assisting each of the ships transiting the federal navigation channels, and the large numbers of tankbarge traffic. The Northeast Marine Pilots also confirmed that the integrated tug-barge units also employed additional tugs to assist with berthing. Currently available local tugs are all of the conventional (i.e., non-tractor) type. These tugs were not included in the Coast Guard data because they were based locally and were not classified as ships entering the Coast Guard zone.

- *Tankbarges* - Coast Guard records indicate that on average one tankbarge per day transporting bulk petroleum products transits the Narragansett Bay. The most frequented destination for this traffic is the Exxon/Mobil facility located in the upper Providence River.

- *Recreational vessels* - During the summer months, yachting regattas are frequently held within Narragansett Bay. The Coast Guard, the regatta sponsors, and the Northeast Marine Pilots normally coordinate commercial vessel transits to minimize any adverse impact to marine traffic that may be caused by these regattas.

Future Traffic

Maintenance dredging of the navigation channel to Providence to restore it to a depth of 40 feet will once again allow deeper draft vessels to enter the port, will reduce delays to vessels that currently have to wait for the correct tidal conditions, and will reduce the need for lightering of certain vessels before entering the port. There is no indication that deepening this channel will result in an increase in the total number of vessels transiting lower Narragansett Bay on passage to Providence.

The proposed KeySpan LNG project would receive 50 to 60 LNG ships per year, or an average of one ship every 6 to 7 days, which would enter Narragansett Bay and transit the federal navigation channel in the Providence River. (It is possible that these deliveries may occur more frequently in the winter and less frequently in other seasons to accommodate the increased demand during cold weather.) In addition,

on December 19, 2003, Weaver's Cove Energy, L.L.C. filed applications with the FERC to site, construct, and operate a LNG terminal in Fall River, Massachusetts. The proposed Weaver's Cove LNG Project, if approved, would receive about 50 to 70 LNG ships a year. LNG ship transit to this facility would be through Narragansett Bay and the federal navigation channel in Mount Hope Bay and the Taunton River.

Potential impacts of the Project on existing and future traffic in the Providence River are discussed below.

Ship Traffic in the Navigation Channel

There are a number of factors that influence the movement of ship traffic in the federal navigation channel in the Providence River. These include:

- *Channel Depth and Current* - Sediment buildup in the Providence River since the last major dredging project in 1976 generally limits use of the channel to vessels with a draft of less than 35 feet. As noted previously, the COE is undertaking a project to dredge the channel to its authorized depth of 40 feet (plus 2 feet over cut). Even without the dredging project, the current channel depth would be adequate for the smaller LNG ships that may call on the LNG facility. Once the proposed dredging is completed, the channel would be adequate for safe navigation on a routine basis of the larger LNG ships that have a normal draft of 37.5 feet. Currents in the river are generally less than 1.5 knots and do not hinder navigation. The Providence River has a narrow fetch, which limits waves to short periods and low heights.

- *Daytime/Nighttime Transit* - KeySpan LNG has proposed that transit times for LNG vessels to the terminal be scheduled for either early morning or night to allow transit of LNG vessels outside of the peak usage time by recreational boaters. The timing for LNG ship transit through the navigation channel to the LNG facility would be determined by the pilots and the Coast Guard.

- *One-Way Traffic* - One-way traffic is currently enforced from Conimicut Point to Fox Point (Providence River) due to the extensive dredging of the Providence River being conducted by the COE. This dredging should be completed by summer 2005, at which time the restriction on one-way traffic should be removed. However, the current requirement for one-way traffic is not considered to present a problem due to the low volumes of traffic. During LPG transits (and anticipated for proposed LNG transits), all traffic in the East Passage and the Providence River is restricted to one-way only to prevent any meeting situations with the LPG tanker. Arrangements are in place to permit a vessel, scheduled to depart from upper Narragansett or Mount Hope Bays, to commence its outward passage and wait or anchor temporarily at a suitable location, such as Sandy Point, to allow an LPG ship to pass. In this case the total time of the delay could be approximately 60 minutes. It is anticipated that vessels may encounter similar delays for the LNG ship transits. Currently, about 3 percent of all inbound and outbound vessels transiting the Providence River experience some delay, with a worst case delay being over 1 hour. Assuming 52 LNG ships traveling to the KeySpan LNG facility per year, an estimated 5 percent of all vessel transits would be estimated to experience some delay.

- *Tugs* - LNG ships delivering cargo to the proposed terminal would have tug support for all phases of arrival and departure, and for standby and fire fighting duties during LNG

unloading operations. Although there are established tugboat operations in the Narragansett Bay area, BG LNG would provide two new dedicated tractor tugs with fire-fighting capabilities and sufficient power to assist with the turning and berthing of the LNG ships. Ownership arrangements are not yet established but the tugs would be contracted to the proposed project for all LNG ship movements and would be available at other times for general shipping movements in the Providence Harbor area.

- *Moving Safety and Security Zone* - The Coast Guard currently imposes a moving safety and security zone around LPG ships en route to Providence and would impose a similar zone enforced by a Coast Guard escort for LNG ships. As discussed above, the worst-case effect of this moving safety zone would be an estimated 1-hour delay to other ships. In the federal navigation channel, any delay would be concurrent with, not in addition to, any delay due to one-way traffic.

- *Reduced Visibility* - The Narragansett Bay area experiences fog mostly during spring and fall months. Fogs may last 4 to 12 hours, although periods of 4 to 6 days may occur with only short clear intervals in between. The fog can be localized with clear visibility in the head of the bay and limited visibility in the entrance. Along the Providence River, sea fog may be carried over land by onshore winds in the spring and fall. However, the number of these days is few, typically averaging only 2 to 3 days per month.

- *High Winds* - LNG ships present a relatively high wind sail area and their operation in narrow waterways requires specific controls. Mean wind speeds in the vicinity of the project area are 10 knots or less with winds in excess of 40 knots being very rare. In comparison, KeySpan LNG indicates that ships are able to transit safely under wind conditions that are less than 20 knots. At wind speeds greater than 20 knots, LNG ships may be required to remain at anchorage and not transit to the LNG facility.

- *Pilotage* - Northeast Marine Pilots would provide pilotage of the LNG ships from the pilot boarding station at the entrance to Narragansett Bay until the LNG ship is secured in the berth at the proposed LNG terminal. Pilots have been involved in the simulation studies conducted to date, and additional pilots would be provided the training in the future.

- *Ice Conditions* - During severe winters, floating ice and packs of field ice can be found in the Providence River and Upper Narragansett Bay. The ice is pushed southward down the Providence River by north and northeast winds and is usually broken by harbor traffic. Generally, the approach channel and the Port are free of ice and are navigable throughout the year. Breaking of ice to facilitate energy deliveries is a top Coast Guard priority, second only to icebreaking at its search and rescue stations to maintain emergency response capabilities.

Navigation Simulation Studies

Safe navigation from Fuller Rock Reach to the terminal, including turning of the LNG ship prior to docking and/or departure, was evaluated by Marine Safety International (MSI) in Newport, Rhode Island using marine vessel simulators. Simulated transits were made with the LNG vessel *Khannur*, a 125,000 m^3 six tank vessel of Moss Rosenberg design and two 65 tonne bollard pull Azimuth Stern Drive tugs. This vessel was selected for the simulation exercise because it has a large windage area similar to the larger 145,000 m^3 membrane vessel. The simulations concluded that an LNG carrier of up to 145,000 m^3 capacity could be docked safely and reliably at the terminal site.

BG LNG plans to conduct additional full bridge simulation modeling of the channel transit at MSI in Newport. This simulation would include full digitization of all of the higher risk navigation points on the channel from the pilot station to the LNG berth. The model would be developed by MSI and validated by pilots from the Northeast Marine Pilots Association. After the model is validated, it would be used to practice and assess all navigational aspects of the inbound and outbound transit, including the assessment of the adequacy of night-time aids to navigation. The model would also be used to assess the power requirements and optimize the design of the tractor tugs that would be use used to assist berthing and unberthing of LNG vessels at the site. The simulation model would be continuously used as a training tool for all Pilots, Tug Masters, Ship Masters, and the Coast Guard to familiarize them with safe transit, tug maneuvers, and tug assist in turning LNG vessels in the channel, berthing, and unberthing.

4.12.5.2 Requirements for LNG Ship Operations

The arrival, transit, cargo transfer, and departure of LNG ships in Narragansett Bay would adhere to the procedures of Operations and Emergency Manuals to be developed by KeySpan LNG in consultation with the Coast Guard Marine Safety Office, Providence, Rhode Island. These procedures would be developed to ensure the safety and security of all operations associated with LNG ship transit and unloading. The manuals would contain specific requirements for the LNG ship, pre-arrival notification, transit through Narragansett Bay, the waterfront facility, cargo transfer operations, Coast Guard inspection and monitoring activities, and emergency operations. The Coast Guard Marine Safety Office Providence would monitor each LNG ship in accordance with these manuals.

Some of the anticipated key provisions of the manuals would be the establishment of a moving safety and security zone for all inbound, outbound, and moored LNG ships; the use of a minimum of two tractor tugs to assist in the Providence River and to maneuver the ship into the berth; and one tug to remain with the LNG ship while it is moored at the berth.

The Coast Guard regulations in 33 CFR 127 apply to the marine transfer area of waterfront facilities between the LNG ship and the last manifold or valve located immediately before a storage tank. Further, Title 33 CFR 127 regulates the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, fire fighting, and security of LNG waterfront facilities. The safety systems, including the communications, emergency shut down, gas detection, and fire protection must comply with the regulations in 33 CFR 127. Under 33 CFR 127.019, KeySpan LNG would be required to submit two copies of its Operations and Emergency Manuals to the Captain of the Port Providence.

Title 33 CFR 127 separates cargo transfer operations into three distinct phases: Preliminary Transfer Inspection (section 127.315); Declaration of Inspection (section 127.317); and LNG Transfer (section 127.319). These different sections require specific actions to be completed prior to and during the transfer. Additionally, there are specific actions required in the case of a release of LNG (section 127.321).

In accordance with 33 CFR 127.007, KeySpan LNG submitted a Letter of Intent (LOI) to the Coast Guard on August 20, 2004. A Coast Guard notice seeking comments on KeySpan LNG's LOI appeared in the September 1, 2004 Federal Register, with comments due November 1, 2004. Upon completion of its review, the Coast Guard would issue a Letter of Recommendation to address the suitability of the Narragansett Bay and the federal navigation channel for LNG transport with regard to the following items:

- density and character of marine traffic;

- locks, bridges, or other manmade obstructions;
- depth of water;
- tidal range;
- protection from high seas;
- underwater pipes and cables; and
- distance of berthed vessels from the channel and the width of the channel.

While the Letter of Recommendation would address the suitability of Narragansett Bay and the Providence River for LNG ship transportation, it would not constitute a final authority to commence LNG operations. It is anticipated that the Coast Guard will decide on a Letter of Recommendation as soon as possible after the Commission issues the final EIS, or wait until after the Commission makes an overall public interest determination of the proposal. Issues related to the public impact of safety and security or exclusion zones are addressed later in the development of the Coast Guard's Vessel Transit Security Plan. An initial plan has been developed in conjunction with state and local law enforcement communities. In addition, the Coast Guard would establish a safety and security zone under 33 CFR 165 for LNG vessels in transit and while docked. Only personnel or vessels authorized by the Captain of the Port are permitted in the safety and security zone.

Results of Coast Guard Security Workshops

The Coast Guard recently completed a series of project-specific security workshops with port stakeholders and federal, state, and local agencies. The workshop participants identified measures that would be necessary to responsibly manage the risks associated with LNG traffic. These measures complement the Maritime Transportation Security Act regulations enacted on July 1, 2004. The Coast Guard has identified protocols to mitigate specific risks and created an initial Vessel Transit Security Plan, which will become the basis for appropriate security measures for each Maritime Security threat level. Prior to the LNG vessel being granted permission to enter Narragansett Bay, both the vessel and facility must be in full compliance with the appropriate requirements of the Maritime Transportation Security Act and International Ship and Port Security Code, and the security protocols established by the Captain of the Port in the Vessel Transit Security Plan.

To help gauge local concern with the safety and security of LNG shipments to Rhode Island, the Coast Guard Captain of the Port initiated a series of security workshops beginning in November 2004 with federal, state, local, and industry law enforcement stakeholders to weigh preventative measures. Participants considered competent industry studies from ABSG and Sandia National Laboratories to help validate a vulnerability assessment submitted by the applicant. After weighing their concerns, the group was able to identify specific protocols to mitigate risk, which became the baseline for security planning.

As a result of these workshops, the Coast Guard has identified additional resources, public and/or private, to provide suitable afloat, underwater, landside, and aviation security or surveillance capabilities to implement prevention and mitigation strategies necessary for LNG operations. These resources are not currently available in the Captain of the Port Providence area of responsibility. A detailed security plan describing the resources and prevention/mitigation strategies has been provided to the FERC. The plan includes an offshore security sweep by a Coast Guard boarding team, aerial surveillance, and an escort to the dock by armed security boats to enforce a safety and security zone. While the vessel is at the dock, the plan would include a combination of resources including Coast Guard security boats with state and local police details to complement the Facility Security Plan (see section 4.12.7). The details of this security plan have been designated Sensitive Security Information as defined in Title 49 CFR Part 1520. Because any unauthorized disclosure of this plan could be employed to circumvent the security measures, it is not releasable to the public. Additionally, any security plan is a dynamic document that is subject to change with advances in technologies and improvements in intelligence gathering.

The security plan is robust and necessary considering the demographics and configuration of both the transit route and the marine terminal site. Several concerns were raised about the necessity for bridge closures during the transit. The workshop participants have determined it is not necessary to close the Pell Bridge unless the threat condition or current intelligence raises a concern about security issues. The law enforcement agencies in the region have demonstrated the capability to manage a bridge closure during transits of LPG vessels in the past. Maintaining that capability is built into the present security plan, should it be required, but this option will only be executed when absolutely necessary.

During the public meetings, several people commented on the cost of applying additional security measures and the potential burden on local taxpayers. To meet its anticipated security responsibilities in Rhode Island, the Coast Guard initiated a formal proposal for additional resources through its internal budgeting process for inclusion in the 2006 appropriations bill. A determination on that proposal is pending. To address the expense for state and local resources, the applicant has proposed to fund direct transit-related costs. Estimating security costs of approximately $40,000 - $50,000 per vessel port call, at a rate of 50 - 60 arrivals each year, the applicant has proposed to reimburse all incremental security costs ranging from $2 to $3 million annually.

We recognize that the initial Vessel Transit Security Plan is a dynamic document that has been prepared well before import operations would commence, and that the port's overall security picture may change over time. New port activities may commence, infrastructure may be added, or population density may change. Improvements in technology to detect, deter, and defend against intentional acts may also develop. Therefore, **we recommend that:**

- **KeySpan LNG annually review its waterway suitability assessment for the upgraded project; update the assessment to reflect changing conditions; provide the updated assessment to the cognizant Captain of the Port/Federal Maritime Security Coordinator for review and validation; and provide a copy to the FERC staff.**

Impact of Vessel and Facility Security Requirements

The potential impacts to other commercial and recreational boaters can be evaluated for several general security requirements: (1) moving safety and security zones for inbound and outbound LNG vessels; (2) one-way vessel traffic during portions of the LNG vessel transit; (3) safety and security zones around a moored LNG vessel; and (4) other measures as deemed appropriate. Fifty to 60 cargo deliveries per year would average about 1 per week for each inbound and outbound transit. For the upper limit of 60 cargo deliveries per year, the impact would be once every 6 days.

Applying a moving safety and security zone would restrict other vessels 2 miles ahead, 1 mile behind, and approximately 1,500 feet on either side of the LNG vessel. The Captain of the Port currently places similar restrictions on all high-interest vessels by regulation in 33 CFR 165.121. The LNG vessels would transit the majority of the 29-nautical-mile trip from Rhode Island Sound to the KeySpan LNG terminal at 10 to 12 knots, and slow to about 3 knots near the entrance to Fuller Rock Reach where two tugs would assist the LNG vessel through the final 2.5 miles of the transit and for docking maneuvers. Based on these assumed speeds, it would take about 3 hours for LNG ships to complete the 29-nautical-mile trip from about Point Judith to the KeySpan LNG terminal.

The application of the safety and security zone on land has minimal impact. The regulation provides the Coast Guard and local law enforcement personnel with the authority to implement additional control measures within the zone, such as check points, should such action be warranted based on a specific threat or credible intelligence. Additionally, it is important to note that the requirements of 33 CFR 165.121 were designed to apply to any high-interest vessel transiting Narragansett Bay and does not

give consideration to safety or security measures that may be applied to mitigate risk. Considering the robust security plan that was devised during the Coast Guard-sponsored workshops, it is likely that LNG-specific security zone regulations will be promulgated.

Due to a major COE dredging project of the navigation channel in the Providence River, a one-way vessel traffic system currently applies to all large vessels transiting the river from Conimicut Point to Fox Point. The dredging should be complete and the restriction rescinded before operation of the proposed KeySpan LNG facility begins.

The Coast Guard would establish safety/security zones around the KeySpan LNG marine terminal when an LNG vessel is at the dock. The Coast Guard has not defined the size of a restricted zone around a docked LNG ship but has stated that it would make every effort to minimize disruptions to other waterway users. The Coast Guard security zones for this project would not be treated as absolute exclusion zones that would preclude all other vessel movements. Rather, other commercial and recreational vessels may be allowed to transit through the security zones with the permission of the Captain of the Port. KeySpan LNG has suggested that a 500-foot guarded zone may be established around an LNG ship at the dock. The Providence River is over 1,500 feet wide at this point, allowing for the supervised passage of commercial or recreational vessels to or from upstream docks. It is also anticipated that any security zone which may be applied to the facility when the unloading berth would be unoccupied would be much smaller and would not adversely impact regular river traffic.

During the Coast Guard security workshops, port stakeholders and law enforcement agencies determined the measures that would be needed to protect an LNG ship as it passes underneath the Pell bridge. As previously noted, the workshop participants have determined it is not necessary to close the Pell Bridge unless the threat condition or current intelligence raises a concern about security issues. For those transits when the bridge would not be completely closed, other security measures would be in place to protect against potential threats. These measures may include closing the outboard lanes only, placing law enforcement officials on the bridge at strategic locations, or employing technology that provides suitable security alternatives.

The Pell Bridge, with a horizontal clearance of 1,500 feet and vertical clearance of 194 feet, is located above the East Passage and is the only bridge that crosses the LNG vessel route to the KeySpan LNG site. During those instances when the Rhode Island Bridge and Turnpike Authority chooses to close the Pell Bridge for a vessel en route to Providence, the closure typically lasts about 5 to 7 minutes.

The Pell Bridge runs in an east-west alignment, with two travel lanes in both directions. Connections to the bridge from the east include a single-lane on-ramp that accommodates traffic from Route 138 and JT Connell Highway from the north and a single lane on-ramp that accommodates traffic from northbound Route 238 (JT Connell Highway). The westbound roadway connection to the bridge consists of the 2-lane approach of Route 138.

On behalf of Weaver's Cove Energy (which has a pending application before the FERC that would potentially involve closure of the Pell Bridge and other bridges during LNG ship transits to its proposed LNG terminal in Fall River, Massachusetts), MDM Transportation Consultants, Inc (MDM) conducted a 2004 traffic analysis to identify the potential impacts on traffic in the event of a bridge closure during the passage of an LNG ship. The study used an automated traffic recorder to quantify the regional traffic using the affected bridges. In addition, these traffic counts were used to estimate potential delays and queuing (back-up) distances at the bridges based on how long the bridge might be closed to traffic.

According to the MDM study, the estimated weekday average daily traffic flow across the Pell Bridge is nearly 31,000 vehicle trips per day with 2,630 and 2,790 vehicles per hour during peak morning and evening commuter hours. Saturday daily volumes were calculated to be 24,450 vehicles per day with peak volumes of nearly 2,000 vehicles per hour. Assuming a bridge closure time of 6 minutes for the passage of an LNG ship in transit to the proposed KeySpan LNG terminal, eastbound and westbound traffic would back up on average between 800 feet and one-quarter mile with an average delay of 4 minutes or less during average hour flow conditions. During peak-hour flow conditions, eastbound and westbound traffic would, on average, extend approximately one-quarter to one-half mile with average travel delays of 5 minutes or less. Secondary roads, including JT Connell Highway and local roadway systems, would not likely be affected because the delayed traffic would be contained along Highway 138 or on the ramps (MDM, 2004). The Rhode Island Bridge and Turnpike Authority prohibits the passage of all traffic during bridge closures; however, the Pell Bridge is a state highway (Highway 138) and the State Police typically exercises its authority to allow emergency vehicles to pass during bridge closures (Bianchi, 2004; Swansberg, 2004).

The moving safety and security zone and the safety and security zone at the terminal may affect other commercial, ferry, and recreational traffic using the bay and river. The magnitude of the effect would also be influenced by three other factors: the amount of time it takes to obtain a pilot, other competing ship traffic in the federal navigation channel, and interaction with ferry traffic.

In some areas, the moving safety and security zone could delay the passage of other ships. This presently occurs with LPG vessels which can sometimes delay other vessels using the East Passage or federal navigation channel as they wait or anchor at suitable locations to allow the LPG ship to pass. It is expected that if both the Weaver's Cove Energy and KeySpan LNG terminals are constructed, as many as 100 to 130 LNG ships could potentially move in and out of Narragansett Bay every year. The inbound and outbound traffic of LNG ships moving through either Providence or Fall River could delay other commercial ships in the area.

To evaluate current conditions and the potential impact of LNG vessels on existing commercial ship traffic, KeySpan LNG and BG LNG retained MNI to assess five case scenarios using the Monte Carlo methodology. Vessel types included in the study were passenger or dry cargo ship, tanker, dry cargo barge, and tanker barge. Tugs were not counted as separate entities because it was assumed that they travel as an integrated entity with the barges. Recreational boats were not included in the simulation; however, it can be assumed that the impacts on recreational boaters would be less than on deep draft vessels since recreational boats have shallower drafts and are less restricted on where they can travel in the bay and river. The five case scenarios studied are:

- Case 1: 720 vessels per year with no LNG ships (recreational boats were not included);
- Case 2: future conditions assuming 52 LNG ships per year;
- Case 3: future conditions assuming there are two LNG terminals (the KeySpan LNG Facility and the Weaver's Cove Energy LNG Facility), and 52 and 60 LNG ships per year call at each, respectively;
- Case 4: the same as Case 3 but assumes a hypothetical 70 LNG ships per year call at the KeySpan LNG facility; and
- Case 5: the same as Case 4 but assumes future traffic conditions of non-LNG ships increases 50 percent.

In each scenario, it was conservatively assumed that use of pilots would be mandatory; one-way traffic would apply to all vessels between Conimicut Point and Fox Point; ship traffic traveling in the opposite direction would need to stop when an LNG tanker is moving into Narragansett Bay; ship traffic moving in the same direction as the LNG ship would be allowed but would need to stay at least 2 miles in front, 1 mile behind, and 3,000 feet on either side of the LNG ship; visibility must be at least 2 miles for the estimated duration of the LNG ship's transit from the mouth of the bay to the terminal in order for LNG ships to be allowed to enter the bay; and the draft of the LNG ships would be 38 feet. The Coast Guard has noted that the assumption that ships traveling in the opposite direction would need to stop is not correct and therefore the study may overestimate the actual level of impact.

The results of the study for these five case scenarios are summarized in table 4.12.5-1.

As shown in the table, about 22 inbound and 22 outbound vessels are currently affected by delays each year. If only the KeySpan LNG project is approved and LNG ships are introduced into the existing ship traffic in Narragansett Bay and the channel (Case 2), other ship traffic moving in the opposite direction of the LNG ships would need to wait for the inbound or outbound LNG tanker to complete its 2.5 to 3 hour trip between the Narragansett Bay entrance and the KeySpan LNG berth. Similarly, LNG tankers would need to wait for all opposing traffic to complete the journey between the KeySpan LNG terminal and the mouth of Narragansett Bay before the LNG vessel could begin its transit to or from the LNG facility. In this scenario, up to 14 additional vessels would be affected, and approximately 5 percent of the total ship traffic would experience some delay. In reviewing the results of the MNI Traffic Study, the Coast Guard noted that a vessel at Quonset Point or Fall River would not need to wait for an inbound or outbound LNG tanker to complete its 3-hour journey through Narragansett Bay. Vessels could proceed to their intended destinations and time their passage with LNG tankers such that they temporarily wait in an anchorage, or slow down in the Quonset or Mount Hope channels to avoid meeting the LNG tankers.

TABLE 4.12.5-1

Impact of LNG Traffic on Shipping Operations

Ship Traffic Study Case	Annual Anticipated Delay Inbound (Hours per Year)	Annual Anticipated Delay Outbound (Hours per Year)	Number of Vessels Impacted
Case 1	7-8	7-8	22 inbound 22 outbound
Case 2	27	34	35 inbound 36 outbound
Case 3	37	44	42 inbound 45 outbound
Case 4	46	55	46 inbound 51 outbound
Case 5	70	83	82 inbound 91 outbound

If the proposed LNG ship traffic associated with the Weaver's Cove Energy LNG Project is added to the analysis (Case 3), the anticipated LNG traffic on Narragansett Bay and within the channel would approximately double in volume. Under these conditions, about 6 percent of the non-recreational vessels operating in Narragansett Bay would experience delays each year.

In another case, if KeySpan LNG's traffic is modeled to account for a hypothetical increase to 70 LNG ships per year and these ships are added to Weaver's Cover Energy's proposed LNG traffic (Case

4), an average of 7 percent of the annual bay traffic would experience some delay. Lastly, for a worst-case situation, if this increased KeySpan LNG traffic is added to Weaver's Cove Energy's proposed LNG traffic and then also added to a 50 percent hypothetical increase in non-LNG traffic (Case 5), an average of 8 percent of the annual bay traffic would experience some delay each year. Based on the above, it appears the Coast Guard-required safety and security zones during LNG ship transit and unloading would widen the area restricted to ships and increase the number of ships that are delayed either entering or leaving the port. We note that the 50 percent increase is based on an assumption rather than on projections by port facilities currently receiving non-LNG ships in Narragansett Bay. However, in its comments on the draft EIS, the Coast Guard noted that Rhode Island voters recently approved a $48 million bond to improve the Quonset Point/Davisville port complex including improved vessel berths and new railroad lines directly from the waterfront to the interior. It is expected that this will generate new business at Quonset/Davisville, including more vessel traffic, especially car carriers.

The impact on ferry traffic would generally be small because most of the ferry routes only cross the LNG ship route and conflicts could be managed by schedule coordination. The impact on the Providence to Newport ferry could be more significant because the ferry and LNG ships would travel along the same route for several miles. MNI identified this potential conflict in its study and suggested that the impact could be reduced if the Coast Guard allows the ferry to operate outside of the channel and overtake or pass the LNG ship in transit at specific locations. The Coast Guard has indicated that it may grant permission for the ferry to pass the LNG ship or transit through portions of the security zone.

Commercial fishing boats might also be affected by the security zones imposed by the Coast Guard as LNG ships transit the federal navigation channel, particularly if the width of the security zone encompasses the entire width of the waterway. However, the security zone would be a moving zone around the ship, so these impacts would be temporary and of short duration at any given point along the shipping route. In addition, depending on their individual drafts, commercial fishing boats might be able to go around the LNG ships at points in the river that are sufficiently wide for them to be outside of the security zone. To mitigate the impacts of security zones, the Coast Guard would routinely provide Notice to Mariners prior to the arrival and departure of LNG ships as the Coast Guard currently does for LPG vessels and for other activities such as the Tall Ship parades. The notification system employed for safety and security zones consists of broadcasts on radio frequencies used by mariners. This notification may be given from minutes to more than 1 hour before the security zone is enforced. Broadcasts are intentionally not made further in advance for security reasons. Picket boats would also precede the LNG ship to inform vessels of the approaching security zones.

Operation of the LNG terminal could also affect recreational boating and fishing during the weekly transit and unloading of the LNG ships. The safety and security zone around a moored LNG ship may prevent recreational boaters from boating or fishing in the vicinity of the moored ship for approximately 24 hours. In most areas, the waterway that would be traveled by the LNG ships is sufficiently wide to allow recreational craft, which generally are not confined to the federal channel, to navigate around the LNG ships without significant delay. To estimate what kind of delay might result from a passing LNG ship in areas where the waterway is narrower, we identified the locations where the moving safety and security zone has the greatest potential to encompass the entire width of the waterway. We specifically looked for areas where there might be less than approximately 1,500 feet of open water on both sides of the LNG ship route (the anticipated width of the safety and security zone on either side of the ship). These areas include the East Passage between Newport and Jamestown, the Providence River between Conimicut Point and Nayatt Point, the Providence River between Gaspee Point and Bullock Neck, and the Providence River north of Gaspee Point. For an LNG vessel in transit at 10 knots, recreational craft attempting to travel in the opposite direction at one of the narrow locations may need to wait up to 18 minutes for the LNG ship to pass before proceeding on its way, and up to 60 minutes when the LNG vessel is under tug assistance in the Fuller Rock and Fox Point Reaches of the Providence River.

For boaters near or upstream of the facility, an additional 60 minute delay may be experienced while the LNG vessel would be berthed or turned.

The extent of the impact on recreational boaters would depend on the number of boats in the project area during the 50 to 60 days per year that LNG vessels would call on the LNG terminal. These impacts would primarily occur during the peak recreational boating season between about May and September. As noted above, the Coast Guard is expected to use a program of announcements to give advance notice of approaching LNG ships. The Coast Guard and the pilots would consider measures to minimize the impacts on recreational boaters when determining the appropriate time to bring an LNG ship to port. One such measure would be to schedule the transit of LNG ships past Newport during the early morning or at night to minimize the impact on recreational boaters.

Several commentors have expressed the concern that local communities would have to bear some of the costs of ensuring the security of the LNG facility and the LNG vessel while in transit and unloading at the dock. The potential costs can be estimated from the specific security needs that have been identified, and the responsibilities of federal, state, and local agencies that have been established in the Coast Guard's Vessel Transit Security Plan. In addition, the security practices presently employed to secure the LNG vessel transit through Boston Harbor to the Distrigas facility in Everett, Massachusetts, provide an indication of the potential magnitude of the costs involved. A recent report for Congress (Parfomak, 2003) indicates that the security costs per ship to the Everett facility are approximately $80,000, of which $37,500 is covered by state and local governments.

The development of the safety and security plans for the upgraded project has now been formally initiated by KeySpan LNG. The safety and security plan development process has been divided into three sub-processes: (1) the Port and Waterway Safety Assessment Workshop, which will develop the Vessel Transit Safety Plan; (2) the Security Workshop, which will develop the Vessel Transit Security Plan; and (3) the Consequence Management Plan Workshop, which will facilitate the development of the Consequence Management Plan for the project and communities located along the vessel transit route. The draft Vessel Transit Security Plan has been completed; however, the development of the Vessel Transit Safety Plan and the Consequence Management Plan is continuing.

KeySpan LNG and BG LNG intend to provide funding, at a level to be determined, for technical expertise to assist the state and local entities participating in the development of the Consequence Management Plan. KeySpan LNG and BG LNG have also made, and will continue to make, the project's own experts, including Response Management Associates, available to the plan developers.

The Coast Guard has completed an initial Vessel Transit Security Plan, from which the security resource requirements for this project were determined. We requested in the draft EIS that KeySpan LNG provide a plan identifying the mechanisms for funding project-specific security costs that would be imposed on state agencies and local communities. We subsequently sent KeySpan LNG a data request to obtain more specific information on this matter. In response, the applicant restated its commitment to pay for the direct transit-related security costs associated with the upgraded operations. Estimating state and local security costs of approximately $40,000 - $50,000 per vessel port call, at a rate of 50 - 60 arrivals each year, the applicant has proposed to reimburse all incremental security costs ranging from $2 to $3 million annually. Furthermore, the stringent security measures contemplated would require that all resources identified in the security plans are in place and functional prior to the start of operations. In other words, the project cannot commence operations unless and until the Coast Guard is satisfied that the personnel, physical and technological resources are in place to allow those transits to occur. KeySpan LNG would have a vested interest in ensuring that those resources are available when needed, and has reiterated its commitment to working with all affected stakeholders to ensure that project-specific security costs are not borne by local and state agencies.

Although KeySpan LNG has made a commitment to provide funding for the direct transit-related state and local security costs identified in the preliminary plans, there may be a need to fund additional capital costs associated with the base itself, i.e. procuring security equipment and hiring personnel. There may also be revisions to plans in the future to reflect changes in threats and responses. Therefore, we recommend that:

- **KeySpan LNG provide a comprehensive plan identifying the mechanisms for funding all project-specific security/emergency management costs that would be imposed on state and local agencies. In addition to the funding of direct transit-related security/emergency management costs, this comprehensive plan should include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. This plan should be filed with the Secretary <u>prior to initial site preparation</u> for review and approval by the Director of OEP.**

With respect to other costs incurred at the state and local level, KeySpan LNG is honoring, and will continue to consider, requests for assistance from both the state and local agencies that will enhance the safe and secure operation of the facility. Last year, KeySpan LNG sponsored 16 firefighters, at an estimated cost of $16,000, to receive specialized LNG fire fighting training at the Massachusetts Fire Academy in Stow, Massachusetts. KeySpan LNG has also committed to sponsor an additional 20 firefighters to be trained this year, and will consider funding future years on a need-determined basis. In addition, KeySpan LNG plans to conduct two yearly training exercises (including pre-planning table-tops) for first responders at a cost of approximately $75,000 per year. KeySpan LNG also plans to invite local emergency responders to attend Incident Command System training that will be conducted for facility security officers.

4.12.5.3 LNG Ship Safety

Since 1959, LNG has been transported by ship without a major release of cargo or a major accident involving an LNG ship. Starting in 1971, LNG began arriving at the Distrigas facility in Everett, Massachusetts. To date, more than 450 cargos, with volumes ranging from 60,000 to 138,000 m^3, have been delivered into the Port of Boston without incident. During 2003, a total of 506 billion cubic feet (204 cargos) of LNG was imported into the United States. For 30 years, LNG shipping operations have been safely conducted in the United States.

The world's LNG ship fleet numbers 151, with an additional 57 ships contracted for delivery by 2006. During the last 40 years, LNG ships have made over 33,000 voyages and safely transported over 2.72 billion cubic meters of LNG. This includes over 1,500 voyages to or from U.S. ports. Currently, all of the ships in the LNG fleet operate under a foreign flag with foreign crews. A foreign flag ship must have a Certificate of Compliance inspection by the Coast Guard to ensure compliance with International safety standards.

History

During the 33,000 voyages that have been completed since the inception of LNG maritime transportation, there have been only eight significant incidents involving LNG ships, none of which resulted in spills due to rupturing of the cargo tanks. These incidents are described below:

- ***Pollenger*** had an LNG spill onto the steel cover of cargo tank number one during unloading at Everett, Massachusetts in April 1979. The spill caused cracking of the steel plate.

- ***Mostafa Ben Boulaid*** had a check valve fail in April 1979 when unloading at Cove Point, Maryland, releasing a small quantity of LNG onto the ship and causing some minor fracture of the deck plating. Activation of the ship's safety systems (i.e., the emergency shutdown system and water spray system), along with excellent response of the crew, kept the incident from propagating, thus minimizing any serious damage.

- ***El Paso Paul Kayser*** grounded on a rock in June 1979 in the Straits of Gibraltar during a loaded voyage from Algeria to the United States. Extensive bottom damage to the ballast tanks resulted; however, the cargo tanks were not damaged, and no cargo was released. The complete cargo of LNG was subsequently transferred to another LNG ship and delivered to its U.S. destination.

- ***LNG Libra's*** propeller shaft fractured while the ship was en route to Japan with a full cargo in October 1980. The ship was taken under tow, and the cargo was safely transferred to another LNG ship and delivered to its destination.

- ***LNG Taurus*** grounded in December 1980 near the entrance to Taboata Harbor, Japan. The grounding resulted in extensive bottom damage, but the cargo tanks were not affected. The ship was refloated and the cargo unloaded.

- ***Isabella*** had LNG spill onto its deck due to a cargo tank overflow in June 1985, causing severe cracking of the steelwork. The spill had been attributed to a cargo valve failure during discharging of cargo.

- ***Tellier*** was blown from its docking berth at Skikda, Algeria in February 1989 during severe winds causing damage to the loading arms and the ship and shore piping. The cargo loading had been secured just before the wind struck, but the loading arms had not been drained. Consequently, the LNG remaining in the loading arms spilled onto the deck causing fracture of some plating.

- ***Norman Lady*** was struck by the USS Oklahoma City nuclear submarine while rising to periscope depth near the Strait of Gibraltar in November 2002. The 87,000 cubic meter LNG tanker, which had just unloaded its cargo at Barcelona, Spain, sustained only minor damage to the outer layer of its double hull but not to its cargo tanks.

There have also been some incidents that involved the release of small quantities of LNG, such as minor leaks from seals and gaskets, some of which required that operations be temporarily stopped in order to rectify the malfunction.

Vessel Construction

In 1980, at the initial peak of LNG import activity in the United States, the Coast Guard published the report, *Liquefied Natural Gas and Liquefied Petroleum Gas – Views and Practices – Policy and Safety*. The report summarized the Coast Guard's extensive research into the safety hazards of LNG and its view that "...the nature of both LNG and LPG presents an acceptable risk for transportation in maritime commerce." This is due to the fact that LNG ships are well constructed, robust vessels designed to withstand low-energy type incidents that are prevalent in harbors and during docking operations. Moreover, safety measures, both in equipment and training, are planned and designed into these LNG ships to prevent or control all types of potential incidents.

The insulation of cargo tanks on LNG carriers is a complex assembly of many layers. The relief valve capacity for cargo tanks is designed to compensate for over-pressure caused by fire. The potential that impingement by a cryogenic liquid could cause brittle fracture of the ship's hull was known to the Coast Guard in the mid-1970s when the U.S. regulations for LNG carriers in 49 CFR 154 were being developed. Accordingly, the regulations require the use of special crack-arresting steel in strategic locations throughout the vessel's hull. LNG carriers used in U.S. waters must also be constructed in accordance with the IMO Code for the Construction and Equipments of Ships Carrying Liquefied Gases in Bulk. This standard requires that the vessel inner hull adjacent to the cargo tanks be protected against contact from liquid cargo through a combination of proper material selection, adequate insulation, and use of heating systems.

As required by the IMO conventions and design standards, hold spaces and insulation areas on an LNG carrier are equipped with gas detection and low temperature alarms. These devices monitor for leaks of LNG into the insulation between primary and secondary LNG cargo tank barriers. In addition, hazard detection systems are also provided to monitor the hull structure adjacent to the cargo tank, compressor rooms, motor rooms, cargo control rooms, enclosed spaces in the cargo area, specific ventilation hoods and gas ducts, and air locks.

LNG carriers are equipped with a firewater system with the ability to supply at least two jets of water to any part of the deck in the cargo area and parts of the cargo containment and tank covers above-deck. A water spray system is also available for cooling, fire prevention, and crew protection in specific areas. In addition, certain areas of LNG carriers are fitted with dry chemical powder-type extinguishing systems and CO_2 smothering systems for fighting fires.

Unlike many conventional crude oil tankers, all LNG ships used to deliver LNG to this proposed project would have double-hull construction, with the inner and outer hulls separated by about 10 feet. Furthermore, the cargo tanks are normally separated from the inner hull by a layer of insulation approximately 1 foot thick. As a result, many grounding incidents severe enough to cause a cargo spill on a single-bottom oil tanker would be unable to penetrate both inner and outer hulls of an LNG ship. An earlier Federal Power Commission (FPC, predecessor to the FERC) study estimated that the double-bottom of an LNG ship would be sufficient to prevent cargo tank penetration in about 85 percent of the cases that penetrated a single-bottom oil tanker.

The probability of an LNG ship sustaining cargo tank damage in a collision would depend on several factors – the displacement and construction of both the struck and striking vessels, the velocity of the striking vessel and its angle of impact with the struck vessel, and the location of the point of impact. The previous FPC study estimated the additional protection afforded by the double-hull would be effective in low energy collisions; overall it would prevent cargo tank penetration in about 25 percent of the cases that penetrated a single-hull oil tanker.

In 1995, to assist the Coast Guard in San Juan, Puerto Rico, EcoEléctrica L.P. prepared an analysis of the damage that could result from an oil tanker striking an LNG ship at berth (FERC, 1996). The analysis assumed a 125,000 m^3 LNG ship and an 82,000 dead weight ton tanker carrying number 6 fuel oil without tug assistance. The analysis determined the minimum striking speed to penetrate the cargo tanks of an LNG ship for a range of potential collision angles. The resulting minimum striking speeds are presented in table 4.12.5-4 for the two principal cargo systems.

TABLE 4.12.5-2 **Minimum Striking Speed to Penetrate LNG Cargo Tanks**		
	Minimum Striking Speed (knots)	
Angle of Impact	Spherical Tanks	Membrane Tanks
Greater than 60 degrees	4.5	3
45 degrees	6.3	4
30 degrees	9	6
15 degrees	18	12

For membrane tanks, the critical beam-on striking speed is 3.0 knots, and for spherical tanks, the critical on-beam speed is 4.5 knots. For both containment types, lower angles of impact result in much greater minimum striking speeds to penetrate LNG cargo tanks. In the July/August 2002 issue of the "LNG Journal," the SIGTTO General Manager provided a table that shows the critical speed necessary for a 20,000-ton vessel to puncture the outer hull of an LNG carrier is 7.3 knots. For a 93,000-ton ship, the impact speed is 3.2 knots. In neither case does such an impact result in damage to the LNG cargo containment system or the release of LNG.

Hazards

In the event of a collision or allision of sufficient magnitude to rupture an LNG cargo tank, it is likely that sparks or flames would ignite the flammable vapors at the spill site. In a grounding of sufficient magnitude to rupture an LNG cargo tank, the damage would occur under water and the potential for ignition would be less than for collisions or allisions. In this case, an LNG spill would rapidly vaporize on water and form a potentially flammable cloud. If not ignited, the flammable vapor cloud would drift downwind until the effects of dispersion would dilute the vapors below the lower flammable limit for methane. The maximum range of potentially flammable vapors (i.e., the distance to the lower flammable limit) is a function of the volume of LNG spilled, the rate of the spill, and the prevailing meteorological conditions. If the flammable vapor cloud encountered an ignition source, the cloud would burn back to the spill site.

The segment of the transit from the mouth of Narragansett Bay through the East Passage to Sandy Point is relatively wide and deep. From Sandy Point up the Providence River to the LNG terminal site, the federal navigation channel has an authorized depth of 40 feet and a minimum width of 600 feet. The bed of the channel is generally even and soft, making an LNG spill from cargo tanks highly unlikely in a grounding incident. In certain areas, rocks and ledges are located near the channel, including five shoal areas that exist in the upper reaches of the channel. These shoal areas are identified as the Green Jacket Shoal, Sabin Point, Bullock Point, Pomham Rocks and Fuller Rock. Green Jacket Shoal is up river from the proposed facility and should not have an effect on LNG ships transiting to the facility. Sabin Point and Bullock Point are bordered by shallow water depths that will prevent the LNG ships from reaching these two points. Pomham Rocks and Fuller Rock are adjacent to the channel, but are well marked and the channel is of sufficient width to allow LNG ships to maneuver without navigating near the rocks. In addition, the LNG ships would be under control of the Pilots and assisted by tractor tugs when transiting in this area of the channel.

The final EIS for the Calcasieu LNG Project in Lake Charles, Louisiana (September 1976) analyzed the maximum range of a flammable vapor cloud and hazardous radiation levels from an instantaneous one-tank spill. As was consistent with risk analyses at that time and for nearly 25 years thereafter, the instantaneous spillage of one cargo tank was considered to be the "worst case" scenario. Physical constraints on maximum vessel speeds and maximum depths of penetration required to rupture one LNG cargo tank render the possibility of an instantaneous release of more than one cargo tank to be

implausible. This is not to imply that the loss of multiple cargo tanks could never occur, but that the extent of the hazard would not exceed that of the instantaneous spillage of one tank.

For an instantaneous one-tank spill with ignition, the final EIS for the Calcasieu LNG Project estimated that a hazardous thermal radiation level of 5,300 Btu/hr-ft^2 would extend 3,595 feet from the center of the spill. For an instantaneous one-tank spill without ignition, the final EIS for the Yukon Pacific LNG Project (FERC, March 1995) estimated that potentially flammable vapors could travel up to 3.3 miles with a 10 mph wind and typical atmospheric stability.

In October 2001, the use of a one-tank instantaneous release as the "worst case" scenario was re-examined by Quest Consultants, Inc (Quest) as part of an effort by the DOE to determine the hazards associated with reopening the Distrigas LNG import terminal following the terrorist attacks of September 11, 2001. It was determined that time-release spills through 1-meter and 5-meter-diameter holes would more accurately simulate credible "worst case" damage scenarios. Maximum flammable vapor cloud and radiation hazards were calculated for the two spill scenarios. For a spill on water with ignition, the maximum distance to a radiant flux level of 1,500 Btu/ft^2-hr was estimated to be 1,770 feet. For a spill on water without ignition, a flammable vapor cloud of 2.5 miles was estimated. In November 2003, in response to comments concerning its October 2001 study, Quest clarified that its study only applied to LNG spills resulting from a collision with a large ship in Boston's Outer Harbor where waves would restrict the spreading of LNG on water.

During the past year, there has been an emergence of studies by various parties to define the "worst case" scenario that would result from a deliberate, terrorist attack on an LNG vessel and the subsequent release of cargo. Distances have been estimated to range from 1,770 to 4,200 feet for a thermal radiation level of 1,500 Btu/ft^2-hr, the level which is hazardous for persons located outdoors and unprotected. Part of the reason for the apparent discrepancies is the lack of large-scale historical incidents and the need to extrapolate small-scale field test data to a worst case event. This inevitably leads to differing conservative assumptions among the various parties. For example, some models calculate a time-release cargo discharge through 1-meter or 5-meter-diameter holes, while others assume that the cargo tank empties instantaneously.

As a result, the FERC commissioned a study by ABSG Consultants to search and review the literature on experimental LNG spills and on consequence methodologies that are applicable to modeling incidents of LNG spills on water. Further, the goal of the study was to identify appropriate methods for estimating flammable vapor and thermal radiation hazard distances for potential LNG vessel cargo releases during transit and while at berth. The resulting study, *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers*, was released for public comment in May 2004. On June 18, 2004, staff's responses to comments on the consequence assessment methods were issued. As discussed in greater detail in staff's responses, various components of the consequence assessment methodologies were revised based on comments received. The revised study provides the methodology for calculating: (1) the rate of release of LNG from a cargo tank penetration for various sized holes; (2) the spreading of an unconfined LNG pool on water for both continuous spills and rapid (nearly instantaneous) releases; (3) the rate of vapor generation from a unconfined spill on water; (4) thermal radiation distances for LNG pool fires on water; and (5) flammable vapor dispersion distances.

A detailed evaluation of the consequences of a terrorist attack on a modern membrane LNG tanker was prepared by Lloyds Register North America for the Weaver's Cove LNG Project and filed under Critical Energy Infrastructure Information (CEII). The study evaluated the consequences of attacks on an LNG ship by missiles and explosives. Finite element analysis was used to evaluate the effect of various sized charges on both the outer and inner hulls. A 1-meter-diameter hole of the inner hull at the waterline was found to be the average most probable "worst case" scenario for hazard consequence

assessments. This finding is consistent with the attack on the double-hull oil tanker *Limberg* which caused greater than a 5-meter hole on the outer hull but only minor damage to the inner hull. A failure modes and effects analysis was used to understand internal LNG release characteristics, and a residual strength analysis was used to investigate damage scenarios for a loaded LNG tanker.

In December 2004, the DOE released a study by Sandia National Laboratories, *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water* (Sandia Report). The report included an LNG cargo tank breach analysis using modern finite element modeling and explosive shock physics modeling to estimate a range of breach sizes for credible accidental and intentional LNG spill events. The analysis of accidental events found that groundings and low speed collisions could result in minor ship damage but not a cargo spill; while high speed collisions could cause a 0.5 to 1.5 m^2 cargo tank breach area. For intentional scenarios, the size of the cargo tank hole depends on the location of the ship and source of threat. Intentional breach areas were estimated to range from 2 to 12 m^2. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 m^2, which is a more appropriate range to use in calculating potential hazards from spills.

The Sandia Report also included guidance on risk management for intentional spills, based on the findings that the most significant impacts to public safety and property exist within approximately 500 meters (1,640 feet) of a spill due to thermal hazards from a fire, with lower public health and safety impacts beyond 1,600 meters (5,250 feet). Large, unignited LNG vapor releases were found to be unlikely, but could extend to 2,500 meters (8,200 feet) for nominal intentional spill.

Cascading damage due to brittle fracture from exposure to cryogenic liquid or fire-induced damage to foam insulation was evaluated and while possible under certain conditions is not likely to involve more than two or three cargo tanks. Cascading events are not expected to increase the overall fire hazard by more than 20 to 30 percent, but will increase the expected fire duration. Rapid phase transitions are possible for large spills but the effects will be localized near the spill source and should not cause extensive structural damage

The methodology described in the ABSG study and revised in staff's responses to comments was used to calculate the thermal radiation and flammable vapor dispersion distances for several holes ranging in diameter from 1 to 3.9 meters. Based on the penetration of the largest cargo tank of a 140,000 m^3 LNG ship, a potential spill of 23,000 cubic meters is estimated for the volume of LNG above the waterline. The estimated pool spread results and thermal radiation hazard distances are identified in table 4.12.5-3. Thermal radiation calculations are based on an ambient temperature of 50 ºF, a relative humidity of 50 percent, and a 20 mph wind speed.

TABLE 4.12.5-3

LNG Spills on Water

LNG Release and Spread				
Hole Diameter	1.0 meter	2.5 meters	3.0 meters	3.9 meters
Hole Area	0.8 square meters	5 square meters	7 square meters	12 square meters
Spill Time	94 minutes	15 minutes	10.6 minutes	6.1 minutes
Pool Fire Calculations				
Maximum Pool Radius	340 feet	817 feet	935 feet	1,103 feet
Fire Duration	94 minutes	15 minutes	10.8 minutes	6.5 minutes
Distance to:				
1,600 BTU/ft2-hr	2,200 feet	4,340 feet	4,810 feet	5,476 feet
3,000 BTU/ft2-hr	1,710 feet	3,330 feet	3,701 feet	4,206 feet
10,000 BTU/ft2-hr	1,040 feet	1,970 feet	2,174 feet	2,459 feet

Flammable vapor dispersion calculations were based on an ambient temperature of 50 ºF, 50 percent relative humidity, a 4.5 mph wind speed, and atmospheric stability class F. Based on a 1-meter-diameter hole, an unignited release would result in an estimated pool radius of 420 feet. The unignited vapor cloud would extend to 9,030 feet to the lower flammability limit and 12,300 feet to one half the lower flammability limit. It is important to identify certain key assumptions of conditions that must exist in order to achieve the maximum vapor cloud distances. First it would be necessary for an event to create a 1-meter-diameter hole by penetrating the outer hull, the inner hull, and cargo containment without ignition. Far more credible is that the event creating a 1-meter-diameter hole would also result in a number of ignition sources which would lead to an LNG pool fire and subsequent thermal radiation hazards. It is also unlikely that a flammable vapor cloud could achieve its maximum distance over land surfaces without encountering an ignition source, and subsequently burning back to the source. Flammable vapor dispersion for a larger hole was not performed since, realistically, the cloud would not even extend to the maximum distance for a 1-meter-diameter hole before encountering an ignition source.

The inbound transit through the East Passage of Narragansett Bay would pass by Newport and Middletown on the east side, and Jamestown on the west. After turning at Sandy Point, the LNG vessels would enter the Providence River federal navigation channel and transit the Providence River in a northwest course towards the main harbor of the Port of Providence. The transit within the Providence River would pass by the southern portions of the City of Providence and City of East Providence waterfronts. Some areas of development along the shoreline in these communities would be within a potential transient hazard area during the LNG vessel transit, while parts of Providence would be exposed to a potential hazard while the LNG vessel is at the dock and unloading cargo.

The LNG vessels would travel the majority of the 29-nautical-mile trip from Point Judith to the KeySpan LNG terminal at 10 to 12 knots, and slow to about 3 knots when under tug assistance for docking maneuvers. At 10 knots, any adjacent shoreside communities located within the 4,340-foot to 4,810-foot distance for the 1,600 Btu/hr-ft^2 thermal radiation level would be exposed to transient hazard for less than 10 minutes. For final transit at 3 knots, exposure to the transient hazard would be less than 30 minutes. In addition, a temporary hazard would exist around the KeySpan LNG dock during part of the 15-hour period when the LNG vessel is unloading cargo. A thermal radiation level of 1,600 Btu/hr-ft^2 is hazardous to persons located outdoors and unprotected.

The 29-nautical-mile route to the terminal was evaluated for areas of development located within 4,340 feet to 4,810 feet from the LNG vessel route, the 1,600 Btu/hr-ft^2 thermal radiation hazard area for the nominal 5 to 7 m^2 hole for intentional breach scenarios. For a spill in the vicinity of the KeySpan LNG dock, which is the northernmost point of the LNG vessel transit, approximately 460 to 1143 residences and buildings would be within this temporary hazard area. Also located in this area are the Johnson and Wales University Harborside Campus, the William B. Cooley Health and Science Technology Academy, the Play and Learn Preschool, and a 1-mile segment of Interstate 95. Neither Rhode Island General Hospital nor any public housing developments, libraries, or other schools were identified in this temporary hazard area.

In addition, the potential impact on infrastructure and industrial development was also evaluated. A thermal radiation level of 10,000 Btu/ft^2-hr is associated with potential damage to equipment and infrastructure. For a potential spill in the vicinity of the KeySpan LNG dock, the Saint Lawrence Cement Company, the Univar USA chemical facility, the Fields Point wastewater treatment plant, some railroad spurs, and adjacent petroleum storage tanks could be exposed to that level for the 10- to 15-minute duration of a fire resulting from the nominal cargo tank holes of an intentional event. The LPG dock and storage facility could experience similar thermal radiation exposure for incidents downstream in the Fox Point or Fuller Rock Reaches. The actual effect of this thermal radiation on nearby fuel storage tanks and

other infrastructure would depend on the type of fire protection systems at each facility such as firewater and deluge systems.

For potential spills along Sabine Point Reach (Riverside and Pawtuxet), and Bullock Point Reach (Bullock Neck and Gaspee Point), the number of residences and buildings located within the 1,600 Btu/hr-ft^2 transient hazard area would be approximately 950 to 1,440, and 640 to 930 respectively. Bradley Hospital would also fall within the transient hazard area along Fox Point Reach. An estimated 60 residences and buildings in the western peninsula of Bristol would be located in the transient thermal hazard area for a potential spill in that vicinity. The western-most portions of the U.S. Naval Station in Newport, including the track and field area, would also lie within a 1,600 Btu/hr-ft^2 transient hazard area.

The 1,600 Btu/hr-ft^2 transient hazard area from an LNG vessel spill in the main channel of the East Passage in the vicinity of Newport and Jamestown would not affect most shoreside areas. However, potential spill locations in deepwater areas outside the main channel and closer to shore were also evaluated. For a worst case scenario outside the normal route, an estimated 660 to 720 and 420 and 610 residences and buildings in Jamestown and Newport respectively would fall within these potential transient hazard areas.

The operational restrictions to be imposed by the Northeast Marine Pilots on LNG vessel movements through Narragansett Bay, the requirements that the Coast Guard will impose in its operating plan, as well as the design features of the LNG vessels, will minimize the possibility of a hazardous event occurring along the vessel transit.

By focusing on the "worst case" intentional breach scenarios for LNG transportation, there is a tendency to dismiss the potential hazards for other fuels and products commonly transported on our waterways. Some of the previously identified studies that calculate long hazard distances for LNG cargo fires also estimate similarly long distances for gasoline, propane, and jet fuel cargo fires. Also, it should not be assumed that the hazard distances identified are the assured outcome of an LNG vessel accident or attack, given the conservatisms in the models and the level of damage required to yield such large scale releases. Further, these estimated "worst case" intentional breach scenarios should not be misconstrued as defining an exclusionary zone. Rather they provide guidance in developing the operating restrictions for LNG vessel movements in the East Passage of Narragansett Bay and the federal navigation channel in the Providence River, as well as in establishing potential impact areas for emergency response and evacuation planning.

4.12.6 LNG Truck Safety

Proposed LNG Truck Operations

No modifications to the existing LNG truck loading station at the KeySpan LNG facility are proposed. However, the function would change from primarily unloading LNG trucks from Distrigas to primarily loading LNG trucks destined to peak shaving and satellite plants throughout New England. The existing truck loading facilities are capable of loading a maximum of 24 trucks per day. The existing truck loading area is equipped with multiple safety features, both passive and active. Hazard detection includes combustible gas detectors and UV/IR flame detectors. Hazard controls include fixed and wheeled dry chemical fire extinguishers, high expansion foam, and fire water hydrants and monitors. Potential LNG spills would be contained and drained by trenches to a remote impoundment sump. Each trailer would also have a high-level petcock to check the LNG level inside the trailer during filling.

LNG Truck Operations in New England

The transportation of LNG by truck from the Distrigas LNG import terminal in Everett, Massachusetts began in 1971. Approximately 250,000 LNG trucks have been loaded at the facility through the end of calendar year 2001 (see Table 4.12.6-1). For the 31-year period, this represents an annual average of 8,056 trucks per year. However, the number of LNG truck loadings can vary significantly from year to year, depending on the severity of the weather and the number of LNG ship cargos delivered to the Distrigas LNG terminal.

TABLE 4.12.6-1

LNG Truck Loadings at the Distrigas LNG Terminal

Year(s)	Trucks	Max/Year
1971-1979	43,694	
1980-1989	95,027	15,656
1990-1999	83,613	12,885
2000-2001	27,397 [a/]	16,813 [a/]
Total	249,731	

[a/] Estimated from MMBtu truck sendout data.

LNG deliveries by truck have been made to approximately 25 facilities in the northeast, including LNG peak shaving plants, as well as to large and small satellite plants. While the majority of the deliveries are made to facilities in Massachusetts, Rhode Island, and Connecticut, more distant trips are made north to Lewiston, Maine and south to McKee City, New Jersey. The mean distance between Distrigas and the receiving plants is 70 miles.

One of the satellite facilities presently supplied by Distrigas is the KeySpan LNG plant in Providence, which receives an average of approximately 1,300 LNG truck deliveries per year. Loaded LNG trucks from Everett travel south down Interstate 93 to Interstate 95, exit at Thurber's Avenue, and travel south down Allens Avenue to the LNG facility.

Restrictions on LNG trucking have been imposed by local authorities in some areas: curfews when children are arriving or leaving school; routing to avoid congested main streets; avoiding certain bridges where a preferred alternative exists; parking restrictions; and prohibition from tunnels. When LNG trucking commenced in 1971, six trucking companies served the Distrigas trade. That number subsequently dropped to two, with well over 90 percent of the Distrigas trade handled by Transgas of Lowell, Massachusetts with the remainder by L.P. Transport of Chester, New York.

LNG truck drivers receive 1 week of training specific to LNG operations. A licensed, experienced, newly hired driver receives a 1-day classroom session and 1 day of hands-on truck yard training, followed by 3 days of on-the-road operation with a fully qualified and experienced LNG truck driver as co-pilot. The "Transgas LNG Safety Handbook" serves as the basic instructional material.

Since May 1983, LNG transporters and operators of storage facilities have participated in an emergency response cooperative agreement -- "LNG Trucking Emergency Response Plan for New England," sponsored by the New England Gas Association. The plan, which has undergone several revisions, divides New England into 15 zones, each having a designated response company with the capability of responding to an LNG trucking emergency with qualified personnel and specialized equipment. 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 truck;
- identify technical resources available to local authorities responding to the scene of an LNG truck emergency;
- provide a framework for "responding companies" in the Voluntary Assistance Agreement, which defines the roles and obligations of participating New England shippers, LNG terminals, and LNG truck carriers; and
- serve as the LNG Truck Emergency Preparedness Plan.

The organization of the plan incorporates the use of: (a) LNG truck carriers; (b) a zone response network; (c) chemical transportation emergency center; and (d) an emergency plan committee.

LNG Truck Accident History

While the history of LNG trucking has been free of major incidents, the possibility of an LNG truck accident over the duration of the project cannot be discounted. Unlike conventional gasoline or oil tank trailers, LNG trailers are of a double-shell construction -- an inner tank constructed of a cryogenic alloy to contain the LNG, an outer tank of carbon steel, and an evacuated annular space containing perlite insulation. Stiffening rings are incorporated in the outer shell to improve its structural strength and prevent its collapse. A typical 11,000-gallon tanker has a length of 42 feet, an inner tank diameter of 7 feet 4 inches, and an outer tank diameter of 8 feet. LNG trailer design must comply with the requirements of 49 CFR 173. Drivers must meet the training requirements in 49 CFR 172.

The LNG trucks have a relatively high center of gravity compared to other petroleum trucks, due to the low density of LNG and the large tank diameter. This feature increases the truck's susceptibility to over turning accidents in some situations. However, the double-shell construction provides additional damage protection to minimize the potential for a major shell failure and product release.

In 1979, the DOT sponsored a study to quantitatively evaluate the risks associated with the then-current and future levels of LNG trucking from the Distrigas import terminal in Everett. The study was in part a response to an approval by the DOE in 1978 for a three-fold increase of LNG imports at Everett. The final report, "Assessment of Risks and Risk Control Options Associated with Liquefied Natural Gas Trucking Operations from the Distrigas Terminal, Everett, Massachusetts," was completed by Arthur D. Little, Inc. (A.D. Little) in June 1979.

The study included an evaluation of all known LNG truck accidents in the United States from 1970 through 1977, alternatives to LNG trucking, and risk control options. While the study found the risks associated with the then-current LNG trucking operations were fairly low, it presented a number of options which could reduce risk levels even further. It was estimated that the accident rate per mile could be reduced by 60 percent if these recommendations were followed. In fact, the accident rate has dropped by 80 percent.

Table 4.12.6-2 summarizes LNG truck accidents from 1970 through 1977 and 1978 through 2002. The accident rate of the second period, during which the recommendations in the A.D. Little report were adopted, decreased by approximately 80 percent compared with the first period.

TABLE 4.12.6-2

LNG Truck Accident Summary

Years	Number of Accidents	Miles Traveled (millions)	Accidents Per Year	Accidents Per Million Miles
1970-1977	13	26	1.6	0.5
1978-2002	8	81 [a]	0.3	0.1

[a] Estimated for 1995 through 2002 based on trucking levels.

Rollovers, which accounted for 76 percent (16) of the accidents over the 33-year period, are attributed to the relatively high center of gravity. Only four of the accidents resulted in a loss of product, because of the additional damage protection provided by the double-shell construction. Three of these involved relatively minor leaks from fittings or valves that were damaged in the accident. In the only accident involving tank damage, 20 percent of the cargo was spilled. None of the releases resulted in an ignition of vapors and subsequent fire. If an LNG truck accident were to occur along the truck route, the potential hazard would depend on the severity of the accident and whether the cargo tank or associated valves sustained damage. This in turn would determine if the evacuation of nearby residences or businesses was necessary as well as what radius to evacuate. From the historical data, LNG truck accidents have resulted in only minor spills without an LNG fire. According to the 2000 Emergency Response Guide, for a large spill of either LNG or LPG, both widely transported throughout New England, the initial evacuation of 0.5 mile should be considered.

Although the A.D. Little study was prepared in the late 1970s, it is a comprehensive analysis that accurately depicts the LNG trade some 25 years later for several reasons: (1) the LNG trucking levels have remained within the maximum predicted in the report; (2) the LNG truck routes are essentially unchanged other than minor variations to improve safety; (3) the annual mileage has remained within the limits of the study; and (4) the destinations are essentially unchanged (except that five satellite plants in Connecticut have been taken out of service). As a result, the conclusions on the safety of LNG truck transportation remain valid. Further, the 33 years of operation in New England without a public fatality or the ignition of LNG vapors from an LNG truck spill supports the relative safety of this mode of transportation.

4.12.7 Terrorism and Security Issues

The security requirements for the onshore component of the proposed project are governed by 49 CFR 193, Subpart J - Security. This subpart includes requirements for conducting security inspections and patrols, liaison with local law enforcement officials, design and construction of protective enclosures, lighting, monitoring, alternative power sources, and warning signs. Requirements for maintaining safety of the marine terminal are in 33 CFR 127. Requirements for maintaining security of the marine terminal are in 33 CFR 105.

In the aftermath of the terrorist attacks that occurred on September 11, 2001, terrorism has become a very real issue for the facilities under the Commission's jurisdiction. The FERC, like other federal agencies, is faced with a dilemma in how much information can be offered to the public while still providing a significant level of protection to the facility. Consequently, the FERC has removed energy facility design plans and location information from its website to ensure that sensitive information filed under CEII is not readily available (RM02-4-000 and PL02-1-000 issued February 20, 2003).

Since September 11, 2001, the FERC has been involved with other federal agencies in developing a coordinated approach to protecting the energy facilities of the United States. The FERC continues to

coordinate with these agencies and specifically with the Coast Guard to address this issue. The Coast Guard now requires arriving ships to provide them with a 96-hour advance notice of arrival that includes key information about the vessel and its crew which allows the Coast Guard to conduct a terrorism risk assessment and put in place appropriate mitigation before the ship reaches the ship channel. In addition, interstate natural gas companies are actively involved with several industry groups to chart how best to address security measures in the current environment. A Security Task Force has been created and is addressing ways to improve pipeline security practices, strengthen communications within the industry and the interface with government, and extend public outreach efforts.

In September 2002, the DOT's OPS issued non-public guidelines to LNG operators that direct them to develop new security procedures for onshore facilities. Operators were required to prepare a security plan within 6 months that responds to the five threat levels defined by the Office of Homeland Security. OPS conducts subsequent onsite reviews of the security procedures.

On October 22, 2003, the Coast Guard issued a series of six final rules that promulgated the maritime security requirements of the Marine Transportation Security Act of 2002: Implementation of National Maritime Security Initiatives; Area Maritime Security; Vessel Security; Facility Security; Continental Shelf Facility Security; and the Automatic Identification System. The entire series of rulemakings establishes a new subchapter H in 33 CFR. In support of the rulemakings, the Coast Guard applied a risk-based decision making process to comprehensively evaluate the relative risks of various target and attack mode combinations and scenarios for those vessel types and port facilities that pose a risk of a security incident. This approach provides a more realistic estimation of risk than a simple "worst-case outcome" assessment. Risk management principles acknowledges that while risk generally cannot be eliminated, it can be reduced by adjusting operations to lower consequences, threats, or vulnerability, recognizing that it is easier to reduce vulnerabilities by adding security measures.

On December 29, 2003, all terminal owners or operators subject to 33 CFR 105 were required to submit a *Facility Security Assessment and Facility Security Plan* to the Coast Guard Captain of the Port for review and approval. The Facility Security Plans were required to be implemented no later than July 1, 2004 or for facilities constructed after July 1, 2004, 60 days prior to operations. Some of the principal owner or operator responsibilities include:

- designating a FSO with a general knowledge of current security threats and patterns, risk assessment methodology, and the responsibility for implementing the Facility Security Plan and Assessment and performing an annual audit for the life of the project;

- conducting a Facility Security Assessment to identify site vulnerabilities, possible security threats and consequences of an attack, and facility protective measures;

- developing a Facility Security Plan based on the Facility Security Assessment, with procedures for responding to transportation security incidents, notification and coordination with local, state, and federal authorities, prevent unauthorized access; measures and equipment to prevent or deter dangerous substances and devices, training, and evacuation;

- implementing scalable security measures to provide increasing levels of security at increasing MARSEC levels for facility access control, restricted areas, cargo handling, vessel stores and bunkers, and monitoring;

- conducting security exercises at least once each calendar year and drills at least every 3 months; and

- reporting of all breaches of security and security incidents.

Increased security awareness has occurred throughout the industry and the nation. President Bush established the Office of Homeland Security with the mission of coordinating the efforts of all executive departments and agencies to detect, prepare for, prevent, protect against, respond to, and recover from terrorist attacks within the United States. The Commission, in cooperation with other federal agencies and industry trade groups, has joined in the efforts to protect the energy infrastructure, including the more than 300,000 miles of interstate natural gas transmission pipeline and associated LNG facilities.

Safety and security are important considerations in any Commission action. The attacks of September 11, 2001 have changed the way pipeline operators as well as regulators must consider terrorism, both in approving new projects and in operating existing facilities. However, the likelihood of future acts of terrorism or sabotage occurring at the proposed LNG import terminal, or at any of the myriad natural gas pipeline or energy facilities throughout the United States is unpredictable given the disparate motives and abilities of terrorist groups. The continuing need to construct facilities to support the future natural gas pipeline infrastructure is not diminished by the threat of any such unpredictable acts.

4.12.8 Pipeline Facilities

The transportation of natural gas by pipeline involves some risk to the public in the event of an accident and subsequent release of gas. The greatest hazard is a fire or explosion following a major pipeline rupture.

Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but is classified as a simple asphyxiate, possessing a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death.

Methane has an ignition temperature of 1,000 ºF and is flammable at concentrations between 5 percent and 15 percent in air. Unconfined mixtures of methane in air are not explosive. However, a flammable concentration within an enclosed space in the presence of an ignition source can explode. Methane is buoyant at atmospheric temperatures and disperses rapidly in air.

4.12.8.1 Safety Standards

The DOT is mandated to provide pipeline safety under Title 49, U.S.C. Chapter 601. The Pipeline and Hazardous Materials Safety Administration's (PHMSA) OPS administers the national regulatory program to ensure the safe transportation of natural gas and other hazardous materials by pipeline. It develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Many of the regulations are written as performance standards which set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve safety. The PHMSA ensures that people and the environment are protected from the risk of pipeline incidents. This work is shared with state agency partners and others at the federal, state, and local level. Section 5(a) of the Natural Gas Pipeline Safety Act provides for a state agency to assume all aspects of the safety program for intrastate facilities by adopting and enforcing the federal standards, while section 5(b) permits a state agency that does not qualify under section 5(a) to perform certain inspection and monitoring functions. A state may also act as the DOT's agent to inspect interstate facilities within its boundaries; however, the DOT is responsible for enforcement action. The majority of the states have either 5(a) certifications or 5(b) agreements, while nine states act as interstate agents.

The DOT pipeline standards are published in Parts 190-199 of Title 49 of the CFR. Part 192 of 49 CFR specifically addresses natural gas pipeline safety issues.

Under a Memorandum of Understanding on Natural Gas Transportation Facilities (Memorandum) dated January 15, 1993 between the DOT and the FERC, the DOT has the exclusive authority to promulgate federal safety standards used in the transportation of natural gas. Section 157.14(a)(9)(vi) of the FERC's regulations require that an applicant certify that it will design, install, inspect, test, construct, operate, replace, and maintain the facility for which a certificate is requested in accordance with federal safety standards and plans for maintenance and inspection, or shall certify that it has been granted a waiver of the requirements of the safety standards by the DOT in accordance with section 3(e) of the Natural Gas Pipeline Safety Act. The FERC accepts this certification and does not impose additional safety standards other than the DOT standards. If the Commission becomes aware of an existing or potential safety problem, there is a provision in the Memorandum to promptly alert the DOT. The Memorandum also provides for referring complaints and inquiries made by state and local governments and the general public involving safety matters related to pipeline under the Commission's jurisdiction.

The FERC also participates as a member of the DOT's Technical Pipeline Safety Standards Committee which determines if proposed safety regulations are reasonable, feasible, and practicable.

The pipeline and aboveground facilities associated with the KeySpan LNG Project must be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR 192. The regulations are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. Part 192 specifies material selection and qualification, minimum design requirements, and protection from internal, external, and atmospheric corrosion.

Part 192 also defines area classifications, based on population density in the vicinity of the pipeline, and specifies more rigorous safety requirements for populated areas. The class location unit is an area that extends 220 yards on either side of the centerline of any continuous 1 mile length of pipeline. The four area classifications are defined as follows:

Class 1	Location with 10 or fewer buildings intended for human occupancy.
Class 2	Location with more than 10 but less than 46 buildings intended for human occupancy.
Class 3	Location with 46 or more buildings intended for human occupancy or where the pipeline lies within 100 yards of any building, or small well-defined outside area occupied by 20 or more people on at least 5 days a week for 10 weeks in any 12-month period.
Class 4	Location where buildings with four or more stories aboveground are prevalent.

Class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. Pipelines constructed on land in Class 1 locations must be installed with a minimum depth of cover of 30 inches in normal soil and 18 inches in consolidated rock. All pipelines installed in navigable rivers, streams, and harbors must have a minimum cover of 48 inches in soil or 24 inches in consolidated rock. Class 2, 3, and 4 locations, as well as drainage ditches of public roads and railroad crossings, require a minimum cover of 36 inches in normal soil and 24 inches in consolidated rock.

Class locations also specify the maximum distance to a sectionalizing block valve (e.g., 10.0 miles in Class 1, 7.5 miles in Class 2, 4.0 miles in Class 3, and 2.5 miles in Class 4). Pipe wall thickness and pipeline design pressures, hydrostatic test pressures, MAOP, inspection and testing of welds, and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas. Algonquin performed conservative class location reviews which took into account existing class factors as well as the potential for growth along the proposed route. These reviews utilized aerial photography, preliminary surveys, and other reliable information. Based on these reviews, Algonquin has designed the project to meet Class 3 requirements for the entire length. After the project would be completed, a final detailed class location analysis would be performed using as-built drawings, surveys, and other relevant information consistent with 49 CFR 192.111. Current class locations for this pipeline would be developed based on the relationship of the pipeline centerline to other nearby structures and manmade features. As a result of this final class location analysis, some of this pipeline may be re-designated as Class 1 or Class 2 instead of Class 3. If a subsequent increase in population density adjacent to the right-of-way indicates a change in class location for the pipeline, Algonquin would be required to reduce the MAOP or replace the segment with pipe of sufficient grade and wall thickness to comply with the DOT code of regulations for the new class location.

In 2002, Congress passed an act to strengthen the Nation's pipeline safety laws. The Pipeline Safety Improvement Act of 2002 (HR 3609) was passed by Congress on November 15, 2002, and signed into law by the President in December 2002. No later than December 17, 2004, gas transmission operators must develop and follow a written integrity management program that contains all the elements described in §192.911 and addresses the risks on each covered transmission pipeline segment. Specifically, the law establishes an integrity management program which applies to all high consequence areas (HCAs). The DOT (68 Federal Register [FR] 69778, 69 FR 18228, and 69 FR 29903) defines HCAs as they relate to the different class zones, potential impact circles, or areas containing an identified site as defined in §192.903 of the DOT regulations.

OPS published a series of rules from August 6, 2002 to May 26, 2004 (69 FR 29903) that defines HCAs where a gas pipeline accident could do considerable harm to people and their property and requires an integrity management program to minimize the potential for an accident. This definition satisfies, in part, the Congressional mandate in 49 U.S.C. 60109 for OPS to prescribe standards that establish criteria for identifying each gas pipeline facility in a high-density population area.

The HCAs may be defined in one of two ways. In the first method an HCA includes:

- current class 3 and 4 locations;
- any area in Class 1 or 2 where the potential impact radius[8] is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle;[9] or
- any area in Class 1 or 2 where the potential impact circle includes an identified site.[10]

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[8] The potential impact radius is calculated as the product of 0.69 and the square root of the MAOP of the pipeline in psi multiplied by the pipeline diameter in inches.

[9] The potential impact circle is a circle of radius equal to the potential impact radius.

[10] An identified site is an outside area or open structure that is occupied by 20 or more persons on at least 50 days in any 12-month period; a building that is occupied by 20 or more persons on at least 5 days a week for any 10 weeks in any 12-month period; or a facility that is occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.

In the second method an HCA includes any area within a potential impact circle which contains:

- 20 or more buildings intended for human occupancy; or
- an identified site.

Algonquin Gas Transmission, LLC, has stated that both the proposed pipeline route and the only viable alternative (alternative route 6) appear to be located entirely within high consequence areas. Once a pipeline operator has determined the HCAs on its pipeline, it must apply the elements of its integrity management program to those segments of the pipeline within HCAs. The DOT regulations specify the requirements for the integrity management plan at § 192.911. The pipeline integrity management rule for HCAs requires inspection of the entire pipeline in HCAs every 7 years.

Part 192 prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Under section 192.615, each pipeline operator must also establish an emergency plan that includes procedures to minimize the hazards in a natural gas pipeline emergency. Key elements of the plan include procedures for:

- receiving, identifying, and classifying emergency events, gas leakage, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- emergency shutdown of system and safe restoration of service;
- making personnel, equipment, tools, and materials available at the scene of an emergency; and
- protecting people first and then property, and making them safe from actual or potential hazards.

Part 192 prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. The proposed pipeline would be operated by Algonquin according to standards and procedures that have been approved by the DOT.

The pipeline would be patrolled and inspected on a periodic basis per DOT requirements or better. The frequency of these inspections would be affected by activity along the pipeline route such as construction or possible encroachment. These inspections would identify conditions indicative of pipeline leaks, evidence of pipeline damage or deterioration, damage to erosion controls, loss of cover, third party activities, or conditions that may presently or in the future affect pipeline integrity, safety, or operation. The pipeline system would participate in the state "One Call" system (referred to in Rhode Island as the “Dig Safe” program).

Part 192 requires that each operator must establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a natural gas pipeline emergency, and to coordinate mutual assistance. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public

officials. Algonquin would maintain liaisons with public authorities and local utilities and maintain a current contact list that it periodically reviews and updates. Algonquin's liaison program would include:

- periodic fire fighting demonstrations emphasizing when and when not to extinguish a natural gas fire during an emergency and how to extinguish different types of natural gas fires;
- periodic visits with municipal safety officials to inform them of the nature and operation conditions of the pipeline facilities and to coordinate emergency response in the event of an accident;
- special informational meetings and training at the request of the municipality;
- periodic literature distribution to the emergency response agencies listing emergency telephone numbers for Algonquin and other pertinent data; and
- maps provided to police and fire departments showing the location of the pipeline within the boundaries of their communities.

4.12.8.2 Pipeline Accident Data

Since February 9, 1970, 49 CFR 191 has required all operators of transmission and gathering systems to notify the DOT of any reportable incident and to submit a report on form F7100.2 within 20 days. Reportable incidents are defined as any leaks that:

- caused a death or personal injury requiring hospitalization;
- required taking any segment of transmission line out of service;
- resulted in gas ignition;
- caused estimated damage to the property of the operator, or others, or both, of a total of $5,000 or more;
- required immediate repair on a transmission line;
- occurred while testing with gas or another medium; or
- in the judgment of the operator was significant, even though it did not meet the above criteria.

The DOT changed reporting requirements after June 1984 to reduce the amount of data collected. Since that date, operators must only report incidents that involve property damage of more than $50,000, injury, death, release of gas, or that are otherwise considered significant by the operator. Table 4.12.8-1 presents a summary of incident data for the 1970 to 1984 period, as well as more recent incident data for 1986 through 2003, recognizing the difference in reporting requirements. The 14.5-year period from

1970 through June 1984, which provides a larger universe of data and more basic report information than subsequent years, has been subject to detailed analysis, as discussed in the following sections.[11]

During the 14.5-year period, 5,862 service incidents were reported over the more than 300,000 total miles of natural gas transmission and gathering systems nationwide. Service incidents, defined as failures that occur during pipeline operation, have remained fairly constant over this period with no clear upward or downward trend in annual totals. In addition, 2,013 test failures were reported. Correction of test failures removed defects from the pipeline before operation.

TABLE 4.12.8-1

Natural Gas Service Incidents by Cause

	Incidents per 1,000 Miles of Pipeline (Percentage)	
Cause	1970-1984	1986-2003
Outside force	0.70 (53.8)	0.10 (38.4)
Corrosion	0.22 (16.9)	0.06 (23.9)
Construction or material defect	0.27 (20.8)	0.04 (15.0)
Other	0.11 (8.5)	0.06 (22.7)
Total	1.30	0.26

Additional insight into the nature of service incidents may be found by examining the primary factors that caused the failures. Table 4.12.8-1 provides a percentage distribution of the causal factors as well as the annual frequency of each factor per 1,000 miles of pipeline in service. The pipelines included in the data set in table 4.12.8-1 vary widely in terms of age, pipe diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline.

The frequency of service incidents is strongly dependent on pipeline age. While pipelines installed since 1950 exhibit a fairly constant level of service incident frequency, pipelines installed before that time have a significantly higher rate, partially due to corrosion. Older pipelines have a higher frequency of corrosion incidents, since corrosion is a time-dependent process. Further, new pipe generally uses more advanced coatings and cathodic protection to reduce corrosion potential.

Older pipelines have a higher frequency of outside forces incidents partly because their location may be less well known and less well marked than newer lines. In addition, the older pipelines contain a disproportionate number of smaller diameter pipelines, which have a greater rate of outside forces incidents. Small diameter pipelines are more easily crushed or broken by mechanical equipment or earth movements.

The dominant incident cause between 1970 and 1984 was outside forces, constituting 53.8 percent of all service incidents. The 1986 through 2003 data show that the portion of incidents caused by outside forces has decreased to 38.4 percent. Outside forces incidents result from the encroachment of mechanical equipment such as bulldozers and backhoes; earth movements due to soil settlement, washouts, or geologic hazards; weather effects such as winds, storms, and thermal strains; and willful damage. Table 4.12.8-2 shows that human error in equipment usage was responsible for approximately 75 percent of outside forces incidents. Since April 1982, operators have been required to participate in "One Call" public utility programs in populated areas to minimize unauthorized excavation activities in the vicinity of pipelines. The "One Call" program is a service used by public utilities and some private

[11] Jones, D.J., G.S. Kramer, D.N. Gideon, and R.J. Eiber, 1986. "An Analysis of Reportable Incidents for Natural Gas Transportation and Gathering Lines 1970 Through June 1984." NG-18 Report No. 158, Pipeline Research Committee of the American Gas Association.

sector companies (e.g., pipeline and cable television companies) to provide preconstruction information to contractors or other maintenance workers on the underground location of pipes, cables, and culverts.

TABLE 4.12.8-2

Outside Forces Incidents by Cause (1970-1984)

Cause	Percent
Equipment operated by outside party	67.1
Equipment operated by or for operator	7.3
Earth movement	13.3
Weather	10.8
Other	1.5

Table 4.12.8-3 clearly demonstrates the effectiveness of corrosion control in reducing the incidence of failures caused by external corrosion. The use of both an external protective coating and a cathodic protection system, required on all pipelines installed after July 1971, significantly reduces the rate of failure compared to unprotected or partially protected pipe. The data show that bare, cathodically protected pipe actually has a higher corrosion rate than unprotected pipe. This anomaly reflects the retrofitting of cathodic protection to actively corroding spots on pipes.

TABLE 4.12.8-3

External Corrosion by Level of Control (1970-1984)

Corrosion Control	Incidents per 1,000 Miles per Year
None-bare pipe	0.42
Cathodic protection only	0.97
Coated only	0.40
Coated and cathodic protection	0.11

4.12.8.3 Impact on Public Safety

The service incident data summarized in table 4.12.8-1 include pipeline failures of all magnitudes with widely varying consequences. Approximately two-thirds of the incidents were classified as leaks, with the remaining one-third classified as ruptures, implying a more serious failure.

Table 4.12.8-4 presents the average annual fatalities that occurred on natural gas transmission and gathering lines from 1970 to 2003. Fatalities between 1970 and June 1984 have been separated into employees and nonemployees, to better identify a fatality rate experienced by the general public. Of the total 5.0 nationwide average, fatalities among the public averaged 2.6 per year over this period. The simplified reporting requirements in effect after June 1984 do not differentiate between employees and nonemployees. However, the data show that the total annual average for the period 1984 through 2003 decreased to 3.8 fatalities per year. Subtracting two major offshore incidents in 1989, which do not reflect the risk to the onshore public, yields a total annual rate of 2.9 fatalities per year for this period.

TABLE 4.12.8-4

Annual Average Fatalities - Natural Gas Transmission and Gathering Systems [a/], [b/]

Year	Employees	Nonemployees	Total
1970-June 1984	2.4	2.6	5.0
1984-2003 [c/]	-	-	3.8
1984-2003 [c/]	-	-	2.9 [d/]

[a/] 1970 through June 1984 - American Gas Association, 1986.
[b/] DOT Hazardous Materials Information System.
[c/] Employee/nonemployee breakdown not available after June 1984.
[d/] Without 18 offshore fatalities occurring in 1989: 11 fatalities resulted from a fishing vessel striking an offshore pipeline and 7 fatalities resulted from an explosion on an offshore production platform.

The nationwide totals of accidental fatalities from various manmade and natural hazards are listed in table 4.12.8-5 in order to provide a relative measure of the industry-wide safety of natural gas pipelines. Direct comparisons between accident categories should be made cautiously, however, because individual exposures to hazards are not uniform among all categories. Nevertheless, the average 2.6 public fatalities per year is relatively small considering the more than 300,000 miles of transmission and gathering lines in service nationwide. Furthermore, the fatality rate is approximately two orders of magnitude (100 times) lower than the fatalities from natural hazards such as lightning, tornados, floods, earthquakes, etc.

The available data show that natural gas pipelines continue to be a safe, reliable means of energy transportation. Based on approximately 306,000 miles in service, the rate of public fatalities for the nationwide mix of transmission and gathering lines in service is 0.01 per year per 1,000 miles of pipeline. Using this rate, the pipeline facilities associated with the KeySpan LNG Project might result in a public fatality every 69,000 years. This would represent a slight increase in risk to the nearby public.

TABLE 4.12.8-5

Nationwide Accidental Deaths [a/]

Type of Accident	Fatalities
All accidents	90,523
Motor vehicles	43,649
Falls	14,985
Drowning	3,488
Poisoning	9,510
Fires and burns	3,791
Suffocation by ingested object	3,206
Tornado, flood, earthquake, etc. (1984 to 1993 average)	181
All liquid and gas pipelines (1978 to 1987 average) [b/]	27
Gas transmission and gathering lines Nonemployees only (1970 to 1984 average) [c/]	2.6

[a/] All data, unless otherwise noted, reflect 1996 statistics from the U.S. Department of Commerce, Bureau of the Census, "Statistical Abstract of the United States 118th Edition."
[b/] U.S. Department of Transportation, "Annual Report on Pipeline Safety - Calendar Year 1987."
[c/] American Gas Association, 1986.

4.12.9 Additional Safety Issues Identified in Scoping

Liability - Although this topic is outside the scope of the EIS and is more properly addressed in legal forums, several laws may apply. Financial responsibility for the compensation of personal or property losses due to a marine incident may be subject to the Limitation of Vessel Owner's Liability Act, 46 U.S.C. 181 et seq. Under 49 U.S.C. 60111, the Secretary of Transportation can order the operator of a LNG facility to demonstrate and maintain financial responsibility in at least the amount the Secretary considers adequate.

Tug Fire Fighting Capacity - Questions were raised by commentors regarding the fire-fighting capability of the tugs that would be used to assist with berthing and unberthing of LNG vessels at the proposed facility. It is anticipated that two new tractor tugs would typically assist with LNG vessel berthing and unberthing. An additional tug would be used during extreme docking conditions to provide additional control. Each new tug would comply with fire fighting capability recommendations for LNG Receiving Terminals of the SIGTTO, and with the international firefighting specifications known as FiFi Class 1. FiFi Class 1 requires the following capabilities:

- 2 Firewater monitors per vessel
- Monitor Flow Rate of 1,200 m^3 per hour per each firewater monitor
- 1-2 Fire Pumps per vessel
- Total pumping capacity of 2,400 m^3 per hour (approximately 10,550 gallons per minute) per vessel
- Operating time of 24 hours based on fuel capacity
- Minimum water stream throw length of 120 meters
- Minimum water stream throw height of 45 meters
- Water spray deluge system to allow for operation close to a fire.

Proximity to Airport - Some commentors mentioned a concern that the KeySpan LNG facility may be sited too closely to the TF Green Airport and its associated flight paths. The federal regulations address this issue, in general, in 49 CFR 193.2155(b), which states that "an LNG storage tank must not be located within a horizontal distance of one mile (1.6 km) from the ends, or ¼ mile (0.4 km) from the nearest point of a runway, whichever is longer." The existing KeySpan LNG facility is located over 4 miles from the runways at the TF Green Airport and therefore currently complies with this regulation.

Existing LNG Storage Tank - Several commentors questioned the proposed use of KeySpan LNG's existing 30-year-old storage tank with respect to the frequent loading cycles associated with LNG import operations. Specific concerns included the general aging of the tank, stress on the tank due to thermal cycling, stress due to constant pressure within the tank, and physical stress on the tank from the loading and unloading cycles.

There are a number of operational factors that have preserved the structural integrity of the LNG storage tank over its 30-year history. An oxygen-free environment has been maintained on all sides of the inner LNG tank, which has served to prevent any possible deterioration due to corrosion. In addition, the LNG tank does not experience high pressures. The pressure inside the outer tank remains only slightly above atmospheric pressure, and the pressure exerted by loading cycles on the inner tank is well within the design limit of the materials. Furthermore, the LNG storage tank is continuously maintained at

cryogenic temperatures to avoid thermal cycling effects. KeySpan LNG's storage tank has only been warmed to ambient temperature one time (in 1999) during its three decades of service, and the integrity of the welds on the inner floor was verified at that time.

Issues regarding compliance of the existing LNG storage tank and facilities with the current LNG safety standards in 49 CFR Part 193 and NFPA 59A (2001 edition), and what modifications would be necessary to meet them are evaluated in Section 4.1.3.

Hurricanes and Severe Weather - One commentor requested an explanation of KeySpan LNG's safety plan for a hurricane or severe storm occurring at the LNG terminal, particularly if this event occurred during ship unloading operations.

The effects of hurricane force winds were taken into consideration during the design of the existing KeySpan LNG storage tank and the proposed LNG facilities. The existing storage tank was designed to withstand a 100 mph windspeed and was later evaluated to be capable of withstanding 155 mph winds. In accordance with 49 CFR 193.2067, the design wind force for the proposed facilities was calculated based on a wind velocity having a probability of exceedance in a 50-year period of 0.5 percent or less. Using data provided by the National Climatic Data Center for Providence Airport at Warwick, Rhode Island for the period of 1930 through 1996, this design wind velocity was determined to be 115 mph. All critical structures within the terminal (i.e., LNG and natural gas containing equipment and piping and their support structures, emergency shutdown systems, fire protection systems, and main control room) are designed to withstand a sustained windspeed of at least 115 mph. Plant emergency procedures also require de-energizing electrical equipment in the LNG tank and dike area if storm surges are predicted. More discussion on storm surges and flooding appears in section 4.1.4.5.

Most importantly, ships would not be allowed to unload LNG at the KeySpan LNG terminal during hurricane conditions. Sustained windspeeds of this magnitude are predictable with a reasonably long forecast, and an LNG ship would not transit to the terminal unless weather conditions would allow the vessel to berth and discharge its cargo safely. During less severe storm events, if an LNG ship would be berthed at the terminal, KeySpan LNG has stated that all cargo transfer operations would cease whenever the windspeed became excessive or whenever an electrical storm was in the area. The actual limitations of severe weather would be determined by the Coast Guard in developing the LNG Operating Plan. Additionally, tugs would be available in the port on short notice to assist the vessel's mooring systems if needed to keep the vessel safely moored alongside the berth in the event of high wind conditions. The Coast Guard would require the vessel to depart before windspeeds increased to unsafe levels.

4.12.10 Conclusions on Safety Issues

The existing KeySpan LNG facility commenced operations in May 1974, prior to the February 1980 Federal LNG Safety Standards in 49 CFR Part 193. During more than 30 years of operation, the facility has provided winter storage services with the tank filled exclusively by LNG truck, except for a single barge cargo in July 1974. The proposed change of the historical mode of operations of the facility to a baseload import terminal, with the LNG storage tank filled weekly by LNG vessels, supports the need for the existing LNG storage tank and facilities to be modified as necessary to meet the current LNG safety standards in 49 CFR Part 193 and NFPA 59A (2001 edition).

To meet the current Federal Safety Standards, KeySpan LNG would need to make major modifications to the LNG storage that would remove it from service for 2 to 3 heating seasons: (1) replace anchor straps, increase inner floor thickness, or replace foundation for seismic requirements; (2) install in-tank pumps and eliminate bottom penetrations to reduce flammable vapor exclusion zones; (3) increase

impoundment capacity; (4) add pressure and vacuum relief valves; and (5) acquire legal control of eight adjacent industrial properties for thermal exclusion zones.

Compliance with the flammable vapor exclusion zone requirements of 49 CFR Part 193.2059 for the proposed facilities is based on the assumption that the entire volume of cold vapor from the design spill would be contained within the main LNG storage tank impoundment, and therefore the flammable vapors would not extend beyond the LNG terminal site. However, the results of field tests would appear to refute this assumption that the 20-foot-high KeySpan LNG storage tank berm would completely contain the cold vapor from the design spill. As a result, we have recommended that KeySpan LNG provide a revised flammable vapor exclusion analysis for design spills that considers the effects of mixing with air on LNG vapors evolving from a spill within the impoundment in order to verify compliance with 49 CFR Part 193.2059.

Much of the recent safety debate has centered on the perceived size of worst case scenarios; the distance to various thermal radiation heat levels for LNG fires; the range of potentially flammable vapors; and the population and infrastructure that are located within the various hazard areas. These are components of a consequence analysis.

However, the evaluation of safety is more than an exercise in calculating the consequences of worst case scenarios. Rather, safety is a determination of the acceptability of risk which considers: (1) the probability of events; (2) the effect of mitigation; and (3) the consequences of events.

Accidental Causes - Based on the extensive operational experience of LNG shipping, the structural design of an LNG vessel, and the operational controls imposed by the Coast Guard and the local pilots, the likelihood of a cargo containment failure and subsequent LNG spill from a vessel casualty – collision, grounding, or allision – is highly unlikely. For similar reasons, an accident involving the onshore LNG import terminal or LNG trucking from the terminal is unlikely to affect the public. As a result, the risk to the public from accidental causes should be considered negligible.

Intentional Attacks - Unlike accidental causes, historical experience provides little guidance in estimating the probability of a terrorist attack on an LNG vessel or onshore storage facility. For a new LNG import terminal proposal, having a large volume of energy transported and stored near populated areas, the perceived threat of a terrorist attack may be considered as highly probable to the local population.

However, at the national level, potential terrorist targets are plentiful, many having national significance, while others with a large concentration of the public (major sporting events, skyscrapers, etc.) or critical infrastructure facilities. Currently, the United States has over 500 chemical facilities operating near large populations. U.S. waterways also transport over 100,000 annual shipments of hazardous marine cargo, including LPG, ammonia, and other volatile chemicals. Many of these substances pose a similar hazard to that of LNG.

Risk Management - While the risks associated with the transportation of any hazardous cargo can never be entirely eliminated, they can be managed. For potential targets where the threat is perceived to be high, resources can be directed to mitigate possible attack paths. Such efforts may deter potential attacks on one target, but shift efforts to those that are less protected. As a result, the issue is how to best direct finite resources.

For the proposed project, it may be possible to apply risk management resources to manage realistic threats; however, an even greater level of resources may be required to manage the threats as perceived at the local level. The issue for the decision makers is whether the resources required to

manage the risks are justified by the benefits, while recognizing that the risks cannot be entirely eliminated.

4.13 CUMULATIVE IMPACTS

Cumulative impact results when impacts associated with a proposed project are superimposed on, or added to, impacts associated with past, present, or reasonably foreseeable future projects within the area affected by the proposed project. Although the individual impacts of the separate projects may be minor, the effects from the projects taken together could be significant.

Existing environmental conditions in the project area have been influenced by human activities and residential, commercial, and industrial developments that have permanently altered the natural ecosystems within the immediate project area and the Narragansett Bay watershed. This is particularly true in and around the public ports within the bay including those at Providence, Quonset Point-Davisville, and Fall River.

Table 4.13-1 provides a list of past, present, or reasonably foreseeable future projects or activities that have impacted or may cumulatively impact resources that would be affected by construction and operation of the KeySpan LNG Project. These projects and activities are primarily located in the vicinity of the proposed project. More distant projects are not assessed because they generally do not have regional effects and, therefore, do not contribute significantly to cumulative impacts in the proposed project area. Potential impacts associated with the projects that are most likely to be cumulatively significant are related to aquatic resources, infrastructure and public services, vehicular traffic, ship traffic, air quality/noise, and natural gas infrastructure.

4.13.1 Aquatic Resources and Water Quality

The Providence River has been, and continues to be, degraded by both point and non-point sources of pollution. Non-point sources are predicted to continue and contribute significantly to water quality degradation (DEM, 2000). According to Rhode Island's 2004 Section305(b) Report ("State of the State's Waters" prepared by the DEM) of the 116.5 square miles of estuarine waters assessed for aquatic life use, 74.6 square miles (64 percent) fully support aquatic life needs, and 42 square miles (36 percent) are impaired for aquatic life uses. Pollution discharges have resulted in bacterial contamination, nutrient enrichment, and low dissolved oxygen problems in Narragansett Bay.

Major pollution sources include the upstream water treatment facilities on the Blackstone and Pawtuxet Rivers, combined sewer outfalls, and the two wastewater treatment facilities that discharge into the Seekonk and Providence Rivers. It is estimated that the wastewater treatment facilities, when combined with non-point sources, could be responsible for more than 50 percent of the suspended solids and concentrations of nitrates, cadmium, chromium, lead, PCBs, and PAHs entering the Providence River. Further, the two wastewater treatment facilities discharging directly to the Seekonk and Providence Rivers may contribute more than 50 percent of the ammonia, orthophosphate, petroleum hydrocarbons, copper, and nickel concentrations (COE, 2001). Additionally, combined sewer overflows can aesthetically limit use of the shore and restrict or curtail shellfishing. As discussed in section 4.8.5, the Providence River and Upper Narragansett Bay as well as certain other areas within the LNG ship route are permanently closed to shellfishing due to poor water and sediment quality, and two areas south of Conimicut Point (Conditional Areas A and B) are closed for 50 to 70 percent of the year due to unsuitable conditions.

TABLE 4.13-1

Past, Present, and Future Projects That Could Cumulatively Impact Resources of Concern Near the KeySpan LNG Project

		Primary Environmental Impact							
Activity/Project	Description	Aquatic Resources	Vegetation	Public Services	Vehicular Traffic	Ship Traffic	Land Use	Air Quality/Noise	Gas Infrastructure
Past and Present Activities/Projects									
Residential/Commercial/Industrial Developments	Various developments, including marinas, in and along the shore of Providence and East Providence as well as in other cities along the shipping channel and within the Narragansett Bay watershed.	✓	✓	✓	✓	✓	✓	✓	✓
Commercial/Recreational Fishing	Historically, commercial and recreational fishing and shellfishing occurred in the Providence River and Narragansett Bay. Because of the current status of fish populations, commercial fishing and shellfishing has been essentially eliminated from the Providence River but continues in some areas in Narragansett Bay. Recreational fishing is also an important activity in the river and in Narragansett Bay.	✓				✓		✓	
Recreational Boating	Recreational boating, including motor boating and sail boating, is widespread throughout Narragansett Bay and also occurs to a degree on the Providence River. Current estimates indicate that there are as many as 60,000 registered boaters in Rhode Island and the number is increasing. These activities generally occur during the six warmer months of the year but are particularly concentrated during June, July, and August.	✓		✓	✓	✓	✓	✓	
Regional Stormwater and Sewer Systems	The Narragansett Bay Commission estimates that 3.2 billion gallons of untreated wastes are discharged into Narragansett Bay every year from the 86 Combined Sewer Overflows (CSOs) within its jurisdiction; there are a total of 120 CSO inputs to Narragansett Bay.	✓		✓					

TABLE 4.13-1 (cont'd)

Past, Present, and Future Projects That Could Cumulatively Impact Resources of Concern Near the KeySpan LNG Project

		Primary Environmental Impact							
Activity/Project	Description	Aquatic Resources	Vegetation	Public Services	Vehicular Traffic	Ship Traffic	Land Use	Air Quality/Noise	Gas Infrastructure
Fields Point Wastewater Treatment Facility	The Fields Point facility provides preliminary and primary treatment for up to 200 million gallons of wastewater per day and secondary treatment for up to 91 million gallons of wastewater per day in addition the facility discharges into the bay.	✓							
Morton Salt	Located just north of the KeySpan LNG facility, Morton Salt produces table salt and provides salt to RIDOT for roadway use.	✓	✓		✓		✓		
Manchester Station Gas-Fired Generating Facility	Fossil fuel burning, electrical generating plant located on the Providence River less than a mile from the existing KeySpan LNG facility.	✓	✓				✓	✓	
Federal Project Navigational Channel Dredging	Maintenance dredging of existing 16.8-mile-long federal navigational channel and at specific marinas between Providence Harbor and Prudence Island.	✓				✓		✓	
ProvPort	Major port facility located adjacent to the existing KeySpan LNG facility. ProvPort generates large ship traffic in Narragansett Bay and stores materials, salt, aggregate, petroleum, and chemicals on site.	✓		✓	✓	✓	✓	✓	
Other Port Facilities	The State Pier and other port facilities along the banks of the Providence River and Narragansett Bay (e.g., Motiva Enterprises, Quonset / Davisville) are used to offload marine cargos including petroleum products.	✓		✓	✓	✓	✓	✓	
Future Activity/Project									
Narragansett Landing	Redevelopment of waterfront in the northern portion of the Providence River, between Point Street and Fields Point, to provide mixed use residential, commercial, and recreational land uses.	✓		✓	✓	✓	✓	✓	

TABLE 4.13-1 (cont'd)

Past, Present, and Future Projects That Could Cumulatively Impact Resources of Concern Near the KeySpan LNG Project

		Primary Environmental Impact							
Activity/Project	Description	Aquatic Resources	Vegetation	Public Services	Vehicular Traffic	Ship Traffic	Land Use	Air Quality/Noise	Gas Infrastructure
East Providence Waterfront Special Development District Plan	Redevelopment of waterfront in East Providence to provide mixed use residential, commercial, and recreational land uses.		✓	✓	✓		✓	✓	
T.F Green Airport Expansion	Growth plan that includes the potential expansion of an existing runway from 7,166 feet to 9,500 feet.		✓	✓	✓		✓	✓	
Interstate 95/Interstate 195 Highway Construction Project	Relocation and upgrade of major interstate highway system within 0.5 mile of proposed project area.		✓	✓	✓		✓	✓	
Weaver's Cove Energy LNG	Construction of a new LNG import terminal at Fall River, Massachusetts. Sendout pipeline would provide natural gas to the Algonquin system.	✓	✓	✓	✓	✓	✓	✓	✓
Somerset LNG	Construction of a new LNG import terminal at Brayton Point in Somerset, Massachusetts. Sendout pipeline would provide natural gas to Algonquin's G-system.	✓	✓	✓	✓	✓	✓	✓	✓
Expansion of boat slips and docking facilities	Proposals for the addition of approximately 2,056 boat slips within Narragansett Bay, the bulk of which are associated with the Weaver Cove Marina in Portsmouth.	✓		✓	✓	✓	✓	✓	

The Providence River waterfront in the vicinity of the proposed project area has been extensively modified by human activities. Dredging of ship channels and berths as well as coastal developments (e.g., piers, marinas, waterfront structures) have significantly altered habitats within the Providence River and Narragansett Bay. For example, Fields Point was created by importing fill and depositing it within the Providence River to create industrial waterfront. In addition to the existing KeySpan LNG facility, Fields Point contains a major wastewater treatment plant, ports, and other facilities. The Providence River channel has undergone significant modification as well. Finally, water temperatures in Narragansett Bay have increased the past 30 years. Likely causes include the discharge of waste heat into the bay from local power plants.

The federal navigational channel is periodically dredged to allow for transit of ship traffic to ports in Providence. This year the COE will complete the maintenance dredging of much of the federal navigational channel to reestablish a navigational channel depth of 40 feet and a width of 600 feet. The federal project along with other associated non-federal dredging actions involves dredging a total of about 4.8 million cubic yards of sediment from the existing navigational channel and from other locations throughout Narragansett Bay. The dredging extends from a point approximately 1 mile north of the KeySpan LNG facility to a point well south of the LNG terminal site in upper Narragansett Bay. The main effect of dredging the channel has been the disturbance of the benthic environment in the areas to be dredged and an associated increase in the suspended solids and contaminants in the water column.

In the foreseeable future, there will likely be other projects or activities that result in additional stresses on the aquatic resources of the Providence River and Narragansett Bay. As listed in table 4.13-1, there are also future waterfront development plans such as those proposed by Providence and East Providence, new boat slip developments, and future maintenance dredging, which could also degrade aquatic habitat in the project area. Specific KeySpan LNG Project activities such as pier and mooring installation and upland earthwork could result in cumulative impacts on aquatic resources if other projects are being constructed at the same general time.

During operation of the LNG terminal, prop wash from LNG ships and tugs could temporarily increase suspended sediments and turbidity in the navigation channel and contribute cumulatively to the impacts of current shipping activities in the Providence River and Narragansett Bay that temporarily disturb bottom sediments. If the Weaver's Cove Energy and/or Somerset LNG Projects are realized, additional cumulative impacts would occur along the KeySpan LNG shipping route within the approximately 16-nautical-mile-long portion of the shipping channel that would be used by all three of these projects. However, the sediments suspended by LNG ships calling at the KeySpan LNG terminal and other ships would resettle shortly after each ship passage. Additionally, even with the existing and proposed facilities operating simultaneously, disturbance associated with prop wash would not be expected to occur at intervals that would prevent resettling after each ship, although some of the suspended sediments could settle out in adjacent shallow water areas, harbors, and marinas, which could ultimately result in increased sedimentation in these areas. During the unloading of the LNG ships, the intake of ballast water could also contribute to sediment disturbance in the vicinity of the KeySpan LNG facility.

The entrainment and impingement of fish (eggs, larvae, juveniles, and/or adults) during construction and operation of the KeySpan LNG Project could also contribute to the cumulative impact on biological resources in Narragansett Bay and the Providence River. As discussed in section 4.3.2 of this EIS, Algonquin may withdraw 120,000 gallons of water from the Providence River to hydrostatically test the sendout pipeline. Further, each ship unloading LNG at the terminal would take on between an estimated 8 and 11 million gallons of ballast water from the river. Given that the facility is expected to accommodate between 50 and 60 ships per year, the withdrawal of water for LNG ship ballast from the Providence River could be between 400 and 660 million gallons per year during operation of the terminal.

These withdrawals would be in addition to other existing or planned facilities in the area or greater Narragansett Bay watershed that currently withdraw or potentially withdraw much larger volumes of water, such as the Manchester Street Station and Brayton Point Power Plant.

The cumulative impacts of these withdrawals are difficult to quantify given that the numbers of aquatic organisms entrained or impinged during water intake is a function of the intake structure's location, design, capacity, and approach velocity, and on the abundance of organisms of various species in the general vicinity at the time of the withdrawal. Historically, the estimated average annual loss of fish eggs and larvae due to average water withdrawals of 258 million gallons per day (or 94 billion gallons per year) at the Manchester Street Station and up to 1 billion gallons per day (or 365 billion gallons per year) at the Brayton Point Power Plant amounted to 891 million eggs/larvae and 15.9 billion eggs/larvae, respectively. Although figures are not available, the number of eggs and larvae lost through the ballasting of other ships that offload at Providence and in other areas of the bay and its tributaries would also be a fairly large number. For comparison, assuming 60 LNG ships per year and 11 million gallons of ballast water required per ship, operation of the proposed LNG terminal could result in the annual loss of 9.7 million eggs and 648,000 larvae. Although the number of eggs and larvae potentially lost as the result of LNG ship ballasting even if multiple LNG projects are developed within the within the Narragansett Bay watershed (estimates of potential annual loss due to ballasting of LNG ships for the Weaver's Cove LNG project are 12.3 million eggs and 1.9 million larvae) would be much less than the numbers lost as the result power plant operations, the cumulative impacts of these losses could further stress the fish populations in Narragansett Bay. In conclusion, construction and operation of the KeySpan LNG Project could contribute cumulatively to impacts on aquatic resources and water quality when considered in relation to past, present, and reasonably foreseeable impacts on the Providence River. Potential impacts would be minimized by KeySpan LNG's and Algonquin's compliance with our recommendations, the FERC Plan and Procedures, Algonquin's ESCP (to be used by Algonquin), the companies' respective SPCC Plans, adherence to the mitigative measures discussed in section 4.6.2, and compliance with other applicable permits and regulations. With the implementation of these measures, we believe impacts on aquatic resources and water quality would be relatively short-term and/or minor in comparison to those from non-point sources of pollution or from operation of facilities such as the wastewater treatment plant, the Manchester Street Station, the Brayton Power Plant, and dredging of the federal navigation channel.

4.13.2 Vegetation and Wildlife

When projects are constructed at or near the same time, the combined construction activities could have a cumulative impact on vegetation and wildlife living in the immediate area. Land use within the project area is industrial, therefore clearing, grading, and other construction activities associated with the KeySpan LNG Project along with other construction projects would result in minimal removal of vegetation, alteration of wildlife habitat, displacement of wildlife, or other secondary effects such as increased population stress or predation. While there is some potential for the establishment of invasive plant species, the majority of the project area consists of paved or graveled surfaces so that invasive species would be unlikely to thrive. Because the LNG facility upgrade would occur within the existing LNG facility site and the majority of the pipeline would be co-located with existing city streets, the project would allow for the consolidation of similar land uses and would be expected to minimize cumulative impacts on vegetation and wildlife.

Although the proposed sendout pipeline for the KeySpan LNG Project is located in an industrial setting, it is possible that the combined development of the KeySpan LNG, Somerset LNG, and Weaver's Cove Energy LNG Projects could require an expansion of the existing Algonquin pipeline system. The specific nature of the improvements required by Algonquin to accommodate all three projects is unknown, but it is possible that additional pipeline facilities may be necessary as discussed in section

4.13.8. The construction of additional pipeline could require widening of existing Algonquin pipeline rights-of-way, resulting in both vegetation and wildlife impacts.

4.13.3 Infrastructure and Public Services

The cumulative impact of the KeySpan LNG Project and other projects on infrastructure and public services would depend on the number of projects under construction at one time and the specific services required for each project. The small incremental demands of several projects occurring at the same time could become difficult for police, fire, and emergency service personnel to address. This problem would be temporary, and would occur only for the length of construction.

The operation of the proposed LNG terminal and associated facilities is not expected to have a major impact on public services since it would not result in the construction of new public roads, new sewer or water systems, or significant changes in local population levels. The project involves modifications to an existing, operating LNG facility and construction of limited new pipeline facilities. However, there has been public concern about the training of the local police, fire, and emergency responders and their capability to handle an incident at the LNG terminal or along the shipping route in addition to their existing duties. We acknowledge this concern but note that LNG is already being stored at the existing KeySpan LNG facility and the storage capacity of this facility would not change as a result of the project. If the project is approved, the potential impact on emergency response services would be associated with the LNG ships. As detailed in section 4.12.5, KeySpan LNG has committed to conducting or sponsoring certain training activities for firefighters and other emergency responders and is providing direct financial assistance to the State of Rhode Island and the City of Providence to assist each in its evaluation of the proposed project and to assist in the preparation of emergency response plans. KeySpan LNG would have its own fire-fighting equipment at the LNG facility, and LNG ships are required to have adequate fire detection and protection systems. Thus, while the details regarding the specific demands and roles of the police and fire departments in the event of an incident are not available at this time, we believe the efforts described above would minimize the cumulative effects of this project on existing public services. See sections 4.9.3, and 4.12.5 of this EIS for additional discussion of fire and public safety impacts and KeySpan LNG's coordination with the area emergency response departments.

We also received comments expressing concern that local communities might be overburdened by the additional costs of ensuring the security of the LNG terminal and the LNG ships while in transit and unloading at the terminal. If more than one terminal is constructed and operated within the Narragansett Bay area, particularly if the facilities are in close proximity and each requires the services of one or more towns, the combined security costs of multiple projects could have additional cumulative impact on some communities. There are currently two proposed LNG terminals (the KeySpan LNG Project and the Weaver's Cove LNG Project) and possibly a third planned LNG terminal (Somerset LNG Project) that would require LNG ships to transit Narragansett Bay. The specific costs associated with security for all of these projects are not known at this time. However, as discussed in section 4.12.5 and below, per-transit cost estimates for security associated LNG marine deliveries to the proposed KeySpan LNG terminal have been identified and the Coast Guard has developed an initial Incident Action Plan for the KeySpan LNG Project that will become the basis for appropriate security measures. The development of the safety and security plan for the Weaver's Cove LNG Project has also been initiated.

The security measures anticipated to be implemented each time an LNG ship calls at Providence would require Coast Guard as well as state and local agency support. Specific costs associated with Coast Guard support for the KeySpan LNG Project have yet to be specified. However, the specific costs associated with overtime and detail work by state and local agency personnel including the Providence Police, East Providence Police, State Police, other local police, and the DEM has been estimated to be in the range of $40,000 to $50,000 per LNG shipment.

KeySpan LNG has stated that it would reimburse state and local agencies for the incremental costs associated with LNG ship security on a per-transit basis. Weaver's Cove Energy has also proposed compensation to offset security costs associated with its proposed project. We believe these commitments to cover security costs would minimize the potential for cumulative impacts associated with security costs if multiple LNG terminals are constructed within the Narragansett Bay area. It should also be noted that the KeySpan LNG and Weaver's Cove Energy LNG terminals would be located in different states and cities, and while LNG ships traveling to the two terminals would share the same ship channel in the vicinity of Newport, Jamestown, Middletown, and Portsmouth, the remainder of the ship routes do not overlap, which would tend to mitigate the cumulative costs on a single state or community.

4.13.4 Vehicular Traffic

As discussed in section 4.9.4, the truck traffic that can be expected during operation of the upgraded LNG facility would vary depending on the market demand of the LNG and the availability of trucks for transporting the LNG. At present, trucking LNG into the facility occurs primarily during the summer months. Following completion of the proposed upgrade, there would be little or no need to truck LNG to the facility; however, some LNG would likely be sold for delivery via truck. No modifications are proposed to the truck loading/unloading equipment at the terminal so the capacity of these facilities would govern the volume of truck traffic generated by the facility. The existing truck loading/unloading equipment can handle a maximum of 24 trucks per day. This capacity would not change even if the proposed upgrades are implemented. LNG trucks, employees, and visitors traveling to the site from Interstate 95 would all likely use Terminal Road, Allens Avenue, and Thurbers Avenue. Vehicles leaving the site and needing to go southbound on Interstate 95 would have to travel short distances of 0.28 and 0.34 mile on Ernest and Eddy Streets, respectively, as well as on Thurbers Avenue in order to obtain access to the southbound entrance ramp. Overall, the anticipated traffic volume resulting from operation of the LNG terminal, even when considered in terms of projected future traffic volumes and in relation to reasonably foreseeable future projects, would not significantly increase the existing traffic volumes on local area roadways.

During construction of the proposed pipeline facilities, there would be a pronounced but short-term impact on local traffic. However, operation of the pipeline would not contribute to traffic congestion because the pipeline would be installed below ground and the existing roadways that are affected by construction would be restored following installation of the pipeline. There is potential for cumulative traffic impacts if other projects such as road improvements are scheduled to take place at the same time and in the same area as the proposed LNG and pipeline facilities. Currently, we are aware of the planned Interstate 95/Interstate 195 freeway improvement project that could cumulatively add construction traffic associated with the proposed project (see section 4.8.3.2 for further discussion of the freeway improvement project). However, several factors would minimize the potential for cumulative traffic impacts, including the relatively localized nature of the proposed facilities and the tendency for construction workers to frequently share rides and travel to and from work during off-peak hours.

Additional measures proposed by Algonquin to minimize traffic impacts include developing site-specific construction plans for in-street construction and road crossings, and implementing detours or other measures to maintain 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. Additionally, 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 also 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, if necessary. With implementation of these measures, potential cumulative impacts on traffic are expected to be temporary and short term.

Cumulative road traffic impacts could also result if more than one LNG terminal is constructed in the Narragansett Bay area and the Pell Bridge is closed during the passage of LNG ships. The Pell Bridge is located above the East Passage and is the only bridge that crosses all three proposed/potential LNG ship routes (i.e., KeySpan LNG, Weaver's Cove Energy, and Somerset LNG). The Pell Bridge is currently closed a few times a year to allow the passage of LPG ships. If both the KeySpan LNG and Weaver's Cove Energy LNG terminals are approved, up to 260 LNG ships (counting inbound and outbound trips) could pass under the bridge each year. If the Somerset LNG Project proposal moves forward and is approved, the number of LNG ship passages could be as high as 380. As discussed in section 4.12.5, it was determined during the Coast Guard's recent security workshops for the KeySpan LNG Project that it would not be necessary to close the bridge for every LNG ship transit associated with the KeySpan LNG Project unless warranted by particular security concerns. Therefore, under normal circumstances, the KeySpan LNG Project would not contribute to cumulative impacts associated with closures of the Pell Bridge.

As discussed in detail in section 4.12.5.2, in the event that the Rhode Island Bridge and Turnpike Authority decided to close the Pell Bridge for an LNG vessel, the closure would typically last about 5 to 7 minutes and, based on a traffic study commissioned by Weaver's Cove Energy, would result in a maximum anticipated average traffic delay during peak traffic flow conditions of 5 minutes or less, with traffic backing up 0.5 mile or less. The actual frequency of bridge closures cannot be determined and would depend on specific conditions at the time of the LNG ship passages. If, as an example, we assume the Pell Bridge would be closed for 10 percent of LNG transits, then delays of 5 minutes would be experienced up to 26 times a year if both the KeySpan LNG and Weaver's Cove LNG projects were operating and up to 38 times a year if the Somerset LNG Project were also operating. Overall, the cumulative effect on traffic associated with bridge closures is not expected to be significant because bridge closures would be temporary and are anticipated to be limited to periods of high alert.

4.13.5 Ship Traffic

The project would introduce additional ship traffic, specifically LNG tanker vessels, to Narragansett Bay and the Providence River, which would result in an incremental increase in ship traffic in the region. COE data indicate that the number of domestic and foreign ships entering Narragansett Bay to call on the Port of Providence was 930 ships in 2001 and 945 ships in 2002. The majority of the ships were tanker barges and tows or tugs. Other ships in descending order of frequency included tankers, passenger and dry cargo carriers, and dry cargo barges. In 2001 and 2002, another 311 and 353 domestic and foreign ships also entered Narragansett Bay en route to the Port of Fall River. The ships in transit to the Port of Fall River would use the same channel as the LNG ships for 1.5 nautical miles.

There are also a number of ferries that transit Narragansett Bay and utilize the Providence River channel. Ferry service between Providence and Newport is provided from May 1 through October 31, with five daily trips during weekdays and six daily trips on weekends. Service is provided between Bristol and Prudence with five daily trips during the week and six daily trips on the weekend during the summer months. In the winter months, the number of trips between Bristol and Prudence is two for both weekdays and weekends. Service between Newport and Jamestown occurs from late April to late October with eight daily trips on weekdays and nine daily trips on weekends. There is also ferry service between Newport and Block Island and between Point Judith and Block Island. The Newport to Block Island ferry runs one daily trip on both weekdays and weekends. Normal ferry service between Point Judith and Block Island consists of 2 to 3 daily trips on both weekdays and weekends from October through June and 8 daily trips on weekdays and 10 daily trips on weekends from July through September.

There is a high-speed ferry between Point Judith and Block Island that runs from May 13 to October 12, with six daily trips on both weekdays and weekends. Lastly, there is a high-speed ferry between Quonset Point and Martha's Vineyard that runs from May through October. Normal ferry service during the peak season, June through Labor Day, consists of two to three daily trips on both weekends and weekdays. During non-peak season, the schedule consists of one or two trips on both weekends and weekdays. All of these ferry routes, with the exception of the Point Judith to Block Island route, cross or use the federal channel that would be used by LNG ships to travel to and from the KeySpan LNG facility. The Providence to Newport ferry uses the channel for a significant portion of its route.

It is conceivable that the dredging of the federal navigation channel could increase the number of large vessel movements in Narragansett Bay and the Providence River. However, because we are not aware of specific proposals by other industrial and commercial operators, we do not view these activities as reasonably foreseeable and have not included additional ship traffic as a result of recent dredging in our analysis. The proposed project would result in an additional 50 to 60 ships per year transiting the bay to Providence. During the transit of the LNG ships, it is anticipated that a safety and security zone would be enforced around each LNG ship and around the ship unloading facility while an LNG ship is docked. See section 4.12.5 for additional discussion of shipping safety during operation of the proposed activities.

In addition to the proposed project, another proposed LNG terminal could potentially add to LNG ship traffic in Narragansett Bay. On December 19, 2003 Weaver's Cove Energy filed an application with the FERC seeking authorization to site, construct, and operate an LNG terminal in Fall River, Massachusetts. If approved, up to 70 LNG ships per year would unload cargo at this facility beginning sometime after 2008. LNG ships going to the Weaver's Cove Energy facility would transit up Narragansett Bay and follow the East Passage to the entrance of the federal navigation channel near Sandy Point on Prudence Island. Ships would then turn into Upper Narragansett Bay and follow the navigation channel to the Taunton River. The portion of the ship route along the East Passage would be the same for LNG ships moving to or from either Providence or Fall River. In total, LNG ships calling on the KeySpan LNG terminal and those calling on the Weaver's Cove LNG terminal would follow the same route for about 16 nautical miles from the Narragansett Bay entrance to the turnoff to Mt. Hope Bay. LNG ships going to the KeySpan LNG and Weaver's Cove Energy facilities (and the Somerset LNG facility if that project moves forward) could therefore cumulatively contribute to ship traffic delays in Narragansett Bay.

If both the KeySpan LNG and Weaver's Cove Energy Projects are constructed and operated, as many as 100 to 130 LNG ships could potentially transit each way in and out of Narragansett Bay every year. As described in section 4.12.5.2, MNI, on behalf of KeySpan LNG and BG LNG, assessed five case scenarios to evaluate current conditions and the potential impact of LNG ships on existing commercial ship traffic (see section 4.12.5.2 for a full discussion of the MNI study methods and results). Three of the five scenarios KeySpan LNG assessed assumed that both the Weaver's Cove Energy LNG and KeySpan LNG terminals would be operational.[12] These three cases included:

- Case 3: future conditions assuming both the KeySpan LNG and the Weaver's Cove Energy Projects are realized, and 52 and 60 LNG ship per year call at each facility, respectively;

- Case 4: the same as Case 3 but assumes a hypothetical 70 ships per year call at the KeySpan LNG facility; and

[12] KeySpan LNG did not model the potential for the Somerset LNG facility to also be operational.

- Case 5: the same as Case 4 but assumes future traffic conditions of non-LNG ships increases 50 percent.

The results for Case 3 indicated with the anticipated number LNG ships serving the KeySpan LNG and Weaver's Cove Energy LNG facilities, about 6 percent of the non-recreational vessels operating in Narragansett Bay would experience delays each year, which is double the number of ships that currently experience delays. In Case 4, which includes a hypothetical larger number of LNG ships serving the KeySpan LNG facility, an average of 7 percent of the annual ship traffic in the bay would experience some delay. In Case 5, considered the worst-case scenario, an average of 8 percent of the annual ship traffic in the bay would experience some delay each year.

As discussed in section 4.12.5.2, the project would not likely contribute to cumulative impacts on ferries. The Coast Guard has indicated that it would typically grant permission for ferries to pass an LNG ship or transit through portions of the security zone. Commercial fishing boats in the area that could be affected by both LPG ships traveling to Providence and LNG ships traveling to KeySpan LNG's or Weaver's Cove Energy's proposed terminals might also experience cumulative impacts in the form of more frequent short-term delays due to the security zones around the LPG and LNG ships. To mitigate the impacts of security zones, the Coast Guard would routinely provide Notice to Mariners prior to the arrival and departure of LNG ships as it currently does for LPG vessels. In addition, the Coast Guard has indicated that other ships and boats could request passage by radio or cell phone, and that permission for such passage might be granted by the Federal Maritime Security Coordinator/Captain of the Port.

As discussed in section 4.8.6, there will likely be a number of projects or activities in the foreseeable future that result in the increased recreational use of Narragansett Bay. The extent of the potential cumulative impact on recreational boaters would depend on the number of boats in these locations when LPG and LNG ships transit the area. These impacts would primarily occur during the peak recreational boating season between about May and September. In most areas, the waterway that would be traveled by the LNG ships is sufficiently wide to allow recreational craft, which generally are not confined to the federal channel, to navigate around the LNG ships without significant delay. As noted previously, the Coast Guard has indicated that it would attempt to minimize impacts on other users of the waterways including recreational users and tourism events. Measures to minimize such impacts might include timing of LNG ship passages to avoid periods of highest recreational use and Coast Guard coordination with regatta sponsors and the Northeast Marine Pilots to minimize adverse impacts on marine traffic related to regattas.

4.13.6 Land Use

There are a variety of reasonably foreseeable commercial, industrial, and transportation projects in the vicinity of the proposed LNG terminal and the pipeline route (see table 4.13-1). Various agencies and organizations have made efforts to account for the cumulative impact of multiple development projects on land use by developing local and regional plans. As discussed in section 4.8.2, future waterfront development plans are being planned by both the City of Providence and the City of East Providence. Based on the 2000 Sasaki study discussed in section 4.8.2., the implementation of the City of Providence's Narragansett Landing development plan would involve the acquisition of existing properties along Allens Avenue, relocation of existing land users, remediation of contaminated sites, and development of various mixed uses including residential development, offices, retail, cultural, and institutional. Because the existing KeySpan LNG facility would need to be acquired and removed regardless of whether the proposed upgrade is constructed and the proposed facilities would add to but not fundamentally change this requirement, the project would not contribute to cumulative impacts associated with the City of Providence's development plan. The proposed facility upgrade would not affect land or water in the City of East Providence or result in any change in existing land use patterns in that city. For

this reason and for other reasons discussed in section 4.8.2, the project would also not contribute to cumulative impacts associated with the City of East Providence's waterfront development plans.

Although the KeySpan LNG Project would affect existing land uses in the area during construction, the project would involve modifications to an existing LNG facility and only limited pipeline construction, and would be consistent with current land uses. Consequently, the immediate cumulative land use effects of the project have already been considered. As discussed previously, it is conceivable that the development of multiple LNG projects in the region could result in a cumulative impact on the existing Algonquin pipeline system. Depending on the specific nature of an expansion by Algonquin, existing pipeline rights-of-way could be widened to accommodate additional pipeline.

The project would have little cumulative visual impact on the project area. The potential visual impacts of the pipeline would be short-term and primarily limited to temporary construction impacts. Operation of the pipeline facilities would not affect the visual character of the area since the pipeline would be located underground primarily within existing roadways. Algonquin's tap valve at MP 1.44 adjacent to Henderson Street would be visible to users of Collier's Point Park, a public access boat launch and recreational area owned by U.S. Generating. However, Algonquin would minimize the visible impact of this facility on the scenic value and existing character of Collier's Point Park, by planting shrubs to help visually screen the tap valve.

The proposed LNG facility upgrade would occur at the operating KeySpan LNG facility, which is in a location that is surrounded by other industrial and waterfront uses. Construction of the tanker unloading facilities would constitute a change in the viewshed for this area, but would not create a significant degradation in viewshed due to the disturbed and developed nature of this industrial waterfront area.

The LNG ships that would transport LNG to the KeySpan terminal would be visible additions to the waterfront at the site for approximately 24 hours at a time. These LNG carriers are up to about 950 feet long. The LNG carriers, although relatively visible, would not result in a cumulative adverse visual impact as they would be in character with the industrial waterfront in the vicinity of the proposed project site where ships are frequently docked.

4.13.7 Air Quality/Noise

Construction of the proposed project and some of the reasonably foreseeable projects and activities listed in table 4.13-1 would involve the use of heavy equipment that produces noise, air contaminants, and dust. Construction of the proposed LNG facility upgrade and pipeline would have temporary adverse impacts on air quality due to fugitive dust emissions. The amount of fugitive dust would depend on the moisture content of the disturbed material and the amount of suppressant applied. Algonquin proposes to control fugitive dust from pipeline construction activities by applying water or calcium chloride as necessary to minimize the impact on nearby businesses. Fugitive dust from construction activities at the LNG terminal would be minimized by the application of water as necessary. As discussed in section 4.11 of this EIS, air quality impacts associated with construction activities and equipment are difficult to estimate because construction equipment would regularly change speed and direction. However, due to the intermittent and temporary nature of these emissions, their impact on air quality would not be long term and would not likely be significant.

Operation of the proposed LNG facility would also contribute cumulatively to air emissions and noise in the project area. Our analysis of potential air quality impacts indicates that operation of the pipeline would generate a negligible quantity of regulated emissions and would therefore be unlikely to adversely affect public health. Operation of the upgraded LNG terminal would result in air emissions

from LNG ships and stationary equipment (heaters, vaporizers, and emergency equipment) associated with the LNG facility. Total emissions from the upgraded LNG terminal do not exceed applicable major source thresholds and would not require a Title V permit or be subject to NSR or PSD regulations; however, the terminal is subject to permitting requirements under the DEM air pollution control regulations. In order to minimize operational emissions from the LNG terminal, KeySpan LNG would use electric BOG compressors and pumps, install low NO_x burners with flue gas recirculation on the natural gas-fired WEG heaters, and take enforceable operating limits on various equipment. As a result of these measures, the emissions from the proposed LNG terminal are not expected to have a significant effect on air quality. The facility would operate as a closed system. No evaporative losses would occur, and natural gas would not be vented to the atmosphere during normal operation. Natural gas would also not be flared.

Although the project would increase emissions of various pollutants, results of a dispersion modeling analysis documented that operation of the proposed LNG terminal and pipeline facilities would not exceed any of the applicable ambient air quality standards. The NO_x and VOC emissions from the KeySpan LNG Project would contribute to regional ozone concentrations (all of Rhode Island is within an area classified as a "serious" non-attainment area for the 1-hour ozone standard and "moderate" attainment for the 8-hour ozone standard). The CO emissions from the KeySpan LNG Project would contribute to regional CO concentrations (the project area is classified as a "maintenance" area for CO). However, these emissions would be small in comparison to the total NO_x and VOCs, and CO emitted by existing sources in the area (e.g., power plants, vehicle emissions). To ensure that the proposed project would conform to the Rhode Island SIP, KeySpan LNG provided air emissions data to assist us in determining whether a conformity analysis would be required. Based on the data provided by KeySpan LNG, the CO emissions from construction of the project would be less than 100 tpy and the NO_x and VOC emissions would each be less than 50 tpy. The operational emissions from the project would also be below 100 tpy for CO and 50 tpy for NO_x and VOC. Therefore, the proposed project would not be subject to a conformity review (see section 4.11). Also, because the entire area is classified as serious non-attainment for the 1-hour ozone standard, projects that would generate large quantities of air emissions that exceed major source thresholds are required to offset their emission increases with emission reductions in the air basin. Therefore, KeySpan LNG and other project proponents such as Weaver's Cove Energy and Somerset LNG must either limit emissions from the project so as not to be considered a major source or be required to obtain the necessary offsets. In either case, the overall total increase in air emissions within the air basin would not be significant in comparison to other existing air emission sources.

Natural gas is a relatively clean and efficient form of energy compared to other fossil fuels, because it is efficiently transported to end users and consists predominantly of simple hydrocarbons (methane and ethane). By burning natural gas rather than other fossil fuels such as coal or fuel oil, it could be possible to reduce the emissions of regulated pollutants (e.g., NO_x, SO_2, and PM_{10}) or unregulated greenhouse gases (e.g., CO_2). As such, it is possible that the KeySpan LNG Project could cumulatively improve air quality in the region by providing a competitively priced source of natural gas that could replace the more polluting forms of energy that are currently being used.

Additional noise produced during construction of the KeySpan LNG Project and other projects could affect nearby residents or businesses during construction. These noise impacts would be localized and would attenuate quickly as the distance from the noise source increases. Therefore, cumulative noise impacts associated with construction would be unlikely unless one or more of the projects occur at the same time and in the same location.

As discussed previously, it is conceivable that the development of multiple LNG projects in the region could result in a cumulative impact on the existing Algonquin pipeline system. Depending on the

specific nature of an expansion by Algonquin, additional compression could be added to the existing pipeline system that would include additional air quality or noise impacts. However, these actions are not reasonably foreseeable for inclusion in this analysis.

4.13.8 Natural Gas Infrastructure

Currently, we are aware of two other companies that are considering construction of LNG import terminals in the Narragansett Bay area - Somerset LNG and Weaver's Cove Energy. Whether or not these projects get built will depend on economics as well as regulatory approvals. Ultimately, the economic feasibility of these projects depends on the demand for LNG (and by extension, natural gas). According to the DOE/EIA's Annual Energy Outlook 2004 With Projections to 2025 Report (EIA, 2004a), demand for natural gas is expected to increase an average of about 1.4 percent per year nationally and about 1.6 percent per year in New England until 2025. In addition, based the NE Report (FERC, 2003), it appears that by 2009 there will be demand during peak periods of use in New England for an additional 500 MMcfd of natural gas above what the current infrastructure is able to provide. More recently, the Governors Conference Report (Power Planning Committee, 2005) indicated that the anticipated additional demand for natural gas by 2009 will be between 420 MMcfd and 590 MMcfd. Given that there are several other projects proposed or under preliminary consideration in the New England region (see section 3.2) it appears unlikely that the market would support the construction of all three of the projects proposed in the Narragansett Bay area. The need for additional modifications or improvements to the existing interstate pipeline system if two LNG import terminals are constructed depends on which facilities would be constructed. It appears, based on information provided by Algonquin, that Algonquin's system has capacity to accommodate the volumes from any single project without additional compression or looping provided $45 to $50 million of existing infrastructure improvements are made involving either uprating or relaying some existing pipeline and other modifications. However, in order to accommodate the natural gas from multiple LNG import terminals, Algonquin would need to implement more significant expansions that could include increased compression and/or the installation of additional pipe. FERC staff requested specific information from Algonquin regarding the additional facilities that would be needed to transport the volumes of natural gas proposed by Weaver's Cove Energy and KeySpan LNG. Recognizing that the specific facilities would depend on the actual[13] delivery points and noting that KeySpan LNG has yet to request specific transportation service or identify delivery points, Algonquin provided information about the additional infrastructure that would be required assuming deliveries from both terminals would be made to Mendon, Massachusetts and Lambertville, New Jersey, the two natural gas delivery points identified by Weaver's Cove Energy.[14]

Our analysis reveals that substantial improvements would be required to accommodate the needed capacity to transport the regasified LNG from the proposed upgraded KeySpan LNG and Weaver's Cove LNG facilities operating at full sendout capacity to deliveries at Mendon and Lambertville. Below are some of the new facilities we estimate would be required. If we assume sendout capacity of 400 MMcfd for Weaver's Cove Energy and 500 MMcfd for KeySpan LNG, Algonquin would need to:

- Uprate its entire G System, including:

  -- operating the G-12 and G-20 laterals at a maximum of 811 psig;

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[13] The effects on infrastructure requirements that may be needed on Algonquin's system do not take into account the additional supplies of natural gas from the speculative Somerset LNG facilities.

[14] The actual delivery points from both terminals could change based on contracts effectuated between BG LNG, which has contracted for capacity rights on Algonquin's 1.44-mile-long sendout pipeline from KeySpan LNG and its shippers, and Weaver's Cove Energy and its shippers.

-- replacing approximately 2.6 miles of 16-inch-diameter pipeline with 30-inch-diameter pipeline from the North Attleboro meter station to the South Attleboro meter station and approximately 0.9 mile of pipeline from the G-5 tap to the South Attleboro meter station;

-- constructing about 8.1 miles of pipeline between the G-1 tap and the Cumberland meter station; and

-- constructing approximately 5.2 miles of pipeline between the Cumberland meter station and the North Attleboro meter station.

- Uprate the MAOP of the G-22 lateral.
- Reverse flow on its 30-inch-diameter pipeline by installing and modifying station piping and other appurtenant equipment at several compressor stations.
- Review all meter stations along the pipelines that would need to be uprated to assess the additional changes necessary as a result of higher operating pressures.
- Install approximately 15 chromatographs throughout the system to accurately track the changes in heating value of the gas being delivered through the Algonquin system downstream of the new KeySpan LNG Project lateral and the Weaver's Cove Energy laterals.

Additionally, because deliveries to Mendon are projected to be at a pressure of approximately 560 psig and because Tennessee operates at a higher pressure, Algonquin would not be able to make the prescribed deliveries at Mendon without installing additional facilities. Moreover, because deliveries to the interconnect with Texas Eastern at Lambertville are projected to be at a pressure of approximately 575 psig and Texas Eastern operates at a higher pressure, Algonquin would not be able to make the prescribed deliveries at Lambertville without installing additional facilities. Algonquin's preliminary estimate of the cost of these facilities is approximately $140 million, which is based on Algonquin's preliminary review of the project and is subject to material adjustments as the result of site variations, additional work, permitting requirements, and other factors.

It is possible that the construction of the KeySpan LNG, Weaver's Cove Energy, and Somerset LNG import terminals also could indirectly or cumulatively result in other potential environmental impacts (both positive and negative) outside of the Narragansett Bay area. The proposals to build new LNG import facilities in the region is in response to current and future demand for natural gas. By providing new sources of competitively priced natural gas and LNG, these projects would help alleviate negative impacts on the economy and regional air quality that could potentially result from more limited access to these sources of energy (see sections 1.3 and 3.1). In addition to potential expansions of Algonquin's system as discussed above, construction of one or more LNG import terminals could result in other changes to the pipeline infrastructure in New England. In a recent study of natural gas infrastructure in the region, the FERC stated that the expansion of LNG deliveries to the area between New York City and Boston would free up capacity on the Algonquin and Tennessee pipelines, thereby providing additional access to natural gas stored in New York and Pennsylvania (FERC, 2003). It seems likely, however, that accessing these storage areas would require some expansions or modifications of the Algonquin and Tennessee pipelines. Nevertheless, the construction of the KeySpan LNG, Weaver's Cove Energy, and/or Somerset LNG import terminals would reduce the overall need for new pipeline capacity in the region (FERC, 2003). This reduction in need for pipeline capacity would result in corresponding reductions in environmental impacts typically associated with pipeline expansions (e.g., temporary or permanent impacts on water quality, wetlands, vegetation, land use, air quality, etc.).