U.S. DEPARTMENT OF TRANSPORTATION
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION

FINAL ENVIRONMENTAL ASSESSMENT
AND
FINDING OF NO SIGNIFICANT IMPACT

Special Permit Renewal and Amendment

Special Permit Information:

Docket Number:	PHMSA-2013-0181
Requested by:	Fairbanks Natural Gas, LLC
Operator ID#:	99128
Original Date Requested:	September 25, 2013
Original Issuance Date:	May 13, 2014
Renewal Date Requested:	November 5, 2018
Renewal Issuance Date:	September 3, 2020
Effective Date:	May 13, 2019 to May 13, 2029
Code Section(s):	49 CFR 193.2155(b)

I. Background

The National Environmental Policy Act (NEPA), 42 United States Code (USC) 321 – 4375, Council on Environmental Quality regulations, 40 Code of Federal Regulations (C.F.R. or CFR) 1500-1508, and U.S. Department of Transportation (DOT) Order 5610.1C, requires the Pipeline and Hazardous Materials Safety Administration (PHMSA) Office of Pipeline Safety (OPS)[1] to analyze a proposed action to determine whether the action would have a significant impact on the human environment. PHMSA analyzes special permit requests for potential risks to public safety and the environment that could result from our decision to grant, grant with additional conditions, or deny the request. As part of this analysis, PHMSA evaluates whether a special

[1] References to PHMSA in this document means PHMSA OPS.

permit would impact the likelihood or consequence of a pipeline or liquefied natural gas (LNG) facility failure as compared to the operation of the pipeline or LNG facility in full compliance with the Federal Pipeline Safety Regulations. PHMSA's environmental review associated with the special permit application is limited to impacts that would result from granting or denying the special permit. PHMSA developed this assessment to determine what effects, if any, our decision would have on the environment.

PHMSA has prescribed the minimum Federal pipeline safety standards for LNG facilities in compliance with 49 United States Code (U.S.C.) 60101 et seq. Those standards are codified in 49 CFR Part 193 and apply to the siting, design, construction, operation, maintenance, and security of LNG facilities. Pursuant to 49 U.S.C. 60118(c), PHMSA may issue a special permit to waive certain regulatory requirements. Special permits are typically contingent on the performance of additional measures beyond minimum Federal Pipeline Safety Regulations, in accordance with 49 CFR 190.341. PHMSA has imposed conditions in the granted special permit renewal that have been determined to be necessary for safety, environmental protection, or otherwise in the public interest. PHMSA has determined that a special permit with conditions is not inconsistent with pipeline safety, so the application will be granted.

The purpose of this final environmental assessment (FEA) is to comply with NEPA for the Fairbanks Natural Gas (FNG)[2] application for a special permit renewal request to waive compliance from 49 CFR 193.2155(b) for one (1) 125,000-barrel (BBL) (nominal 5,250,000 gallons) full containment liquefied natural gas (LNG) storage tank located at 2942 Tria Road, Fairbanks, Alaska. This FEA and finding of no significant impact are prepared by PHMSA to assess the special permit renewal request, in accordance with 49 CFR 190.341, and is intended to specifically analyze any environmental impact associated with the waiver of certain Federal Pipeline Safety Regulations found in 49 CFR Part 193. This permit, as approved, requires implementation of additional conditions on the operations, maintenance, and integrity management of the single 125,000 BBL (5,250,000 gallons) full containment liquefied natural gas (LNG) storage tank located less than one mile from Metro Field airport in Fairbanks, Alaska.

[2] The PHMSA operator identification number (OPID) for Fairbanks Natural Gas is: OPID 99128.

II. Introduction

On May 13, 2014, PHMSA issued a special permit with conditions to waive compliance from 49 CFR 193.2155(b) for one (1) 125,000-barrel BBL (5,250,000 gallons) single containment LNG storage tank located in the Tanana Levee Industrial Park, North Star Borough, Fairbanks, Alaska and includes all ancillary facilities required to operate the LNG storage. PHMSA granted this special permit for a period of no more than five (5) years from the grant date. On November 5, 2018, FNG submitted a request to renew the May 13, 2014 special permit waiving compliance from 49 CFR 193.2155(b). The renewal request includes a design change of the LNG storage tank at the FNG LNG plant from a single containment LNG storage tank to a full containment LNG storage tank.

The secondary impoundment system is the major difference between a single containment tank and a full-containment tank. Both single and full-containment tanks consist of a primary container and a secondary container. The primary container is used to store LNG. The secondary container of a single containment tank system contains insulation and retains vapor boiling off from the LNG. The secondary container of a single containment tank is not designed to contain LNG at cryogenic temperature, so a dike serves as the secondary impoundment system if LNG leaks from the primary container in the event of failure. The secondary container of a full-containment tank system serves as the secondary impoundment system in the event of failure of the primary container in addition to holding the insulation and vapor.

The 125,000 BBL (5,250,000 gallons) full containment storage tank location changed compared to the single containment tank proposed in 2014 to better fit the property for setbacks and other design parameters. The new tank location of the full containment storage tank is still within 0.8-mile from the Metro Field airport in Fairbanks, Alaska. This FEA will accompany a new special permit that renews and modifies the May 13, 2014 special permit, which waived the requirement in Part 193.2155(b) that an LNG storage tank must not be located within a horizontal distance of one mile from the ends of a runway.

On December 22, 2017, FNG awarded the contract for the engineering, procurement and construction of the 125,000 BBL (5,250,000 gallons) full containment LNG storage tank to Preload Cryogenics, LLC. FNG began site work in early 2018 and the construction of the tank was completed in the fourth quarter of 2019.

III. Regulatory Background

PHMSA regulations at 49 CFR 192.2155(b) require that an LNG storage tank must not be located within one (1) mile from the ends, or ¼ mile from the nearest point of a runway, whichever is longer. Additionally, the height of LNG structures in the vicinity of an airport must also comply with Federal Aviation Administration requirements. Below is the relevant text of 49 CFR 193.2155(b):

> *(b) 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 height of LNG structures in the vicinity of an airport must also comply with Federal Aviation Administration requirements in 14 CFR Section 1.1.*

IV. Purpose and Need

FNG's new 125,000 BBL (5,250,000 gallons) full containment LNG storage tank, at its existing FNG LNG plant in Fairbanks, Alaska, is located 0.80 miles (1.29 km) from the end of Runway 6 at the Metro Field airport (MTF). FNG is requesting the special permit renewal due to the storage tank's location, which is adjacent to the existing storage and vaporization site near the gas distribution header. FNG seeks renewal of the May 13, 2014, special permit to waive compliance with the Federal pipeline safety regulation under 49 CFR 193.2155(b).

The height of the full containment storage tank is approximately 40 feet lower in elevation than an existing known obstruction that operates within the traffic pattern of MTF. Included in Appendix A is a letter from the FAA, issued on December 15, 2017, determining that the LNG storage tank at the FNG LNG plant does not exceed obstruction standards and would not be a hazard to air navigation. This determination is based on an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable 14 CFR 77. Note that 14 CFR 77 Safe, Efficient Use and Preservation of the Navigable Airspace prescribes standards for determining obstructions to air navigation and provisions for aeronautical studies and determination while 14 CFR Section 1.1 provides general definitions for Title 14 Aeronautics and Space.

The tank is needed to allow a large-scale conversion of residential and commercial heating fuel from heating oil to natural gas. This large-scale conversion will immediately reduce the particulate matter of two and a half millionths of a meter and smaller ($PM_{2.5}$) air quality issues currently experienced in the Fairbanks and North Pole areas, and move these communities toward air quality attainment (See Air Quality section for a description of $PM_{2.5}$). The airport cannot practicably be relocated because the businesses located around the Metro Field industrial park rely on proximity to the airport. Although the airport experiences very low usage, it is integral to the operations of the owners and users of the airport.

Granting the special permit will allow FNG to proceed with plans for rapid expansion of natural gas service to the greater Fairbanks and North Pole areas and allow natural gas to displace heating oil as a space heating fuel, providing immediate air quality improvements. The public will benefit by the issuance of the special permit by having the option to switch to natural gas as a space heating fuel and receive the dual benefits of cleaner air and lower energy costs. The public will further benefit by the retention of an airport used in commerce.

V. Site Description

The FNG LNG plant is located in the Tanana Levee Industrial Park in Fairbanks Meridian, Fairbanks, Alaska.

FNG operates two (2) storage and vaporization facilities at Site 1 and Site 2 in Fairbanks. The 125,000-barrel full-containment LNG storage tank is located directly west of FNG's existing Storage and Vaporization Site 2 (Site 2). Site 2 was constructed in 2006 and required no Special Permits for its construction and operation. Site 2 contains the following components:

- two (2) 50,000-gallon American Society of Mechanical Engineers (ASME) LNG storage tanks and two (2) 75,000-gallon ASME LNG storage tanks, for a total of 250,000 gallons of LNG storage;
- two (2) send out pumps rated at 25 brake horsepower;
- two (2) ambient heat exchangers and two shell-and-tube vaporizers;
- one (1) control building,
- one (1) glycol heater building;

- one (1) LNG truck off-loading facility;
- one (1) gas odorant injection system; and
- one (1) distribution header, regulator and meter for sending vaporized gas to the distribution system.

The full-containment storage tank is located adjacent to Site 2, so that it can use the existing distribution header. Site 2 is the closest available, properly zoned, adequately sized property available to connect the new tank to the distribution header. Once the full-containment storage tank is in service, some of the existing ASME LNG storage tanks from Site 2 will be relocated to a site in North Pole on the existing gas distribution system to provide pressure support, or to neighborhoods and communities too remote from the Fairbanks gas distribution grid to be economically connected with gas mains.

Site 1 was constructed and placed in operation in 1998. Site 1 contains one ASME tank of 24,380-gallon capacity, one ASME tank of 17,390-gallon capacity, and two ASME tanks of 24,470-gallon capacity for a total storage volume of 91,290 gallons. Site 1 is located directly adjacent to the MTF runway. The facility was issued a waiver (Docket Number P-97-2W) of 49 CFR 193.2155 (c) on May 22, 1997. Special permits were referred to as waivers at the time of filing. The waiver was issued to waive the requirement for a Class 1 impoundment system.

Figures 1 and 2 show the FNG LNG Plant within one mile of the MTF airstrip. The full-containment storage tank is located 4,248 feet (0.80 mile, 1.29 km) from the end of Runway 6 at MTF.

After the full-containment storage tank is in service, FNG is contemplating filing applications for the construction of a 15-mile gas transmission line to provide service to residential, commercial and industrial users in the North Pole area.

FNG is also evaluating the need for a gas transmission pipeline that would run from the Project site to the north side of Fairbanks to provide adequate supply and looping for new service areas on the north side of the City of Fairbanks.

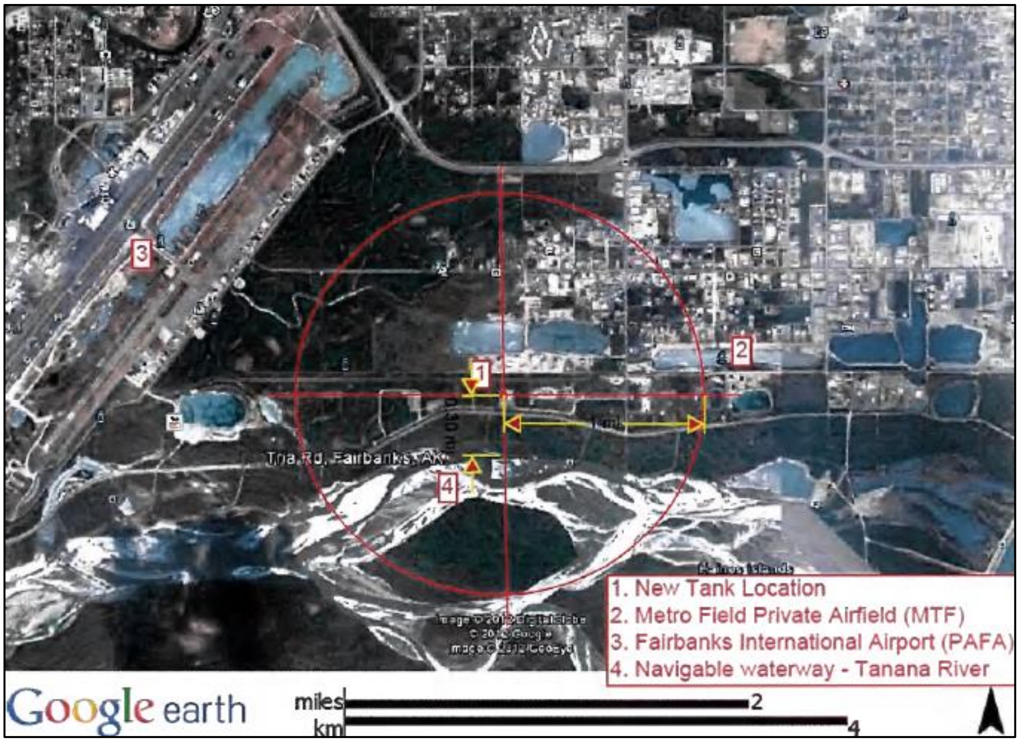

Figure 1 – Site Location and Airports in Vicinity

Figure 2 – Project Site, One-mile Radius, and MTF

Figure 3 provides the location of the FNG LNG plant in relation to the city limits of City of Fairbanks and City of North Pole, Alaska, and Figure 4 shows the location of the FNG LNG plant on a map of the State of Alaska.

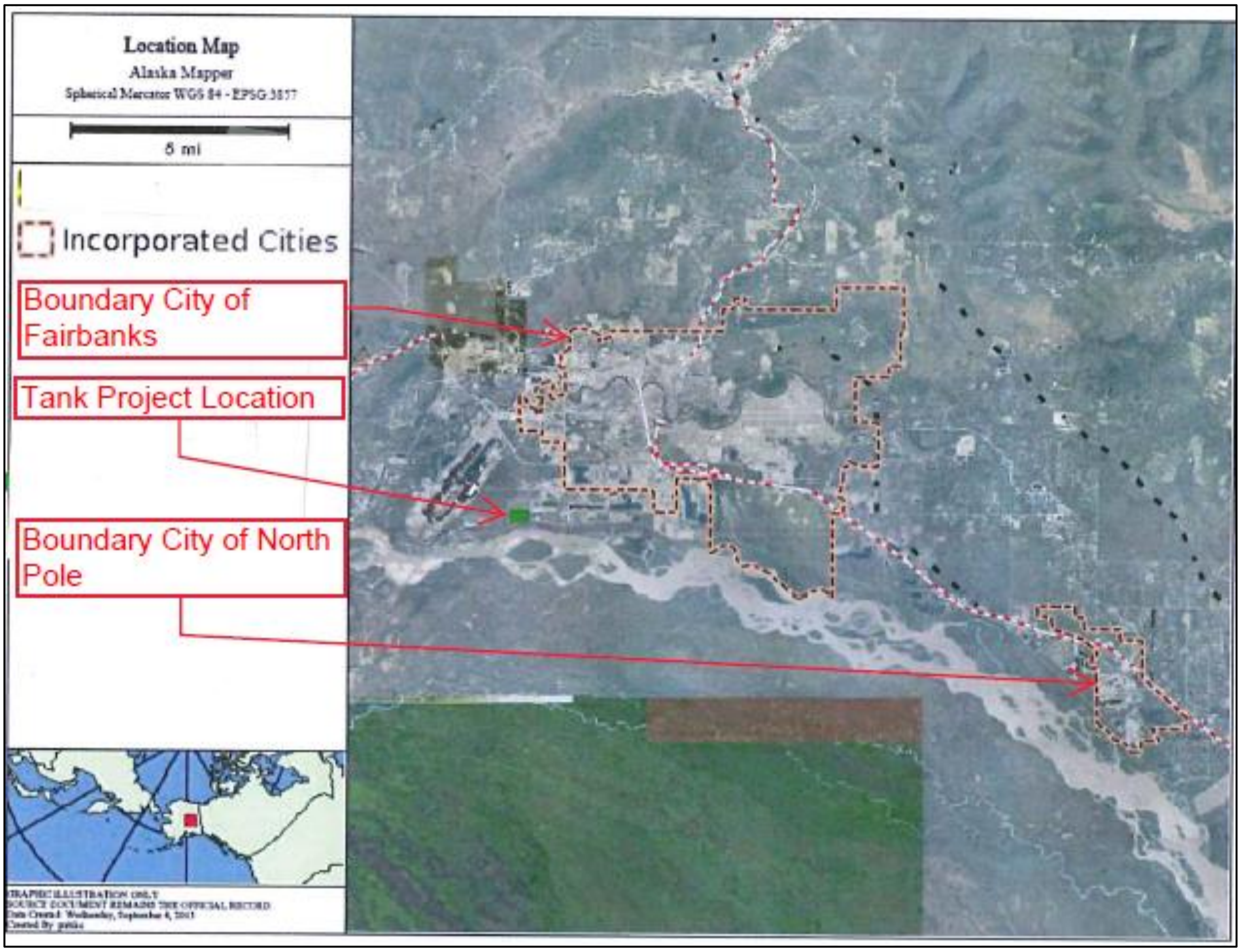

Figure 3 - Project Location and City Boundaries

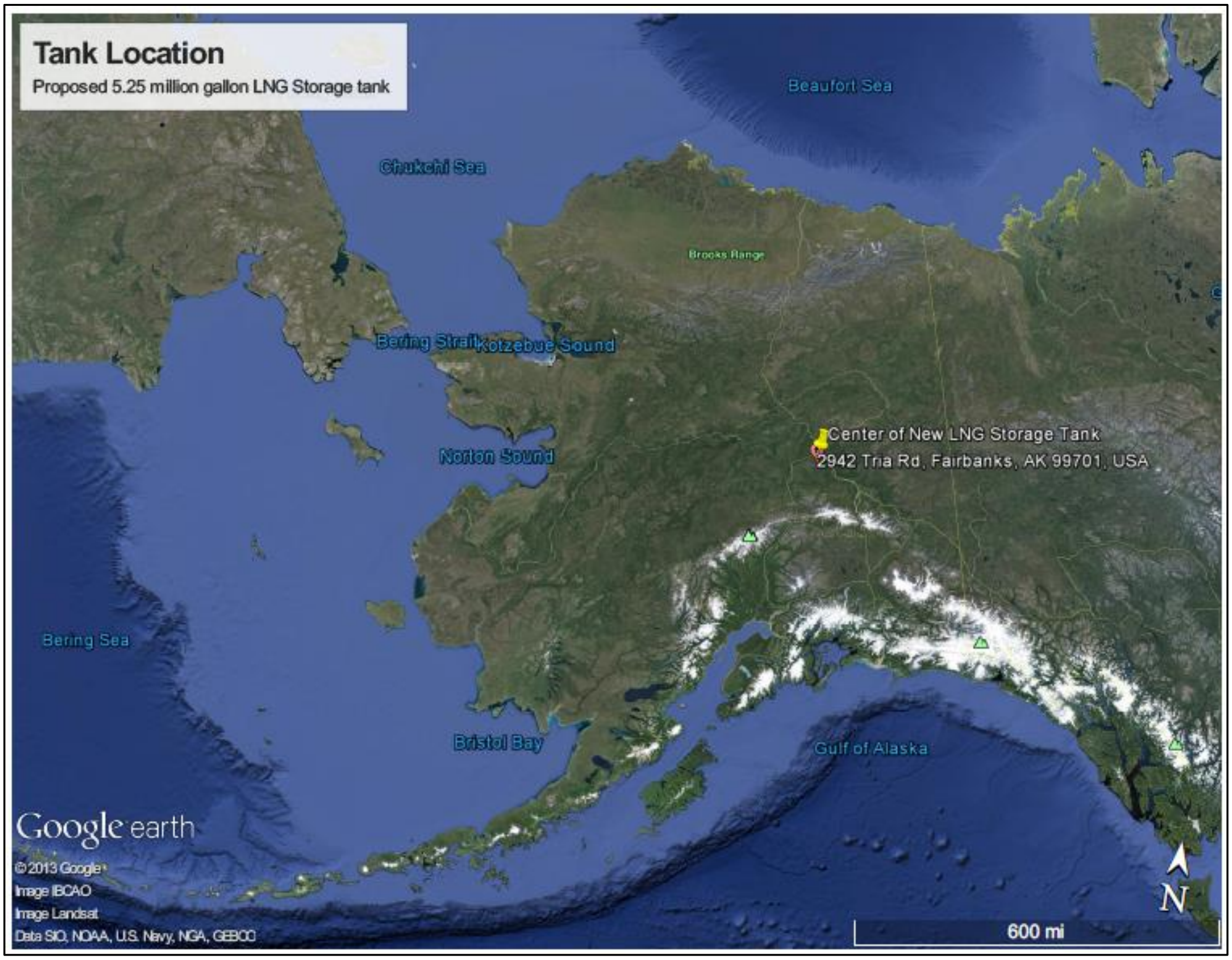

Figure 4 – Project Location in State of Alaska

A. Surrounding Land Use

The project site location is in an area zoned for high impact industrial use. The plat on which the full containment storage tank is located is bordered on the south by Tria Road and the Tanana River Flood Control Levee. The land is unoccupied and contains a recreational trail along the top of the levee. Beyond the levee is the Tanana River. Beyond the river is unoccupied land managed by the US Department of Interior Bureau of Land Management. To the west at 0.42 miles is the Fairbanks Pipeline Training Center, where students are provided trade instruction in pipeline construction. The facility typically has 15 students and is not continuously occupied. To the east 0.37 miles is gravel mining operation. It is in operation during the summer months and is not continuously occupied. There are 5 to 15 employees at the site during operations. To the north 0.58 miles is another gravel mine. It operates during the summer and has 15 to 25 employees during operations. It is not continuously occupied. Northeast 0.70 miles of the full containment storage tank site is an industrial park. The Golden Heart Utilities Waste Water Treatment Facility is located 0.65 miles east from the full containment storage tank location. This area is shown in Figure 5. The buildings are contractor yards, warehouses, storage facilities, auto wrecking yards, machine shops, heavy equipment and aircraft repair shops, and other industrial activities.

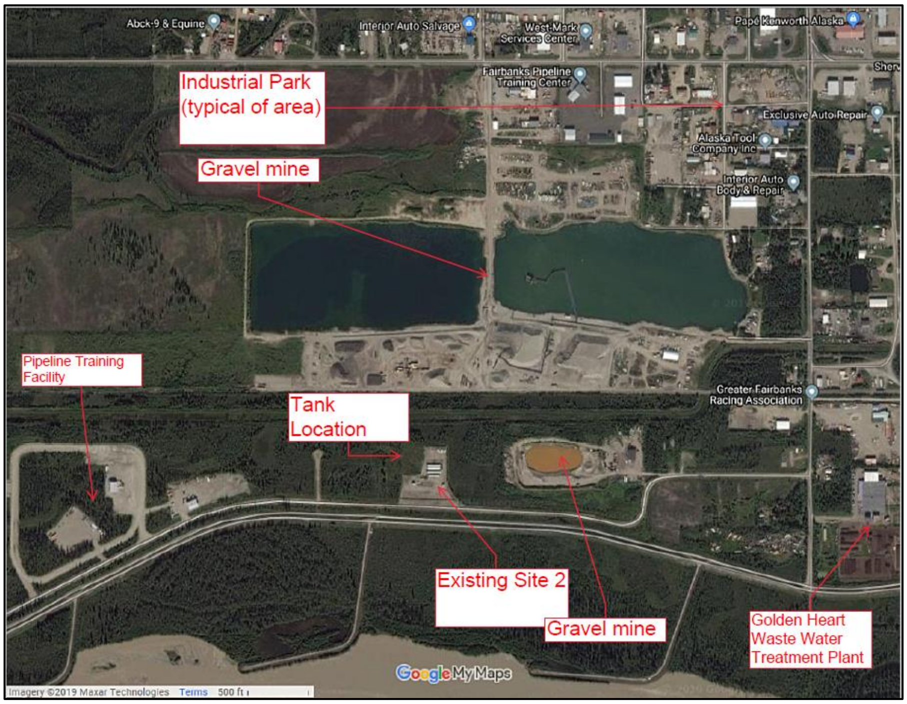

Figure 5 – Land Use near Project Site

Based on Fairbanks North Star Borough (FNSB) zoning and property records, there are no known dwelling units in the Tanana Levee Industrial Park in which the full containment storage tank is located. The area within a 1-mile radius of the full containment storage tank is zoned Heavy Industrial and Light Industrial, and new residential dwelling units will not be built in this zone. There are 24 residential dwelling units located within a one-mile radius of the LNG storage tank which were either allowed under previous zoning designations or prior to zoning requirements being established. The nearest residential dwelling is 3,050 feet (.578 mile) east of the site. The Heavy Industrial and Light Industrial zoning definitions of the FNSB prohibit dwelling units and schools in these zones. Figures 6 and 7 show the MTF and the area viewed from the east of the MTF.

Figure 6 – Metro Field Airstrip

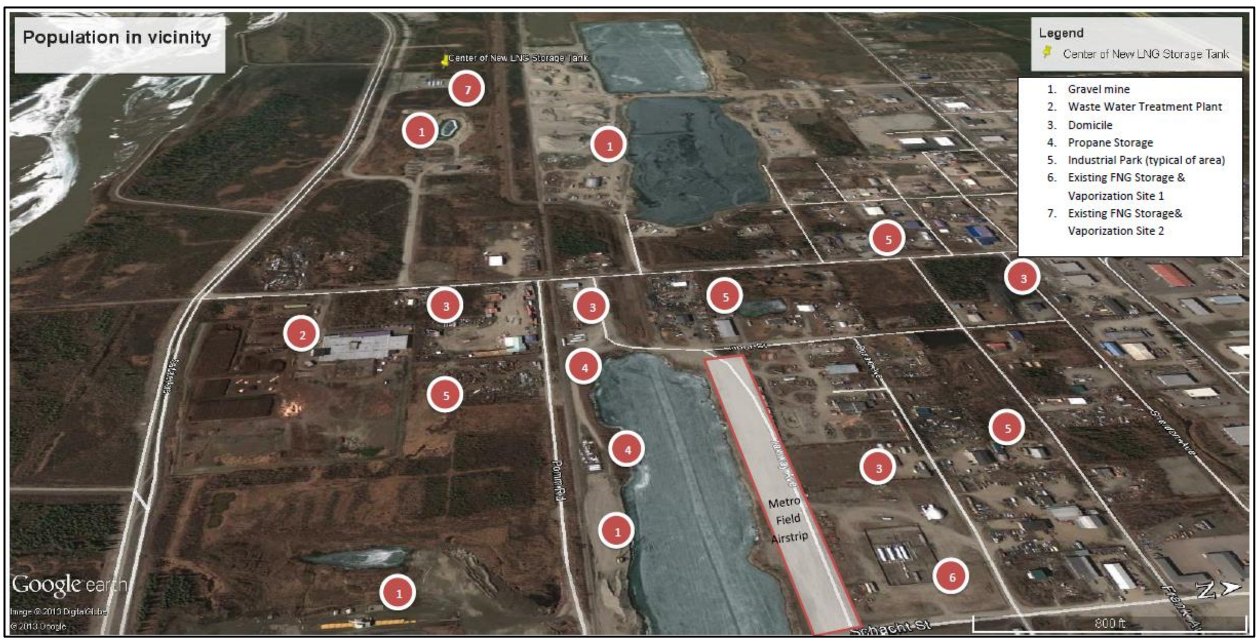

Figure 7 - Population in Vicinity viewed from east of Metro Field

The FNG Project site is generally flat, with natural variations in elevation less than five (5) feet. The Project site straddles both undeveloped land and an area that has undergone varying levels of development for the existing facility on Tria Road. In the undeveloped portion of the site to the west of the existing facility, the area remains largely undisturbed, with the exception of some all-terrain vehicle (ATV) trails that cross the site. The area is predominantly covered in shrub vegetation, but transitions to a forested area in the northern part of the site. The forested area is generally covered with willow, birch, and spruce trees 30 to 40 feet tall. In disturbed areas, shrub vegetation has given way to an area predominantly covered with short sedge and grass vegetation.

The wetland community in the Project area cover approximately 7.66 acres and consist of palustrine (freshwater) scrub-shrub wetland types as shown in Table 1. The Project area does not contain any streams, rivers, or lakes, but the Project is located within the Tanana River floodplain.

Table 1 – Summary of Wetland Areas

Wetland type	NWI Code
Broad-leaved deciduous scrub-shrub wetlands	PSS1B
Broad-leaved deciduous/evergreen scrub-shrub wetlands	PSS1/3B
Needle-leaved evergreen/broad-leaved deciduous scrub-shrub wetlands	PSS4/1B

The three (3) wetland types found within the Project area typically include the following vegetation communities:

1. **PSS1B** – Palustrine Scrub-Shrub, saturated shrub bog typically dominated by alder and willow
2. **PSS1/3B** – Palustrine Scrub-Shrub, saturated shrub bog, with alder and willow mixed with Labrador tea
3. **PSS4/1B** – Palustrine Scrub-Shrub, saturated, open canopy, stunted black spruce bog with a dense deciduous understory scrub-shrub wetlands are dominated by shrubs and/or dwarf or stunted trees. The dominant trees/shrubs of the broad-leaf deciduous communities within the Project Area generally include alders (*Alnus viridus*), willows (*Salix spp.),* dwarf birch (*Betula nana*), Alaska birch (*B. neoalaskana*), glandular birch (*B. glanulosa*), balsam poplar (*Populus trichocarpa*), Labrador tea (*Ledum decumbens*), bog blueberry (*Vaccinium uliginosum*), sweet gale (*Myrica gale*), and leatherleaf (*Chamaedaphne calliculata*). The herbaceous (emergent) layer in the broad-leaved deciduous communities generally includes horsetail (*Equisetum spp.),* grasses (family *Graminacea*), and sedges (*Carex spp*.). The dominant tree/shrub of the needle-leaved evergreen communities is black spruce (Picea mariana). Tamarack (Larix laricina), a deciduous needle leaved species, also occurs in these wetlands and is a dominant in some specific areas.

According to the NRCS soils data, the Fairbanks LNG Project Area is underlain by peat soils. The two (2) types of soil in this area (Mosquito-Noonku Complex and Mosquito mucky peat) are both considered hydric and are very poorly drained soils. The soil profiles typically consist of 0-18 inches of fibrous peat, followed by up to six inches of very fine sandy loam over permanently frozen material (NRCS 2004).

Functions and Values – The scrub-shrub wetlands in the Project Area provide the functions of groundwater recharge, groundwater discharge/lateral flow, and nutrient transformation and export. Surface hydrologic control is not one of the primary functions of these wetlands.

Stabilization of sediments is an important function of these wetlands in that they provide thermal protection for the shallow permafrost. Palustrine scrub-shrub wetlands can serve as foraging areas for black bear and moose. Seasonally, migratory songbirds may use scrub-shrub wetlands for nesting and rearing young during the summer months, and some resident birds use this wetland type during the winter.

FNG received a permit from the U.S Army Corps of Engineers to discharge gravel fill and excavated materials in the 7.66 acres immediately adjacent to the existing LNG facility on Tria Road (Permit No. POA-2007-964-M1). The disturbed wetlands were mitigated through the Mitigation Bank program purchasing 11.5 acres.

B. Full-Containment Tank Design

General

As discussed in Section II, the renewal request includes a design change of the LNG storage tank at the FNG LNG plant from single containment LNG storage tank to full containment LNG storage tank. The full-containment storage tank will store LNG, a cryogenic liquid that is 98% methane and 2% heavier natural gas liquids, stored at a temperature of -259°F (degrees Fahrenheit) (-162° C). Liquefaction of natural gas decreases the volume by approximately 600 times, making it economical to store and ship to areas not served by natural gas pipelines. LNG is a colorless, odorless, non-toxic material. LNG is non-flammable, with a boiling point of -259°F. The methane vapors boiling off of LNG are flammable. Methane is lighter than air at temperatures above -150°F. Therefore, natural gas dissipates in air if released into the environment. The full containment storage tank operates at atmospheric pressure up to a maximum of 2.5 pounds per square-inch gage (psig). The temperature of the stored LNG is maintained using fiberglass blankets, perlite and glass block for insulation. Boil-off gas (BOG) compressors are used to remove the vapors from inside the storage tank.

FNG's full containment (125,000 BBL or 5,250,000 gallons) LNG storage tank consists of a pre-stressed concrete outer wall and 9% Nickel (Ni) steel inner wall, concrete mat foundation, dome roof, suspended ceiling, all required insulation, with internal piping and connections as specified. The full containment storage tank used at the FNG LNG plant tank is generally depicted in Figure 8.

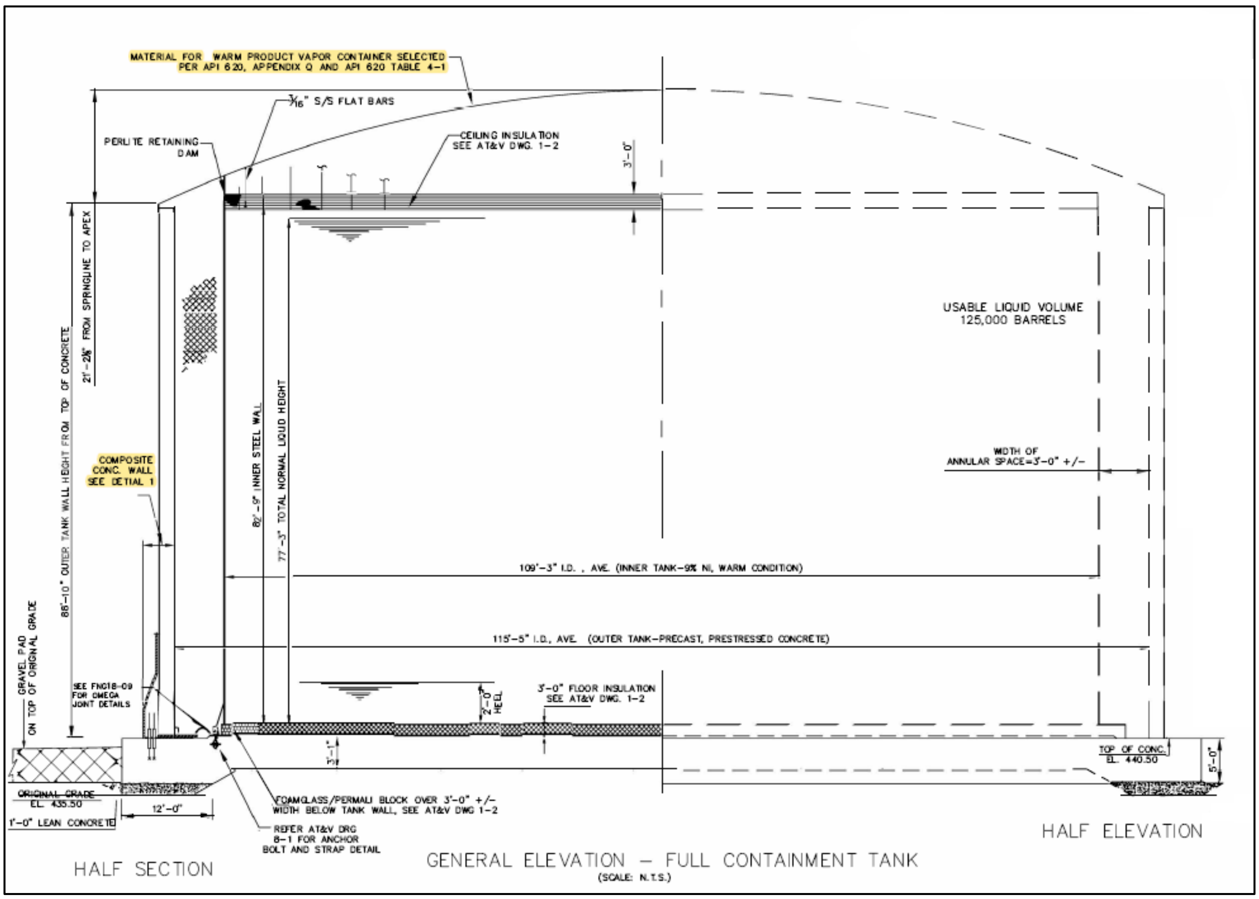

Figure 8 – FNG Full Containment LNG Storage Tank

Advantages of full-containment tanks include:

1. Full-containment tanks have a high integrity design when compared to a single containment tank design. In the event of an inner tank failure of a full containment tank, the outer tank is designed to contain both an LNG spill and the vapor generated. For a single containment tank design, the cryogenic temperature of LNG spilled out of an inner tank would crack the carbon steel outer wall, which is designed to contain the perlite insulation and BOG. Subsequently, LNG and vaporized natural gas would escape to the atmosphere through the cracked carbon steel outer wall. Since the carbon steel outer wall of a single containment tank is not designed to contain an LNG spill from the inner tank, a secondary impoundment system in form of a dike is required to contain LNG spilled from a single containment tank.
2. Full-containment tanks have a smaller thermal radiation exclusion zone than single-containment tanks because an inner tank failure will result in 100% containment in the concrete outer tank. For a single containment tank, the LNG from an inner tank failure would be contained by the secondary impoundment system in form of a dike, which has a greater surface area than the concrete outer tank. Due to the smaller surface area of the concrete outer tank, the thermal radiation from a full-containment tank fire would result in a much smaller hazard footprint and less risk to the surrounding public;
3. Full-containment tanks have a much higher resistance than single-containment tanks to external forces due to a thick pre-stressed concrete outer shell. A principal difference is the relative strength of biaxially pre-stressed concrete outer wall of the full containment tank as compared to the steel wall of the single containment tank. Section G.13 (Safety) discusses the strength of a full containment outer concrete wall in resisting light air-craft impact. For comparison purpose, a qualitative discussion on strength of a single containment system is also included.
4. The concrete finish minimizes external coating maintenance of the outer tank.

FNG's full containment tank system is composed of a 9% Ni steel primary (inner) open-top wall, a cryogenically rated precast, pre-stressed concrete secondary wall with carbon steel vapor barrier, 9% Ni steel primary and secondary tank floors, an aluminum suspended deck, concrete mat foundation, and a low temperature steel roof dome. Unlike a single containment tank that was previously proposed, both primary and secondary walls and steel floors of a full containment system are rated for cryogenic temperature.

The tank dimensions are as follows:

- Inner Tank (warm condition)
  - 109-feet 3-inch Inside diameter
  - 82-feet 9-inch Wall height
- Outer Tank
  - 115-feet 5-inch Inside Diameter
  - 88-feet 10-inch Outer Wall Height
  - 110-feet ± Height of Roof Dome (from top of foundation)
  - 124-feet ± Height to top of Pump Hoist System (from top of foundation)

Outer Tank and Steel Roof

The outer (secondary) wall is constructed using an approximately 10-inch thick precast, vertically pre-tensioned concrete panels with an integrated carbon steel liner on the outside face. Additionally, a layer of shotcrete, varying from 11-inch thick at the base to 2 ¾-inch thick at the top wall, is applied on the outside face of the carbon steel liner and 10-inch thick concrete outer wall. The top portion of the 2 ¾-inch shotcrete wall is circumferentially pre-stressed with a minimum of 53 wires per foot while the 11-inch base of the wall is pre-stressed with 154 wires per foot. The carbon steel liner is sandwiched between the 10-inch thick concrete core wall and the shotcrete layer. The carbon steel liner, along with wall concrete, is in a state of biaxial compression. Thus, the carbon steel liner is protected from exposure to LNG in case of a spill from the 9% Ni inner tank into the annular space. This design feature ensures that both the vapor and liquid containment capabilities of the outer tank are maintained even in case of an LNG spill. Total thicknesses of the outer concrete wall vary along the tank height as follow:

- 21 3/16-inch thick from the outer concrete tank bottom to 3 feet 6 inch;
- 18-inch thick for elevations 3 feet 6 inch to 18 feet;
- 13-inch thick for elevations 18 feet to 36 feet;

- 12 ¾-inch thick for elevations 36 feet to 68 feet;
- 12 ¾-inch thick for elevations 68 feet to 86 feet 1 ½ inch;
- 12 ¾-inch thick for elevations 86 feet 1 ½ inch to 87 feet 5 ½ inch

Insulation materials are installed between the inner 9 % Ni Steel and outer concrete/liner/shotcrete tanks to minimize heat gain from the atmosphere.

It should be noted that during operating conditions, the outer tank is resisting only a combined effects of internal vapor pressure and lateral pressure exerted by perlite. The loading under this operating condition constitutes only a fraction of loading imposed during LNG spill condition. In other words, significant pre-stress exists in the outer concrete wall during operating conditions. Furthermore, the outer wall is designed to maintain residual compression even under a combined action of abnormal events such as LNG spill, operating internal pressure and aftershock earthquake occurring after LNG spill.

The carbon steel liner of the secondary wall is welded to a 9% Ni secondary bottom at the base and low temperature carbon steel roof at the top to form a continuous vapor barrier. The secondary bottom will come in contact with LNG in case of spill scenario and hence is constructed out of 9% Ni steel. The outer tank wall connects to the roof in the compression region and includes a thickened vertical steel member extending from the precast wall panels. A compression bar is welded to the top of the vertical member. The dome roof is a self-supporting carbon steel structure of 3/16-inch thickness. The tank roof is painted white to reflect solar heat away from the tank. The carbon steel roof is located above the insulation deck and is at ambient temperature. The material selection for steel roof complies with provisions of Appendix Q in American Petroleum Institute 620 Design and Construction of Large, Welded, Low-Pressure Storage Tanks, 1990 Edition (API 620), Appendix Q “warm product vapor material” and API 620, Table 4-1.

The tank structure is designed for a wind speed of 150 miles per hour sustained as specified in 49 CFR 193. The pre-stressed concrete outer tank wall is also rated for cryogenic temperature per requirements in 49 CFR 193.2155(a)(3). FNG also designed the concrete outer tank to American Concrete Institute (ACI) 376 Code Requirements for Design and Construction of Concrete Structures for the Containment of Refrigerated Liquefied Gases and Commentary, 2011 Edition, (ACI 376).

The outer tank maximum design internal pressure is 2.5 pounds per square inch gauge (psig) and was tested to 3.125 psig in accordance with API 620. The pressure safety valves on the outer tank roof are set at 2.25 psig. The vacuum safety valves are set at minus 0.8-inch water column (IWC) on the outer tank roof. The outer tank minimum design internal pressure is minus 2 IWC, and FNG tested the outer tank to this limit.

Inner Tank

The inner tank has a maximum liquid capacity of 128,787 BBLs (5,409,054 gallons). The tank has a net-working capacity of 125,000 BBLs (5,250,000 gallons), allowing for the minimum operational level (i.e., 2-feet pump NPSH) of the in-tank pumps.

The inner tank, is a cylindrical, flat bottom, open top tank with a suspended insulation deck. The inner tank shell rings, annular plates, bottom plates, inner tank stiffeners and anchors have been constructed of ASTM A553, Type 1 (9% Ni). The inner tank plate thicknesses vary along the height of the inner tank wall as follow:

- 5/8-inch plates used for the bottom inner tank shell ring (inner tank height: inner tank bottom to 7 feet 11 inch);
- 3/8-inch plates used for the inner tank shell ring 2 (inner tank height: 7 feet 11 inch to 15 feet 10 inch); and
- 0.252-inch plates used for inner tank shell ring 3 to top of inner tank (inner tank height: 15 feet 10 inch to 82 feet 9 inch).

The inner tank, being open top structure, is not subjected to differential vapor pressure and is stressed only by LNG hydrostatic pressure, insulation loads and earthquake loads. The inner tank was successfully hydrostatically tested to 125% of the anticipated LNG loading based on 29.3 pounds per cubic feet.

The pressure differences between the exterior of the tank, atmospheric pressure, and the interior of the tank, vapor pressure is controlled by fixed safety release devices and by emergency control of the systems that remove pressure from the tank system. There are no vapor pressure differences between the outer tank and the inner LNG tank as the top of the inner tank is fully vented to the outer tank.

There is an automatic low tank pressure control system, pilot operated pressure control valves, that supplies natural gas to the LNG Tank in the event that the LNG tank pressure falls to 0.1 psig. The make-up flow rate is designed to be equivalent to the full capacity of the compressors that remove BOG from the LNG storage tank, or the worst-case rise of ambient air pressure change, to preempt the opening of the vacuum safety valves.

All process piping connections (for filling and emptying) for the tanks are through the roof.

Inner Tank Ceiling

The inner tank ceiling is an aluminum structure which covers the inner tank and supports the insulation above. The suspended insulation deck is covered with four (4) layers of 9" thick fiberglass insulation. The ceiling is suspended from the outer tank roof by stainless steel (SS) rods. A pressure equalization system is provided to ensure equal pressure above and below the ceiling. All penetrations of the ceiling are sealed with fabric to prevent any insulation debris from entering the inner tank.

Bottom Insulation

The bottom insulation system is located in between inner and outer tank bottoms and consists of six 6" thick layers of HLB 800 Foamglas™ blocks equivalent for a total thickness of 36 inches. The Foamglas™ layers that are directly beneath the inner tank shell consists of one layer of 5" block and then a 1" thick laminated wood board by Permali-Deho.

Foundation System

Prior to constructing the foundation, the subgrade soils beneath the tank (specifically, the frost-susceptible silts) were removed and replaced with non-frost susceptible gravel fill to the depths determined by the geotechnical engineer (approximately 12 feet). A flat-loop thermosyphon (ie, "active" cooling) system was installed beneath the tank to provide ground cooling during construction. Additionally, a flat-loop cooling system was installed around the perimeter of the tank foundation at a depth of approximately 6 feet below grade in order to provide active cooling to the subgrade during tank operation.

The concrete monolithic foundation is 128 feet in diameter, the outer twenty feet was 5-foot thick with the inner slab being 3-foot thick. Within the slab, foundation heating is provided through the incorporation of 1" NPS diameter SS conduits in the foundation. The SS conduits are spaced as determined by thermal studies, and house ½" PEX (5/8" O.D.) that will circulate a mix of propylene glycol and water to provide heating required to maintain the soils below the foundation at approximately 33 degrees Fahrenheit. SS conduits to house temperature measurement elements (RTD's or TC's) were installed below the foundation and are used to monitor the soil temperature.

Tank Access

A platform is provided at the periphery of the outer tank roof for access to the pump columns, relief valves and the tank gauging. All nozzles to which access is desired are located in the vicinity of this platform. There is a top angle or pipe handrail, center rail, and a ¼-inch by 4-inch kick plate for the roof platform.

The double stringer spiral stairway is provided, along the side of the outer tank shell, to permit access to the rooftop platform on top of the storage tank. This stairway has an OSHA compliant handrail system on the outside. A 3/8-inch SS safety line is installed between the tank top platform and the center of the dome roof to provide a tie-off line for personnel.

Tank Penetrations

Table 2 shows a list of the tank penetrations.

Table 2 – Full Containment Storage Tank Penetrations

Nozzle No.	Size	Description
N1	3"	LNG Tank Top Fill
N2	3"	LNG Tank Bottom Fill
N3A	14"	Pump Well Column
N3B	14"	Pump Well Column
N3C	14"	Pump Well Column
N4	2"	LNG Cool Down Line Spray Bar
N5	6"	Level Transmitter / Density Transmitter
N6	6"	Level Transmitter
N7	4"	Level Switch
N12	12"	Vapor Riser
N13A	10"	Tank Temperature Sensor
N13B	10"	Tank Temperature Sensor
N14	2"	Movement Indicator (4 ea.)

N16	6"	Painters Post/Purge (Center of Tank)
N17A	2"	N2 Purge Outlet
N17B	2"	N2 Purge Outlet
N17C	2"	N2 Purge Outlet
N17D	2"	N2 Purge Outlet
N18	6"	Outer Roof Perlite Fill Nozzle (24 ea.)
N20	1"	Inner Tank Foundation Purge
N21	1"	Inner Tank Foundation Purge
N12C	2"	Inner Tank Movement Indicator
M2	36"	Roof Manway
M3	30"	Roof Manway (temporary)
M4	18"	Roof Manway

LNG Storage Tank Design Spill and Containment System

The current LNG storage tank design is a full containment tank with over the top fill, with no LNG pipe penetrations below the liquid level. The outer wall and outer floor of the full containment tank are cryogenic rated structures as per National Fire Protection Association 59A Standard for the Production, Storage, and Handling of Liquefied Natural Gas, 2001 Edition (NFPA 59A-2001) and form the impoundment area that provides the spill containment for any size cryogenic leak from the inner LNG Tank. In accordance with 49 CFR 193.2181, the minimum volumetric liquid impoundment capacity formed by the outer tank wall must contain 110 percent of the maximum liquid capacity of the inner tank. Volumetric capacity of the outer tank is more than 110 percent of the total LNG volume contained by the inner tank.

The design spill is defined in NFPA 59A-2001, Section 2.2.3.5 as the largest flow from any single line that could be pumped into the impoundment area with the container withdrawal pump(s) delivering the full-rated capacity for 10 minutes. The largest liquid line out of the proposed tank is the 4-inch LNG Pump Discharge line. There are three (3) LNG pumps installed inside the full-containment tank, and these in-tank pumps are used to transfer LNG from the full-containment storage tank to the vaporizer area. Each in-tank pump is designed to deliver 400 gallons-per-minute (GPM) for vaporization and is capable of delivering 600 GPM at the "run-out" condition. The in-tank pumps are electrically interlocked such that only one pump can be operated at any given time. A 10-minute flow at 600 GPM yields a design spill volume of 6,000 gallons.

Within the tank area, there is a concrete open-top spill impoundment basin to account for the design spill volume, as required by NFPA 59A-2001. The spill impoundment basin is 22-feet-wide by 13-feet-long by 4-feet-deep, with an impounding capacity of 1,075 cubic feet, or 8,040 gallons. The top of the basin is at surface elevation, and the capacity of the basin is subsurface.

The impoundment basin has hydronic heating coil in the floor to melt snow accumulations. Rainwater and snow melt may accumulate in the concrete impoundment basin. In accordance with 49 CFR 193.2173, there is a sump pump installed in the impoundment basin to remove water. The sump pump starts automatically and will stop automatically upon detection of combustible vapor or low temperature from an LNG spill.

The impounding basin is divided into two chambers designed to minimize the surface area from which vapors will dissipate. Vapor dissipation in a small area reduces the risk of ignition, reduces the size of the thermal radiation exclusion zone in the event of ignition, and provides for personnel safety as required in 49 CFR 193.2511.

Figures 9 and 10 show the plan view and detailed section of the impounding system for the design spill from the LNG storage tank.

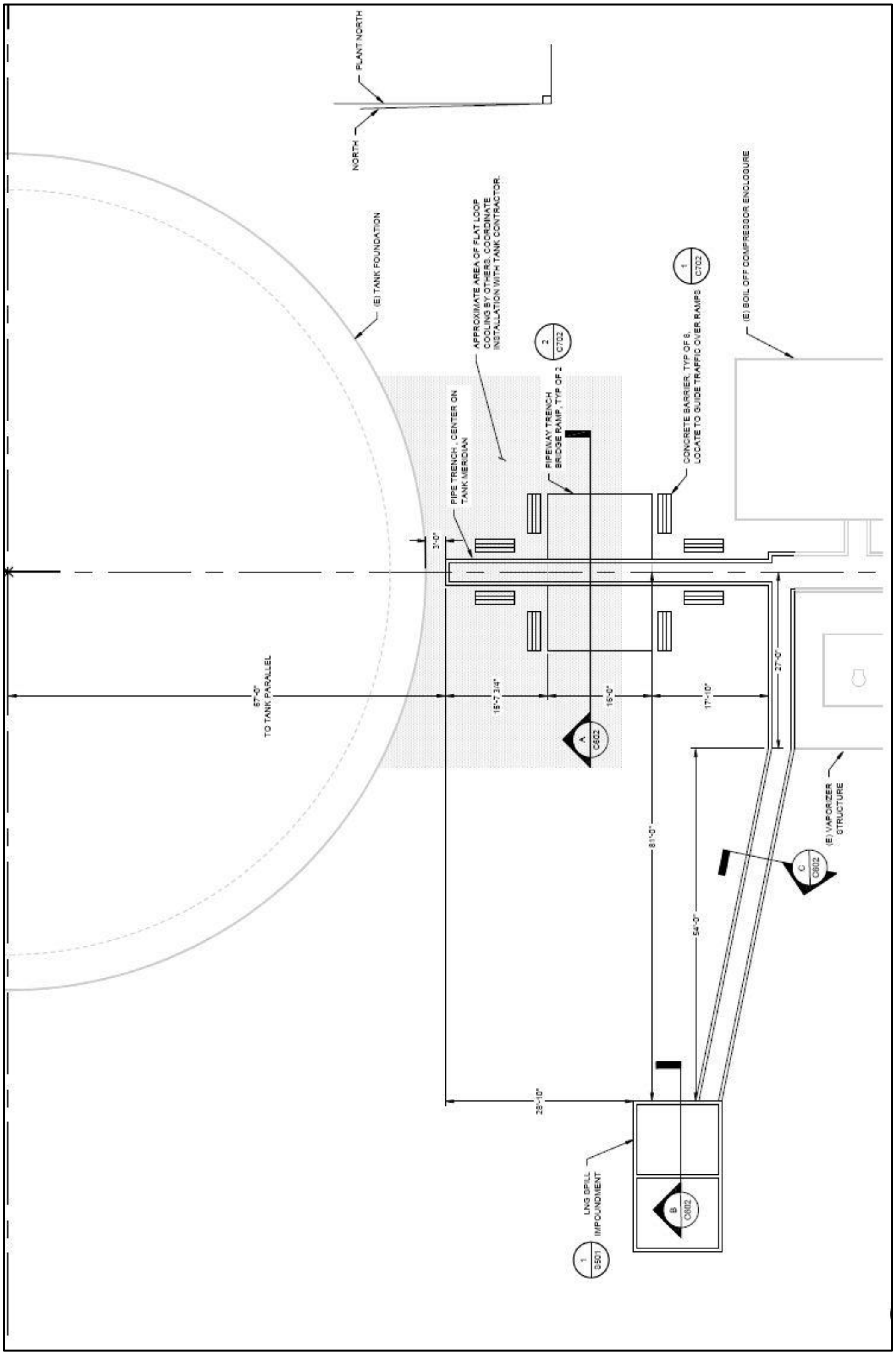

Figure 9 - Site Plan for Tank Spill Containment

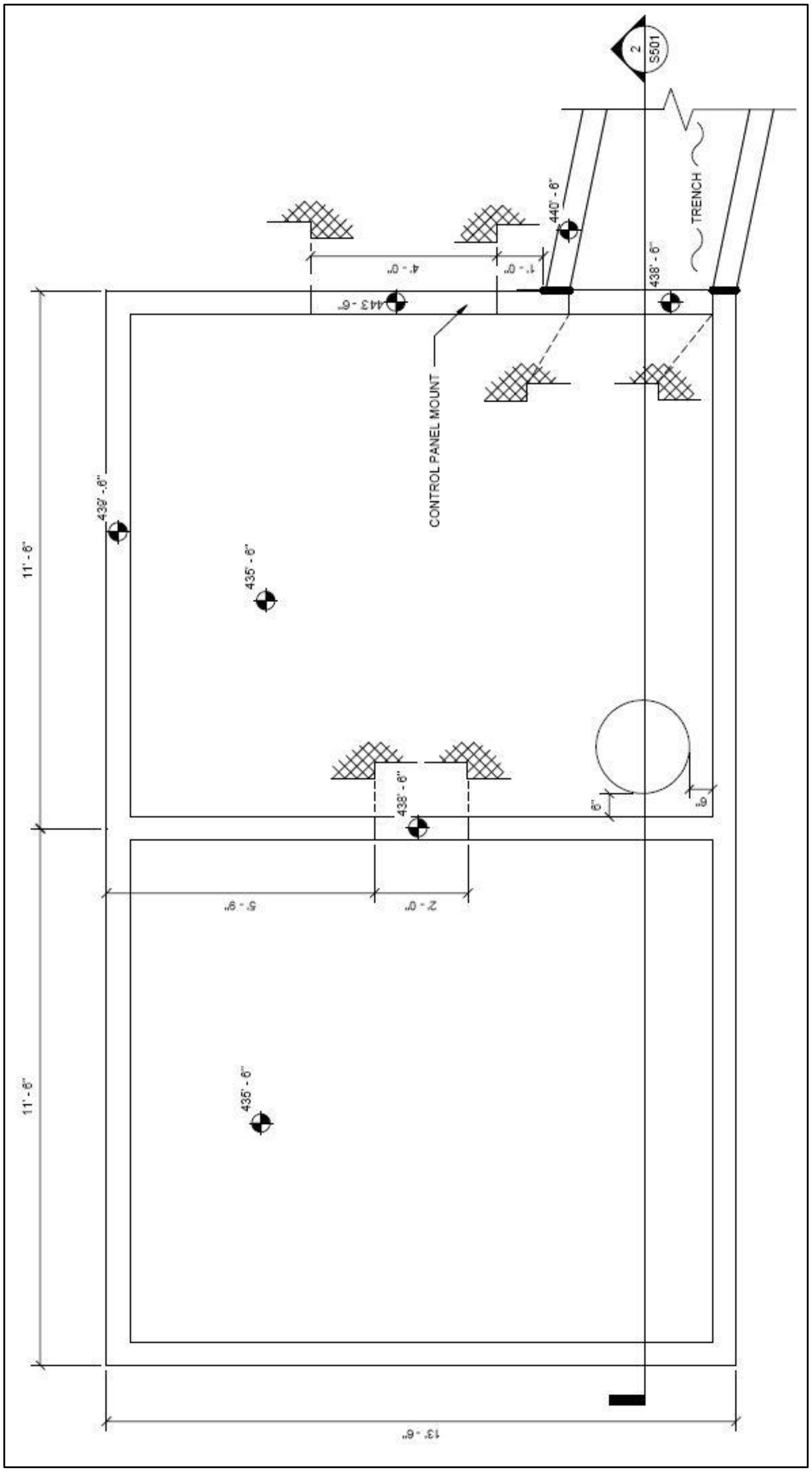

Figure 10 - Spill Containment Basin Detail

It should be noted that FNG's previously proposed single containment tank has a carbon steel outer wall and floor, which is not cryogenic rated, and only serves as a container for the perlite insulation between the outer tank and the inner 9% nickel steel inner LNG tank, and as the container for the gas pressure produced by the evaporation of the cryogenic LNG (boil-off). The thickness of the steel plates in the outer wall is 3/16 to 1/4 inch. Section 2.2.1 in NFPA 59A requires that accidental discharge of LNG at containers must be minimized using an impounding area. FNG's previously proposed single containment tank would include a stand-alone dike that surrounds the storage tank as a secondary impoundment. This dike would contain any release of LNG, including a liquid release due to external impact, from the single containment storage tank.

LNG Use and Source

The LNG product stored in the full containment storage tank will be used in the State of Alaska, FNSB. Initially, the product will be used in the greater Fairbanks and City of North Pole, Alaska areas. Future expansion may deliver LNG to communities not connected to natural gas supply pipelines.

The LNG stored in the full containment storage tank will be produced either in Cook Inlet, in south central Alaska, from either the Kenai and Matanuska-Susitna Boroughs, or on the Alaska North Slope, in the North Slope Borough.

VI. Alternatives

PHMSA's review of the potential alternatives is limited to (1) renewal and modification of the special permit imposing additional operations and maintenance requirements, including integrity management activities beyond those required under 49 CFR Part 193 and (2) denying the renewal application, in which case FNG's LNG storage tank located in Fairbanks, Alaska would need to be fully compliant with 49 CFR 193.2155(b).

Alternative 1: No Action Alternative

If the Special Permit Renewal request is denied, FNG would not be permitted to utilize an LNG storage tank within one mile of the runway end, as requested. FNG would be required to locate another site or not proceed with the construction of an LNG storage tank in the Fairbanks area. Selection of this alternative could delay the implementation of natural gas as a widely available space-heating fuel will be delayed.

Alternative 2: Selected Alternative

Under this alternative, PHMSA grants the Special Permit Renewal request that allows FNB to operate an LNG storage tank within less than one mile from a runway end. Under this alternative, PHMSA also allows FNG to change the design of the LNG storage from what was authorized in the original 2014 special permit that FNG did not act on. As described in greater detail above in **Section V. Site Description, B. Full-Containment Tank Design on pages 13 through 25 of 46**, PHMSA allows FNG to construct a "full containment tank," that does not require diking to achieve secondary containment unlike a "single containment tank" with adjacent secondary containment.

Selection of this alternative provides the most rapid path to natural gas as a space-heating fuel implementation. The location of the full-containment storage tank, although it is less than one mile away from the end of MTF, provides the shortest and most direct connection to the existing gas distribution network.

- This special permit is for the ***special permit facility*** that is defined as one (1) 125,000 BBL (5,250,000 gallons) full-containment LNG storage tank located 0.80 miles from the end of Runway 6 at MTF in Fairbanks, Alaska, where design changes have occurred from a single containment tank system to a full-containment tank system.

Overview of the Special Permit Conditions:

PHMSA grants this special permit subject to the following conditions:

1) **Plans and Procedures:** FNG must review and update the plans and procedures required by 49 CFR 193.2017(c)(2) including operations procedures required by 49 CFR 193.2503, 193.2507, 193.2509, 193.2513, maintenance procedures required by 49 CFR 193.2605, personnel qualifications and training procedures and requirements in 49 CFR Part 193, Subpart H, and security procedures required by 49 CFR 193.2903 at intervals not exceeding 15 months, but at least once every calendar year for the ***special permit facility***.

2) **Emergency Procedures:** FNG must review and update the plans and procedures required by 49 CFR 193.2509 at intervals not exceeding 15 months, but at least once every calendar year for the ***special permit facility***. As part of the review, Fairbanks LNG must update local

coordinating officials, including the Fairbanks Metro Field Emergency Response officials, of the most up-to-date emergency procedures, including changes made since the previous update. The update must address any lessons learned identified during the lessons learned review required by **Condition 5**.

3) **Security Procedures**: FNG must review and update security procedures required by 49 CFR Part 193, Subpart J at intervals not exceeding 15 months, but at least once every calendar year for the ***special permit facility***. As part of the review, FNG must update local coordinating law enforcement officials, including the Fairbanks Metro Field Security officials, of the most up-to-date security procedures, including changes made since the previous update. The update must address any lessons learned identified during the lessons learned review required by **Condition 5**.

4) **Annual Reports to PHMSA**: Within three (3) months following the grant of this special permit and annually[3] thereafter, FNG must submit an annual report to the Director, PHMSA OPS Western Region summarizing all significant integrity threats and the following items:

    a) In the first annual report, FNG must describe the economic benefits of the special permit including both the costs avoided from not locating the ***special permit facility*** further away from Fairbanks Metro Field and the added costs of the inspection program. Subsequent annual reports should address any changes to these economic benefits.

    b) In the first annual report, fully describe how the public benefits from energy availability. This should address the benefits of avoided disruptions and the benefits of maintaining system capacity. Subsequent reports must indicate any changes to this initial assessment.

    c) Any new integrity or security threats identified during the previous year and the results of any assessments performed during the previous year for the ***special permit facility***.

    d) Any reportable incident or any leak normally indicated on the DOT Annual Report, and all repairs on the ***special permit facility*** that occurred during the previous year in the

[3] Annual reports must be received by PHMSA by the last day of the month in which the Special Permit is dated. For example, the annual report for a Special Permit dated May 28, 2014, must be received by PHMSA no later than May, 31, each year beginning in 2015.

special permit facility.

e) Any Lessons Learned (**Condition 5**) findings including findings from the review and procedures update of **Condition 1** - Plans and Procedures, **Condition 2** - Emergency Procedures, **Condition 3** - Security Procedures, or **Condition 7** - Root Cause Analysis for Failure or Leak.

f) Any mergers, acquisitions, transfer of assets, or other events affecting the regulatory responsibility of the company operating the ***special permit facility***.

5) **<u>Lessons Learned</u>**: FNG must complete a minimum of twice each calendar year but not to exceed seven (7) months a lesson learned review and update of any procedures found to be in need of change from leaks, incidents, maintenance findings, security breaches, root cause analysis findings, aircraft near misses or abnormal flight operations that exposed the ***special permit facility*** to the threat of aircraft impact, or findings from liaisons with public officials.

6) **<u>Management of Change</u>**: FNG must develop and implement a management of change procedure to assure that any proposed changes in the design, construction, operation, or maintenance of the ***special permit facility*** that could affect integrity, safety, or security are properly coordinated and approved by all cognizant organizations and responsible parties within the operator’s organization prior to implementation. At a minimum, the management of change procedure must address: (1) establishment of communications between the operator's management, design, construction, engineering, operations, maintenance, security, emergency preparedness, associated field personnel, and any other cognizant organization or responsible party when planning and implementing physical changes to the ***special permit facility*** equipment or configuration; (2) establishment of communications between the operator's management, design, construction, engineering, operations, maintenance, security, emergency preparedness, associated field personnel, and any other cognizant organization or responsible party when planning and implementing procedural or operational changes or practices affecting to pipeline operation or maintenance; and (3) document the analysis and its conclusions, including the basis for approving the contemplated change and why the change is not inimical to safety, integrity, or security. Evaluation, approval, and authorization of contemplated changes must be documented.

7) **<u>Root Cause Analysis for Failure or Leak</u>**: FNG must notify PHMSA's Western Region Director within five (5) days, if a leak, failure or other incident occurs in the ***special permit facility.*** A 'root cause analysis' must be performed to determine the cause of the leak, failure or other incident and the findings must be sent to PHMSA's Western Region Director and Director of Engineering and Research Division within 60-days of the incident. PHMSA will review the 'root cause analysis' report to determine if revocation, suspension, or modification of the special permit is warranted based upon incident findings.

8) **<u>Documentation</u>**: FNG must maintain the records in paragraphs (a) and (b) for the ***special permit facility.*** FNG must maintain all documentation required by paragraphs (a) and (b) below for the life of the special permit and provide such documentation to PHMSA Western Region Director upon request:

   a) Documentation showing that FNG complied with 49 CFR 193.2017(c)(2), 193.2509, and Part 193, Subpart J**.**

   b) Documentation of compliance with all conditions of this renewed special permit.

Alternative 3: Alternatives Considered but Eliminated

The following alternatives were considered by FNG but eliminated:

FNG could have acquired additional land to the west of the proposed location with the intent of locating the full-containment storage tank outside the one-mile horizontal distance from the end of Runway 6 at MTF. FNG did not acquire this land because it would be costly and delay delivery of cleaner and cheaper natural gas to residents.

FNG conducted a search for available properties to place the full-containment storage tank. A site near the University of Alaska Fairbanks campus was considered for its proximity to planned pipeline gas supply. This site was rejected due to congestion, lack of suitably sized available property, and incompatible land uses. Another site near the Steese Highway and Farmer's Loop Road on the north side of Fairbanks was considered but was rejected for lack of available suitable sized lot and incompatible land uses due to residential density. A site in the industrial area North Pole was considered. This site was rejected because the size of the available lot does not provide adequate distance for vapor dispersion exclusion zones. This location requires additional distance for truck hauls from either Point Mackenzie or Prudhoe Bay as well as the greater distance from existing gas distribution infrastructure.

VII. Affected Resources and Environmental Consequences

A. Affected Resources and Environmental Consequences of the Proposed Action and the No Action Alternatives

1. Aesthetics:

The Project is located in an area zoned for Heavy Industrial. The top of the full-containment LNG storage tank is approximately 124 feet above ground level. The storage tank is concrete with a white painted roof, and it will not be visible from many locations outside of the LNG facility. The storage tank and ancillary equipment are similar to other facilities in the area.

2. Agricultural Resources:

There are no agricultural resources in the vicinity.

3. Air Quality:

Although the new LNG storage tank will draw increased trucking traffic to the site, the tank will improve air quality in the greater Fairbanks and North Pole area by providing the opportunity for residential and commercial users to switch from heating oil to natural gas. The FNSB area is currently a non-attainment zone for air quality. The conversion to natural gas as a heating fuel, displacing heating oil and wood, is expected to bring the air quality in the area into attainment.

The combustion of solid and liquid fuels creates very fine particulate matter, known as $PM_{2.5}$. These particles are two and a half millionths of a meter and smaller and cannot be seen with the naked eye. High levels of $PM_{2.5}$ in the air can lead to mild to severe human health problems and even premature death. Federal law provides for the protection of human health and safety, and $PM_{2.5}$ levels in the air are regulated under the federal Clean Air Act.

Due to geography, climate, types of emission sources, and population density within the FNSB, the concentrations of $PM_{2.5}$ often exceed the maximum levels set by the Clean Air Act. If $PM_{2.5}$ levels exceed the maximum allowable levels on a regular basis, federal law mandates the development and implementation of a plan to reduce and maintain $PM_{2.5}$ below the regulatory maximums. In the event that a plan is not developed that meets EPA approval and $PM_{2.5}$ levels are not reduced, the federal government can and will impose economic sanctions, including withholding federal funds for highway construction, reducing or eliminating federal expenditures on military bases in the area, and creating additional challenges for the local power plants and refinery to install emission controls or obtain permits. Figure 11 illustrates the non-attainment area.

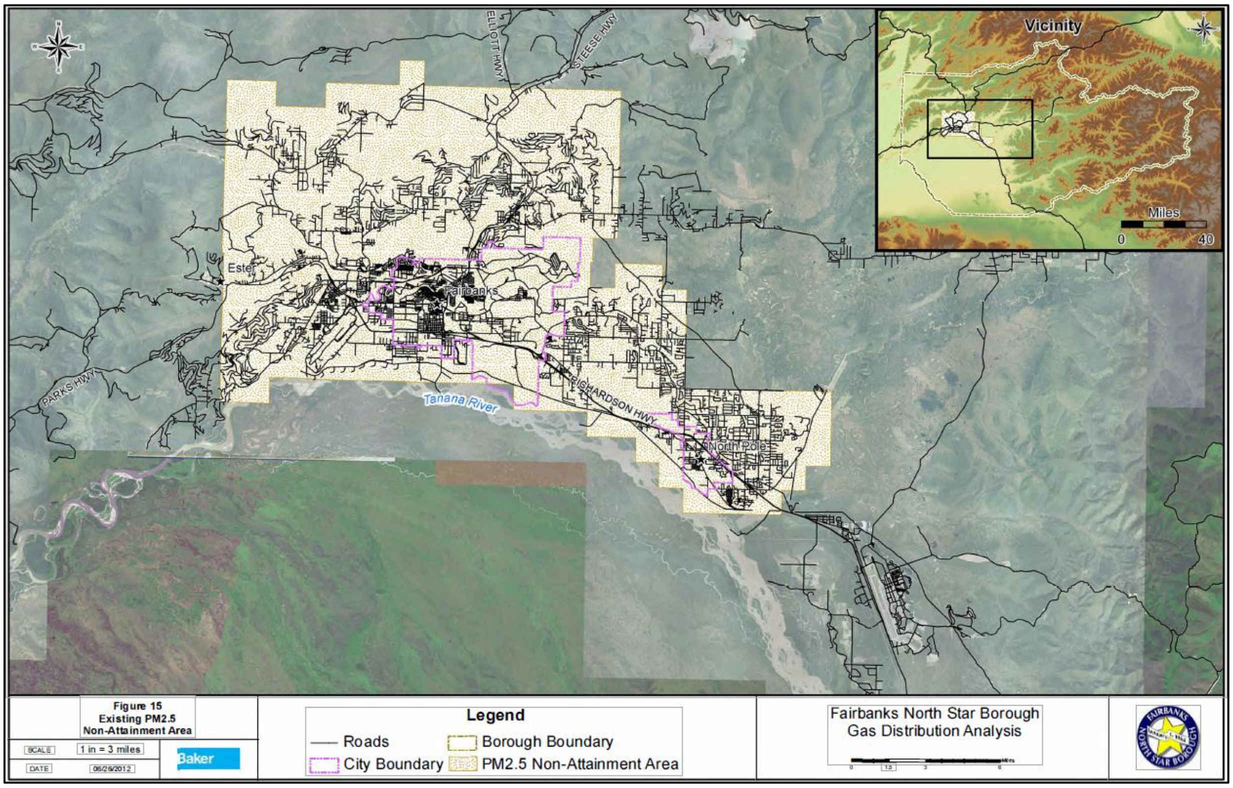

Figure 11 – $PM_{2.5}$ Non-Attainment Area

Studies by the US Energy Information Administration found that natural gas produces 92% fewer particulate emissions than oil, as well as reduced levels of carbon dioxide, nitrogen oxides, and sulfur dioxides.

Table 3 summarizes the difference in emission levels from natural gas and oil:

Table 3 - Fossil Fuel Emission Levels - Pounds per Billion Btu of Energy Input

Source: EIA - Natural Gas Issues and Trends 1998

Pollutant	**Natural Gas**	**Oil**	**Coal**
Carbon Dioxide	117,000	164,000	208,000
Carbon Monoxide	40	33	208

Nitrogen Oxides	92	448	457
Sulfur Dioxide	1	1,122	2,591
Particulates	7	84	2,744
Mercury	0.000	0.007	0.016

The full-containment storage tank has little potential to emit flammable vapor as the BOG from the tank would be sent to the BOG compressors instead of venting to the atmosphere. The compressors are electric driven.

A complete emissions inventory, permit and regulatory analysis was prepared under the General Conformity Rule (40 CFR 93) by SLR Consulting dated January 11, 2019. The results of the report find the project does not trigger any air quality permitting requirements based on potential emissions. The project remains subject to comply with state requirements and emission standards in 18 ACC 50 and the emergency electrical generator must comply with federal air quality requirements in 40 CFR 60 Subpart J.

A study[4] commissioned by the FNSB in 2012 details the improvements expected in air quality with the wider availability of natural gas. The FNSB formed a community-based Air Pollution Control Commission in 2015 to develop the EPA required Air Quality Comprehensive Plan. This report completed in April 2016 anchors on natural gas being paramount to substantially reduce $PM_{2.5}$ emissions and the need for this project.

4. Biological Resources:

The site description in Section A provides the details of the vegetation in the area. Migratory birds and moose occasionally browse in the area. A border of natural vegetation will be maintained around the Project site. There are no known species listed as threatened, endangered, or proposed for listing that occupy or visit the Project location. The remaining wetlands and uplands on the property will remain undisturbed.

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[4] Northern Economics, Inc. *Fairbanks North Star Borough Gas Distribution System Analysis:* Prepared for the Fairbanks North Star Borough. June 29, 2012. FNSB Project Number: 11-PWDPRJ-02.

5. Climate Change:

Because of the positive impact on air quality and reduction of carbon emissions expected with the availability of natural gas, only positive impacts to climate change are expected due to the reduction of particulates and carbon emissions attributable to the switch to natural gas as a space heating fuel. While the burning of natural gas results in the emission of carbon dioxide, which is a greenhouse gas, the burning of an equivalent amount of fuel oil (from an energy standpoint) results in the emission of a greater quantity of greenhouse gases.

The release of unburned methane contributes to climate change more aggressively than the release of carbon dioxide. As discussed in Section B, Full-Containment Tank Design, BOG compressors are used to remove the vapors from inside the storage tank to prevent overpressure of the LNG storage tank. In the event that the BOG compressors do not adequately reduce pressure in the tank, BOG in the LNG storage tank may vent to the atmosphere through the pressure relief valves (PRVs). Roll-over events, which occur following stratification of LNG in an idle storage tank, may cause release of the BOG through the PRVs. However, roll-over events do not occur frequently among existing LNG plants under PHMSA jurisdictions. The FNG LNG plant does not have a flare to burn off vented gas, so unburned methane emissions are possible. Furthermore, it is possible that the increased use of methane/natural gas in Fairbanks could indirectly allow for increased release of unburned natural gas in distribution or truck loading and unloading operations. However, proper procedures, design, and maintenance of hazmat transportation equipment and distribution pipelines allows for operation with minimal seepage release.

It is important to note that this special permit does not authorize the construction or operation of the Full-Containment Tank. It merely authorizes the deviation from the regulation requiring a mile spacing between the nearest airport runway. If PHMSA denied the special permit application and FNG built the tank in an alternate location, the emissions profile would be the same.

6. Cultural Resources:

There are no archeological or paleontological resources affected by the construction of the full containment storage tank.

7. Environmental Justice:

The area selected for the tank construction is an industrial area. However, some mixed income dwellings are in the vicinity. Despite the fact that area is a commercial and industrial area, inhabitants will likely be subject to greater amounts of truck and other traffic. While the risk of failure of the full containment LNG storage tank is extremely low, the nearby inhabitants would face greater risk in the event of a failure. . The racial makeup of the city was 65.0% White, 10.0% Black or African American, 10.1% Native American or Alaska Native, 5.1% Asian, 0.8% Pacific Islander. In addition, 9.0% of the population identified as Hispanic or Latino. In 2011, the per capita income for the city was $19,814. About 7.4% of families and 10.5% of the population were below the poverty line, including 11.6% of those under age 18 and 7.0% of those age 65 or over.

8. Geology, Soils, and Mineral Resources:

FNG had a geotechnical investigation of the site performed by Golder & Associates starting in 2012 with the final report completed in May 2014. A Technical Memorandum, completed in February 2013, provided the site specific seismic parameters for the Operating Basis Earthquake and the Safe Shutdown Earthquake ground motions and a Pile Load Test Report in June 2014. The investigation provided a characterization of the soils and the seismic profile for the site. In summary, the investigations determine that the site has a high seismic potential, but the risks are understood. A suitable foundation for the full containment storage tank can be constructed to allow it to withstand expected conditions.

9. Indian Trust Assets:

There are no Indian Trust Assets in the project area. The Tanana Chiefs Conference, a native tribal consortium of 42 native villages in interior Alaska, makes its headquarters in the city of Fairbanks. Doyon, LTD, with headquarters also in Fairbanks, is the Alaska Native Regional Corporation for the interior Alaska region. The nearest native communities to Fairbanks are Nenana, which is 40 miles to the southwest, and Minto, which is 50 miles to the northwest, of Fairbanks. Figure 12 shows the approximate locations of the nearest native communities.

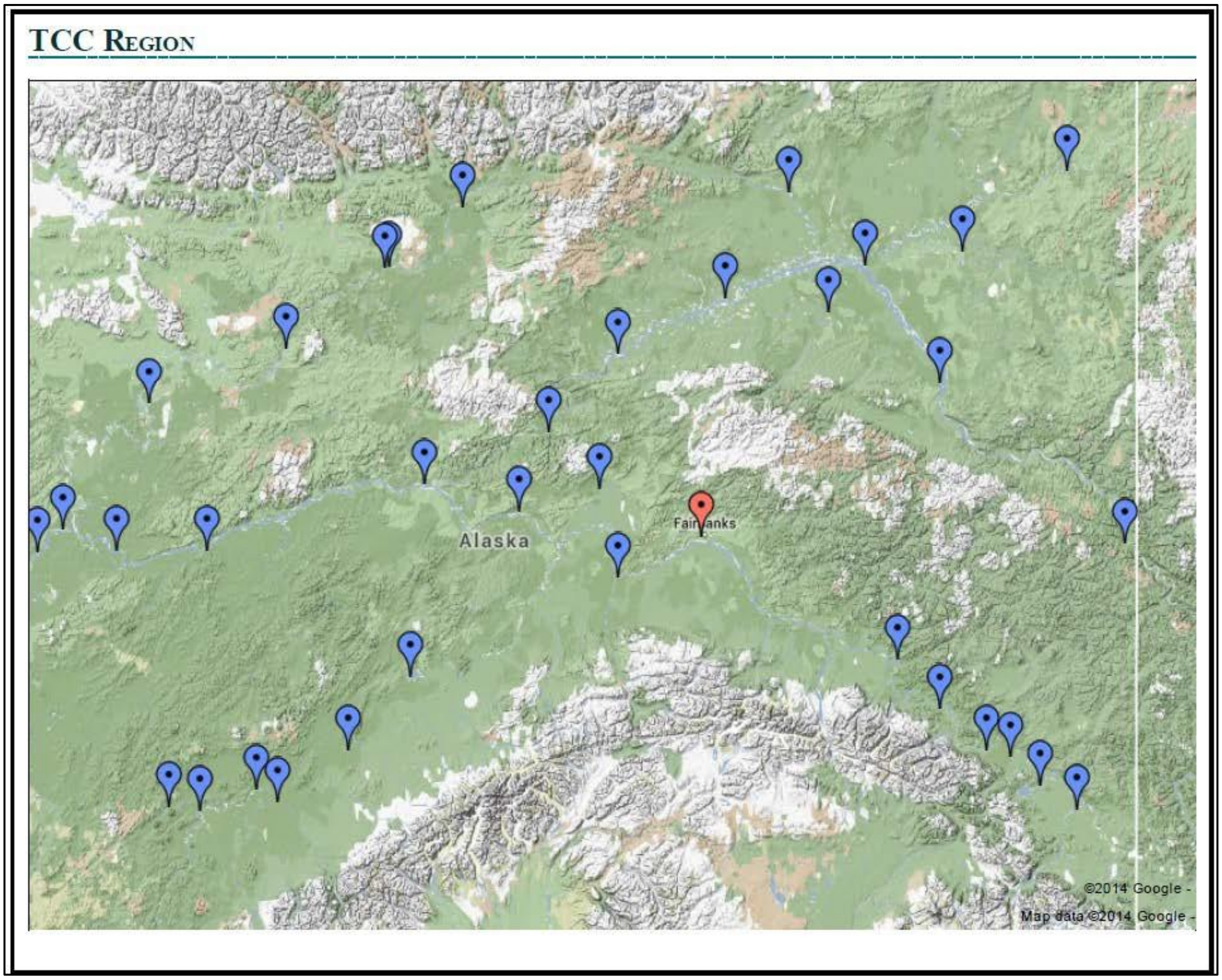

Figure 12 – Nearest Native Communities

10. Land Use:

The LNG tank is situated in an area zoned Heavy Industrial by FNSB[5] and is adjacent to an existing LNG Storage and Vaporization Site. The use of the land for the intended purpose of LNG storage and vaporization is already permitted by ordinance, so no zoning permit is required. The FNSB required a Conditional Use Permit, a Permanent Storm Water Control Plan and a Flood Plain permit, all of which were obtained by FNG. The FNSB 100-year flood elevation for this area is elevation 436 (BFE) feet above sea level and required the site to be 3 feet above this elevation. The structures are constructed at 4 feet above this base elevation. The Alaska Fire Marshal is the building authority and conducts plan review and issues Building Permits.

[5] https://fnsb.borough.codes/FNSBC/18.76.

11. Noise:

Noise levels will not permanently change as a result of the full-containment storage tank operation. Noise will be generated during construction, but the levels will not exceed that of the adjacent gravel mining operations. There are no noise ordinances pertinent to the selected tank site.

12. Recreation:

There is a recreation trail on the top of the Tanana River Flood Control Levee, across Tria Road to the south of the full-containment storage tank location. The full-containment storage tank construction and operation will not impact access to or use of the trail.

13. Safety:

The design and construction of the LNG storage tank complies with 49 CFR 193 and the incorporated by reference industry standards. However, the full-containment storage tank's proximity to the MTF, FNG Airstrip is what requires a special permit for waiving the requirements in 49 CFR 193.2155(b). Given the tank's proximity to the end of a runway and the change in design from the one approved in the 2014 special permit that no longer includes secondary impoundment diking, it is important to assess how an impact from a light aircraft would affect the tank.

This section discusses how a full containment tank's outer concrete wall could withstand the impact of a light aircraft from the MTF. For comparison purpose, a qualitative discussion on strength of a single containment system is also included.

In addition to American Concrete Institute (ACI) 318, FNG used ACI 376 *Code Requirements for Design and Construction of Concrete Structures for the Containment of Refrigerated Liquefied Gases* for the design and construction of the concrete outer wall. ACI 376-11 Section 8.4.12 requires that the wall thickness shall be 20% more than the missile perforation thickness. Perforation is defined as the passing of a missile completely through the impacted structural member with or without exit velocity. ACI 376-11 Section 8.4.13 further requires that "For walls with thickness smaller than twice the perforation thickness the minimum percentage of reinforcement shall be 0.2 percent in each principle direction and on each member face."

The type of aircraft that are known to operate from MTF are single engine "light aircraft" such as Cessna 206 with maximum weight of 3,600 pounds (lbs.), stall speed of approximately 54 miles per hour (mph) and cruise speed of 163 mph. The most popular aircraft is Cessna 172 Skyhawk which weighs 2,450 lbs. with stall speed of 54 mph and cruise speed of 141 mph. The heaviest aircraft with only two flights per year from MTF is reported to be Air Tractor AT 802A with the maximum weight of 16,000 lbs., stall speed of 105 mph and working speed of 160 mph. All aircrafts that operate out of the MTF carry some amount of petroleum-based fuel.

FNG provided calculations based on Comite Euro-International du Beton (CEB) Bulletin No. 187, *Concrete Structures Under Impact and Impulsive Loading*, to demonstrate that the concrete wall thickness is sufficient to prevent perforation. FNG assumed that the impact takes place when aircraft has veered off from its course and is moving towards the tank at a stall speed. FNG used the stall speed in the calculation because the tank is not in direct path of the landing and takeoff strips, and landing/takeoff speeds are much less than cruising speed. An aircraft would lose altitude without any control only when flying speed is less than the stall speed.

As discussed in CEB bulletin No. 187, the aircraft impact is considered as "soft impact." This is because the aircraft body will deform at the time of impact against concrete wall, thus absorbing significant impact energy.

The uncertainties associated with aircraft impact study include the angle of aircraft at the time of the impact, the impacted area of the wall, the components of aircraft that will be in contact with wall at the time of the impact, strain rates, material failure envelopes, deformation of wall as well as aircraft, etc.

CEB 187, Bulletin No 1 provides empirical methods based on extensive experimental research for assessment of concrete wall when subjected to a missile impact. Accordingly, an aircraft will perforate the wall upon impact if the punching shear strength of the wall is less than the average dynamic force generated during the impact. Average dynamic force generated by the aircraft impact is calculated using CEB 187 equation 4.13 for a given weight and speed of an aircraft. This equation is derived from an idealized loading function for a theoretical military fighter jet with a weight of 44,000 lbs. (~ 20,000 kilograms) impacting a concrete wall at a speed of 480 mph (215 meters/second).

The punching shear strength of the concrete wall is calculated per Equation 4.9 of CEB 187 and depends on the area of concrete wall sustaining impact. Significant judgement is required to arrive at appropriate area of impact. In order to evaluate the influence of this area parameter on the punching shear strength of the wall, the impact area was varied from as low as 4-inch diameter to as high as 60-inch diameter in the calculations per CEB 187.

Table 4 shows the dynamic forces generated by impacts from different types of aircraft at the MTF, and Table 5 shows the punching shear strength of the outer concrete wall based on the impact diameters. FNG's calculations show that at stall speeds, the impacts from various aircrafts, such as the Cessna-172, Cessna 206, and Canada DHC-2, would not perforate the outer concrete wall, even for a minimum size of impact area of 4-inch diameter and a minimum total wall thickness near the top of the wall of 12.75-inch at the top. Even though the Air Tract-AT-802A would perforate the concrete wall if the assumed impact diameters are 18 inches or less, FNG noted that there are only two Air Tract-AT-802 flights per year. The punching shear strength of the wall increases with larger impact diameters or areas. Based on the geometry of the aircrafts, FNG expected the impact diameter is approximately 60 inches.

Table 4 – Average Dynamic Force for Aircrafts at MTF

Air Carft Type	Max. Weight (kg)	Stall Speed (m/s)	F_av_stall (N)	Cruise Speed (m/s)	F_ave_max (N)
Cessna-172	1111	24.1	146541.1	63.0	1001397.1
Cessna 206	1636	28.2	254391.2	73.0	1709125.2
Canada DHC-2	2318	26.8	284896.1	64.0	1630549.2
Air Tractor-AT-802A*	7257	46.9	1779604	71.5	4132231.8

*only two flights per year, maximum working speed is 160 mph

Table 5 – Punching Shear Strength of Wall Based on Impact Diameter

Impact Diameter (in)	(meter)	Shear Strength (N)	Comments-Comparison with Average Dynamic Force	
4"	0.1016	2763191	No perforation No perforation	Shear strength exceeds F_av_stall for all aircraft in Table 1 except AT-802A, shear strength exceeds F_av_max for all
8"	0.2032	3092238	No perforation No perforation	Shear strength exceeds F_av_stall for all aircraft in Table 1 except AT-802A, shear strength exceeds F_av_max for all
12"	0.3048	3421284	No perforation No perforation	Shear strength exceeds F_av_stall for all aircraft in Table 1 except AT-802A, shear strength exceeds F_av_max for all
18"	0.4572	3914855	No perforation No perforation	Shear strength exceeds F_av_stall for all aircraft in Table 1 except AT-802A, shear strength exceeds F_av_max for all
24"	0.6096	4408425	No perforation No perforation	Shear strength exceeds F_av_stall for all aircraft in Table 1 shear strength exceeds F_av_max for all
30"	0.7620	4901995	No perforation No perforation	Shear strength exceeds F_av_stall for all aircraft in Table 1 shear strength exceeds F_av_max for all
36"	0.9144	5395565	No perforation No perforation	Shear strength exceeds F_av_stall for all aircraft in Table 1 shear strength exceeds F_av_max for all
42"	1.0668	5889135	No perforation No perforation	Shear strength exceeds F_av_stall for all aircraft in Table 1 shear strength exceeds F_av_max for all
48"	1.2192	6382705	No perforation No perforation	Shear strength exceeds F_av_stall for all aircraft in Table 1 shear strength exceeds F_av_max for all
60"	1.5240	7369846	No perforation No perforation	Shear strength exceeds F_av_stall for all aircraft in Table 1 shear strength exceeds F_av_max for all

Since the common types of aircrafts at MTF cannot perforate the wall at stall speed, the bodies of the aircrafts, including fuselage and fuel tank, would fall to the ground surface. The resulting fire from burning of aircraft fuel can be extinguished by fire protection measures implemented at the FNG LNG Plant because there would be no supply of additional fuel resulting from LNG spill.

The concrete wall section is approximately 21-inch thick at base, including 11 inches of shotcrete and 10 inches of pre-stressed concrete core wall. ACI 216.1 provides information on fire resistance of concrete and masonry assemblies. Calculations by FNG based on the diffusivity of concrete (9.1 x 10^{-6} ft^2/s) indicate that it will take approximately 5 hours before the temperature on the inside face of 21-inch thick wall starts rising in response to fire induced high temperature on the outside face of the wall. A fuel tank of Cessna 206 has 88 gallons of fuel capacity. Typical fuel burning rate for light aircraft is reported to be about 100 gallons per hour;

therefore, a full fuel tank of Cessna 206 would burn out in less than an hour. FNG concluded that the temperature at the inside face of the concrete wall would not respond to the outside temperature rise due to an ignition of the fuel from the aircraft. Depending on the distance of the fire, the temperature of the outermost layer of pre-stressing wire may rise. Figure 13 shows strength reduction in reinforcing and pre-stressing steel with temperature rise.[6] As can be seen, pre-stressing strand has 80% of its original strength at temperature of 500°F and 20% of original strength at 1,000°F. Since the outermost layer of pre-stressing wire is about 1.25 inches inboard of the shotcrete face, FNG calculates that it will take more than one hour before the temperature of pre-stressing steel reaches above 1,000°F, assuming that the temperature on the outside face of shotcrete remains at 1,000°F during that period. Even if outer two layers of pre-stressing wires are rendered ineffective due to fire related strength degradation, FNG concluded that there is no significant loss in the structural capacity of the section because the outer two layers of pre-stressing wires represent 13% (20 wires out of 154 wires) of the total pre-stressing force. The strength requirement of the outer wall at operating condition is only a fraction of strength requirement for upset condition. The outer tank wall is designed to have some amount of residual compression under a combined action of full volume of LNG (spill) and associated thermal shock plus hydrodynamic forces associated with aftershock earthquake event plus internal pressure of 2.5 psig.

[6] Source: ACI 216.1.

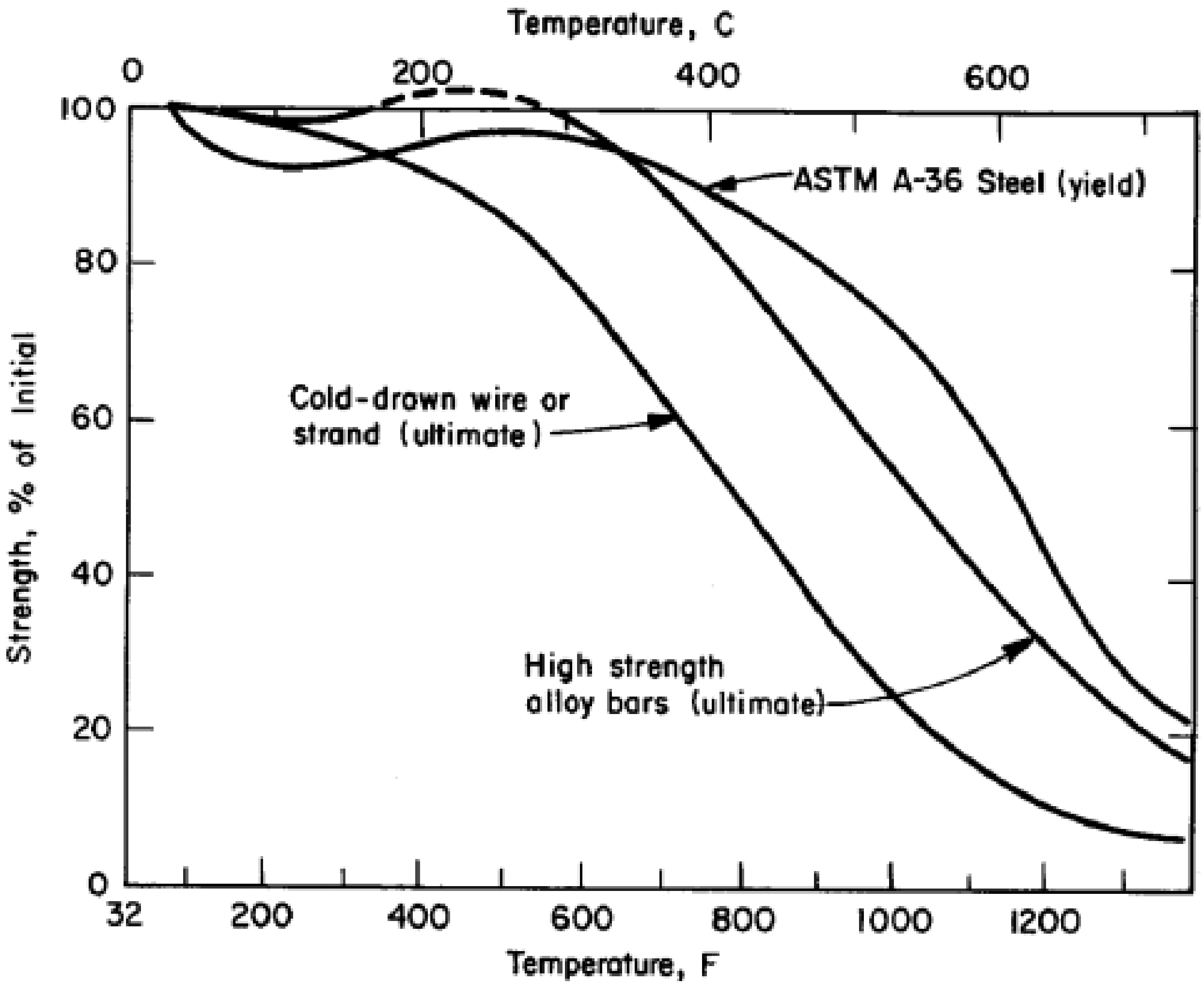

Figure 13 – Strength Reduction in Steel reinforcement with Temperature Rise

If an aircraft impacts the metal roof of the full-containment tank, there is a low probability that the impact of one of the heavier parts of the aircraft would puncture through the metal roof causing a gas leak and a resulting fire. The roof is a spherically shaped structural dome. Unless the impacts are perpendicular to the dome, which is unlikely, the roof would deflect the impacting object off at an angle and significantly reduce the dynamic impact force. Furthermore, the body of aircraft will deform, thus absorbing significant amount of impact energy. In the event of a fire due to complete collapse of the roof, the radiant heat effect from the full-containment tank concrete outer wall would be less significant than from the single containment tank dike. For the previously proposed single containment LNG storage tank, impacts from the airplane may perforate the outer carbon steel secondary container as well as the 9% Ni steel primary container. The LNG released from the primary container of a single containment LNG storage tank would be impounded by a secondary impoundment system in the form of a dike. However, the thermal radiation exclusion zones from the single containment tank dike fire would be greater than the thermal radiation exclusion zones from the full-containment concrete outer wall fire due to the larger surface area of the impoundment system.

On two (2) separate occasions, FNG requested the FAA to conduct an aeronautical study for this project that included both the LNG storage tank and the temporary obstruction of a crane needed for the construction of the tank. The FAA on February 10, 2014 made a Determination of No Hazard to Air Navigation (Aeronautical Study Nos. 2013-AAL-467-OE and 2014-AAL-14-OE) for the previously proposed single containment LNG storage tank. Due to the delay in the project funding, FNG requested the FAA again to conduct an aeronautical study based on a revised design for the currently built full-containment LNG storage tank. On December 12, 2017, the FAA issued a Determination of No Hazard to Air Navigation for the full-containment storage tank and the temporary crane structure used in its construction as part of the pre-construction activity, provided that FNG would complies with all lighting and marking determinations. See Appendices A and B for FAA determinations of Aeronautical Study for the full-containment storage tank and the temporary crane structure.

As shown in Figure 14, the full-containment LNG storage tank location in relation to MTF is not directly in the flight path of the airport, nor is it in the airport traffic pattern. The wooded area surrounding the project site, the adjacent gravel mining operation with stockpiles and cranes, and the proximity of power lines do not make the project site a desirable emergency landing area in the event that an aircraft arriving or departing the MTF had to make an emergency off-airport landing. The ponds and roadways in the vicinity are more attractive emergency landing areas.

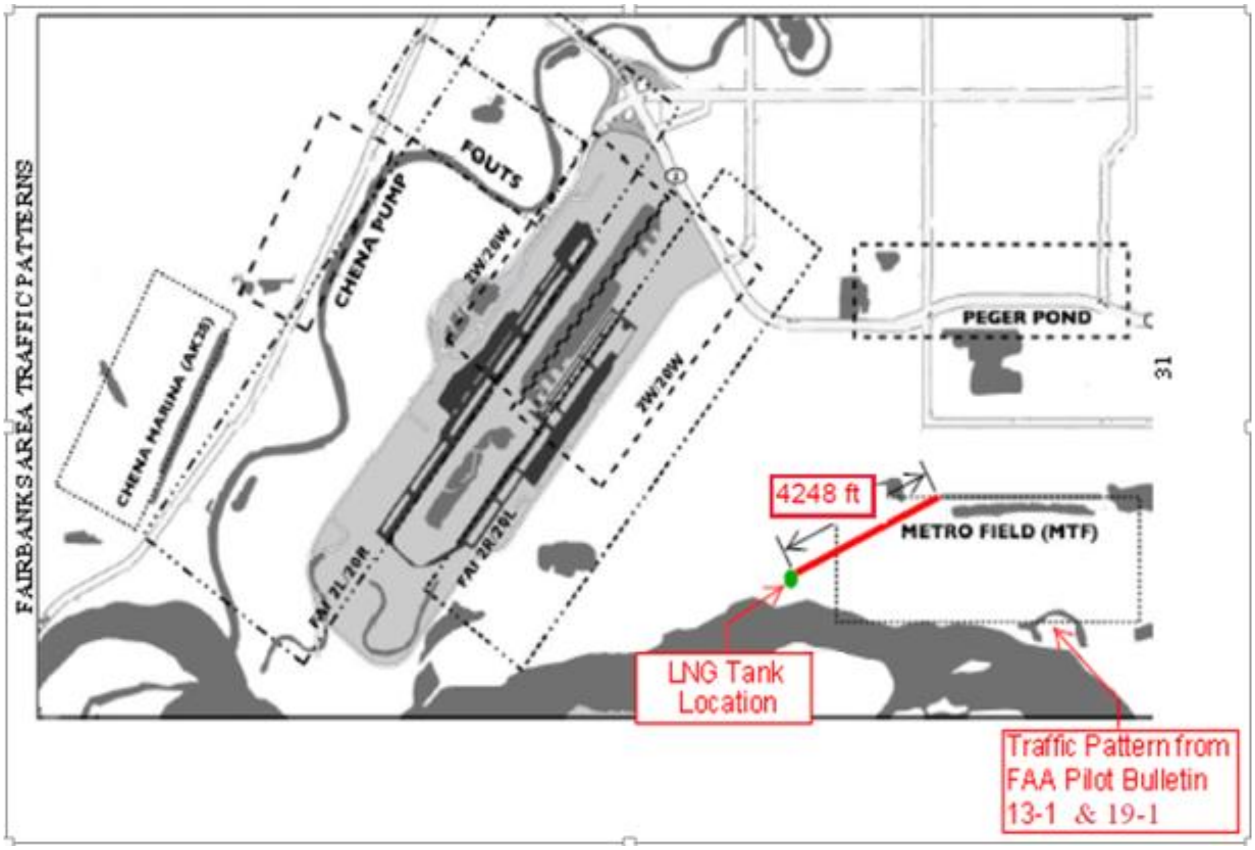

Figure 14: Fairbanks Area Air Traffic Patterns

Based on FNG's calculation that PHMSA has reviewed, the concrete outer wall will in unlikely to perforate or fail structurally in response to impacts from aircrafts that are known to utilize the MTF.

14. Thermal Exclusion Zones under the Special Permit Renewal

Title 49 CFR §193.2057 and the incorporated by reference NFPA 59A-2001 Section 2.2.3.2 provide provisions for thermal radiation exclusion zones from each LNG container. The extent of the thermal radiation fluxes depends on the surface area of the impounded LNG. The impounding area for a full-containment LNG storage tank is the area within its concrete outer wall while the impounding area for a single-containment LNG storage tank is the area of the dike surrounding the primary container. Therefore, the extent of the thermal radiation fluxes for a full-containment LNG storage tank is smaller than from a single-containment LNG storage tank.

With PHMSA's issuance of the Special Permit Renewal, it appearsfewer people would be affected by the thermal radiation from a tank fire. The concrete outer wall is also designed to contain full volume of LNG spill from the primary container in accordance with §193.2181 and provides impact protection to the inner tank.

15. Socioeconomics:

The area within 1-mile radius of the full containment storage tank is zoned Heavy Industrial and Light Industrial, and new dwelling units will not be built in this zone. There are 24 residential dwelling units within the one-mile radius located primarily east and northeast of the FNG LNG Plant. The nearest residential dwelling is 3,050 feet east of the site.

16. Topography:

The site area is generally flat, with natural variations in elevation less than five feet. The site for the full-containment storage tank straddles both undeveloped land and an area that has undergone varying levels of development for the existing FNG LNG Plant on Tria Road. In the undeveloped portion of the site to the west of the existing facility, the area remains largely undisturbed, with the exception of some ATV trails that cross the site. The area is predominantly covered in shrub vegetation but transitions to a forested area in the northern part of the site. The forested area is generally covered with willow, birch, and spruce trees 30 to 40 feet tall. In disturbed areas, shrub vegetation has given way to an area predominantly covered with short sedge and grass vegetation.

Construction of the full-containment storage tank and associated facilities required the clearing, gravel fill and disposal of unsuitable material of approximately 7.7 acres of surface. Areas of permafrost soil, such as this site are typically insulated with approximately four (4) feet of gravel fill to prevent heat from being transmitted into the soil. Failure to follow this practice could cause the permafrost layers to melt, resulting in unsuitable building conditions. The LNG storage tank foundation employs both passive and active cooling systems to ensure that the permafrost remains frozen.

17. Transportation:

Currently, there are up to six (6) delivery trucks per day making deliveries to the existing Storage and Vaporization Site. After the full-containment storage tank is in operation, it will receive up to 30 deliveries per day. Tria Road that provides access to the site is constructed for heavy truck traffic and will not be significantly affected by the additional traffic.

18. Water Resources:

As described in the Preliminary Jurisdictional Determination prepared by URS Corporation in August 2013, FNG applied for a Department of the Army wetlands fill permit, POA-2007-964-M1, on October 25, 2013 and conditionally granted on January 8, 2014. The final issuance of the permit required completion of the in-lieu fee credit program with Middle Tanana Mitigation Bank, which was completed on November 29, 2017. Modification has been made to the permit to provide for the change in configuration of the site for a full-containment tank.

VIII. Consultation and Coordination

FNG and PHMSA personnel involved in preparation of this document include:

PHMSA	Joseph Sieve, Engineer
	Nicole Anderson, Engineer
	Thach Nguyen, Engineer
	Steve Nanney, Engineer
	Amelia Samaras, Attorney
	Robert Bachman, Structural Engineering Consultant

Below is the list of consultation and coordination for FNG:

Fairbanks Natural Gas, LLC	Dan Britton, President
Stantec Consulting Services	David Prusak, Consultant Project Manager
Haskell Corporation	Doug Smith, Consultant previously serving as project director as agent for FNG
URS Corporation	Bill Craig, Project Manager
	Valerie Watkins, Environmental Scientist
	Dave Erikson, Senior Wetlands Scientist
Golder and Associates	John Thornley, Senior Geotechnical Engineer
	Mark Musial, Principal and Manager Alaska Operations
CHI Engineering, Inc.	Chris Hosford, PE, Principal Consulting Engineer
	Matthew Menchen, PE, Process Engineer
	Chris Albers, Project Engineer

Matrix Services, Inc.	Ryan Pippett, Project Manager
Design Alaska, Inc.	Chris Miller, PE, Principal Consulting Engineer
Preload Cryogenics, Inc.	Sanjay Mehta, PE, Engineer for Foundation Design
Global Engineering Services	Sanjay Mehta, P.E., Tank Structural Engineer of Record
American Tank & Vessel	David Houston, PE, Project Engineer

IX. Response to Public Comments Placed on Docket PHMSA-2013-0181

PHMSA published a Notice of Availability in the Federal Register on June 25, 2020 for the special permit renewal request for the LNG storage tank at 2942 Tria Road, Fairbanks, Alaska (85 FR 38250, Docket No. PHMSA-2013-0181 at: www.regulations.gov). PHMSA requested comment on the special permit renewal application, the special permit conditions, and the environmental analyses. The public notice comment period ended on July 27, 2020. PHMSA did not receive any comments from the Federal Register notice by August 3, 2020.

X. Finding of No Significant Impact

In consideration of the safety conditions explained above, PHMSA finds that no significant negative impact will result from the issuance and full implementation of the above-described special permit to waive the requirements of 49 CFR 193.2155(b) for the ***special permit facility***. The ***special permit facility*** consists of one (1) 125,000 BBL (5,250,000 gallons) full-containment LNG storage tank located 0.80 miles from the end of Runway 6 at MTF in Fairbanks, Alaska, where design changes have occurred from a single containment tank system to full-containment tank system.

Based on PHMSA's review of the integrity of the concrete outer wall, there is no significant risk for the full-containment LNG tank in proximity to the MTF. Therefore, PHMSA does not include additional safety conditions for the ***special permit facility***.

XI. Bibliography

Fairbanks Natural Gas Liquefied Natural Gas Storage Tank Geotechnical Report for the LNG Tank Site 2942 Tria Road, Fairbanks, Alaska, Report No. 123-95889, Golder and Associates, May 6, 2014.

Technical Memorandum, Parameters for Seismic Analysis and Design – Fairbanks Natural Gas LNG Storage Facility, Fairbanks, Alaska Report No. 123-95889, Golder and Associates, February 1, 2013.

Air Quality Permit and Regulatory Applicability Analysis for Fairbanks Natural Gas LNG Storage Facility, SLR Consulting, January 11, 2019

Air Quality Comprehensive Plan, Framework for Healthy Air, People, and Economy, FNSB Air Pollution Control Commission, May 4, 2016

Fairbanks Natural Gas, LLC 5.25 Million Gallon LNG Storage Tank Project Environmental Assessment Questionnaire, PHMSA Docket Number 2013-0181, September 16, 2013

Preliminary Jurisdictional Determination of the Waters and United States and Wetlands Fairbanks Liquefied Natural Gas Project, Fairbanks, Alaska, URS Corporation, Report No. 26221119, August 19, 2013

Alaska Mapper http://dnr.alaska.gov/MapAK/

Fairbanks North Star Borough GIS http://gis.co.fairbanks.ak.us/

Completed by PHMSA in Washington, DC on: September 3, 2020

APPENDIX A

FAA 2017 Determination of No Hazard for the Full-Containment Storage Tank

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
10101 Hillwood Parkway
Fort Worth, TX 76177

Aeronautical Study No.
2017-AAL-311-OE
Prior Study No.
2014-AAL-14-OE

Issued Date: 12/15/2017

David Prusak
Fairbanks Natural Gas, LLC
3408 International Street
Fairbanks, AK 99701

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Tria Road LNG Storage Tank
Location:	Fairbanks, AK
Latitude:	64-48-14.19N NAD 83
Longitude:	147-48-00.54W
Heights:	435 feet site elevation (SE)
	122 feet above ground level (AGL)
	557 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

______At least 10 days prior to start of construction (7460-2, Part 1)
__X__Within 5 days after the construction reaches its greatest height (7460-2, Part 2)

Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking/ lighting are accomplished on a voluntary basis, we recommend it be installed in accordance with FAA Advisory circular 70/7460-1 L Change 1.

This determination expires on 06/15/2019 unless:

(a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
(b) extended, revised, or terminated by the issuing office.
(c) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power, except those frequencies specified in the Colo Void Clause Coalition; Antenna System Co-Location; Voluntary Best Practices, effective 21 Nov 2007, will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.This determination includes all previously filed frequencies and power for this structure.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

If we can be of further assistance, please contact our office at (907) 271-5863, or robert.van.haastert@faa.gov. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2017-AAL-311-OE.

Signature Control No: 348946275-351363499 **(DNE)**

Robert van Haastert
Specialist

Attachment(s)
Map(s)

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Sectional Map for ASN 2017-AAL-311-OE

TOPO Map for ASN 2017-AAL-311-OE

Sectional Map for ASN 2017-AAL-311-OE