980 CMR 10.00: SITING OF INTRASTATE LIQUEFIED NATURAL GAS STORAGE

Section

10.01: General Provisions

(1) Scope and Purpose. 980 CMR 10.00 implements the Siting Council's statutory mandate under M.G.L. c. 164, § 69H, I, J and sets forth regulatory standards for the siting of intrastate liquefied natural gas (LNG) facilities proposed for construction in Massachusetts. 980 CMR 10.00 includes forecast data requirements and siting standards.

The purpose of 980 CMR 10.00 is to ensure systematic review of information which is necessary for the Council's determination of need, cost, and acceptable environmental impact.

980 CMR 10.00 includes performance standards for thermal radiation and flammable vapor dispersion in the event of specified design accidents which define acceptable site size, radiation, and environmental impact. Requirements set forth in this chapter are in addition to requirements of 980 CMR 6.00, 7.00 and 9.00 of the Council's regulations. In the case of conflict, 980 CMR 10.00 shall govern in the final instance.

Nothing in 980 CMR 10.00 is to be construed as an infringement upon the authority of the Department of Public Utilities to assure safe and prudent design, construction, operation, and maintenance of LNG facilities. Where an applicant is required to obtain licensing or permit approval from the Council and the Department of Public Utilities, it is encouraged to seek joint review by these agencies.

(2) Definitions.

(a) General Definitions. As used in 980 CMR 10.00:

Accepted Method of Calculation means a formula or technique which is specified in these guidelines or which has been approved by the Council through a rulemaking proceeding.

Dike means a structure surrounding an LNG storage tank which may consist of natural geological formation, compacted earth, concrete, or other material and must be of sufficient size to contain a minimum of 150% of the maximum liquid content of the tank.

Industrial Zone means an area zoned for industrial use or an unzoned area shown by the company to be currently used primarily for industry.

Insulating Material means a substance which may be applied to the external wall of the storage tank and/or dike surfaces and whose properties will decrease the rate of vaporization in the event of a spill.

Site means the area owned or controlled by the operator surrounding the LNG storage tank; has a minimum size equal to the greater of the required

thermal protection zone or vapor dispersion exclusion zone.
Thermal Protection Zone means an area which the operator owns or controls surrounding the LNG storage tank; this zone must be of sufficient size such that in the event of a fire resulting from a spill, thermal flux levels at the outer boundary may not exceed those specified in 980 CMR 10.00.
Vapor Dispersion Exclusion Zone means an area which the operator owns or controls surrounding an LNG storage tank; this zone must be of sufficient size such that in the event of a spill, no flammable vapor having an average gas to air concentration of more than two percent will travel beyond the zone's outer boundary.

(b) Matrix Factor Definitions.

1. Capital Cost Factors

Land Acquisition includes cost of acquiring land, land rights, permits, approvals and associated legal fees.
Site Preparation includes soil testing, clearing, grading and underground piping, water supply, and electrical supply to the site.
Structures and Improvements includes structures associated with LNG processing operations, fencing and roadways.
LNG Processing Equipment includes the installed cost of equipment used to receive, liquefy, hold and regasify LNG for delivery into the operator's distribution system.
LNG Transportation Facilities includes the initial cost of connecting mains and transportation equipment.
Other Equipment includes measuring and regulating equipment, compressor station equipment, communication equipment and equipment not assignable to any of the foregoing factors.

2. Annual Cost Factors

Operating Expenses includes labor; expenses; materials and supplies for engineering, processing and transporting LNG; depreciation, gas purchases, fuel, power, property taxes and gas losses.
Maintenance Expenses includes labor, expenses, materials and supplies for maintenance of land, structures and improvements, processing equipment, transportation facilities and other equipment.

3. Environmental Factors

Ease of Acquisition includes information on number of parcels to be assembled, present land use, projected land use, number of land owners, type of land owner (governmental, corporate, private, etc.), estimated land value, current zoning. (Appropriate Data Source: Municipal tax map, Municipal zoning map)
Climatology includes information on precipitation, temperature, and prevailing winds. (Appropriate Data Source: U.S. Weather Service Climatological Summary)
Geology includes soil type, depth to bedrock, soil permeability, seismic design criteria. (Appropriate Data Source: U.S. Soil Conservation Service,

U.S. Geological Survey)

Hydrology includes permeability, depth to groundwater, location of surface water, location of aquifers, location of flood plains, water quality classifications of contiguous surface water. (Appropriate Data Source: U.S. Geological Survey Soil Conservation Service, Commonwealth of Massachusetts Department of Environmental Quality Engineering, U.S. Department of Housing and Urban Development Flood Plain Zoning Maps)

Transportation Access includes verbal or pictorial description of primary access routes to proposed sites. (Appropriate Data Source: Massachusetts Department of Public Works, Town Maps, U.S. Geological Survey Quadrangle Maps)

Ecological Sensitivity includes an estimate of the uniqueness of the area as a habitat, possibility of the presence of rare or endangered species of plants or animals resulting from a review of 50 CFR 17, the List of Endangered & Threatened Wildlife & Plants, estimate of the amount of site which will be permanently altered. (Appropriate Data Source: MacConnell Cover Maps, Massachusetts Department of Environmental Management, U.S. Fish & Wildlife Service)

Socioeconomics includes projection of land use, expected property tax payments, employment opportunities, air quality and recreational opportunities both with and without the proposed projects. (Appropriate Data Source: Town zoning maps, Regional Planning Commissions, Office of State Planning, Air Pollution Control Districts, Massachusetts Regional Statistical Profiles, Massachusetts Department of Commerce)

Special Resource Commitment includes description of any special resource which will be impacted by the proposed facility. (Appropriate Data Source: Regional Planning Commission)

Other includes description of unique features of the site not covered by any of the other matrix factors.

10.02: Forecast Data Requirements

(1) Facility Need Requirement.

The applicant shall provide a statement of need which will consist of:

(a) a description of the ways in which the applicant's existing facilities will not be adequate to serve the requirements forecasted;

(b) a description of the ways in which all other "no-build" alternatives and other supply alternatives such as pipeline system expansion, SNG, propane, etc. considered by the applicant would not be adequate and preferred to serve the requirements forecasted; and

(c) for two or more sites, at least one of which must be in a non-urban area, a description of how the facility/site proposed will be used to meet the requirements forecasted.

(2) Mapping Requirements.

(a) The applicant shall provide a map or series of maps of the preferred site and all alternative sites proposed which show the following at a useful scale:

1. location of property
2. property boundaries and dimensions
3. major existing structures and equipment on the property
4. location of the following zones:
   - 2,000 BTU/ft2 hr zone;
   - 1,000 BTU/ft2 hr zone;
   - 460 BTU/ft2 hr zone; and the
   - vapor dispersion zone.
5. anticipated location and dimensions of the storage tank, new ancillary facilities, and dike
6. topography of the site out to and including the most distant zone specified in 980 CMR 10.02(2)(a)4.
7. current zoning scheme out to and including the most distant zone specified in 980 CMR 10.02(2)(a)4.
8. special land uses including agricultural land, parks, forests, recreational areas, and areas designated by a governmental agency for protection as natural preserves or historic or scenic districts out to and including the most distant zone specified in 980 CMR 10.02(2)(a)4.
9. location of all hospitals, schools, nursing homes and churches, and places of outdoor assembly out to and including the most distant zone specified in 980 CMR 10.02(2)(a)4.
10. surface water and groundwater resources out to and including the most distant zone specified in 980 CMR 10.03(2)(a)4.
11. population densities out to and including the most distant zone specified in 980 CMR 10.02(2)(a)4.
12. alternative truck routes from exit of nearest highway to site, showing local street names, bridges and elevated roadways, underpasses and tunnels, unpaved roads, and all locations on these routes requiring the exercise of additional caution. Information provided here should also include a general demographic description of the area through which these routes will pass.
13. nearby gas pipelines and point of interconnection for new facility
14. sewers, subway tunnels, drainage systems, underground electrical systems, and all other underground conduits out to and including the most distant zone specified in 980 CMR 10.02(2)(a)4. as well as for all truck routes specified in 980 CMR 10.02(2)(a)4.

(b) The applicant shall provide a system map, showing location of preferred and alternative sites.

(3) Demonstration of Conformity with Siting Standards.

(a) The applicant shall demonstrate quantitatively that the preferred site and all alternative sites meet each siting standard contained in 980 CMR 10.03.

(b) All such demonstrations must be based upon the methods of calculation specified in 980 CMR 10.03.

(4) Alternative Sites Evaluation Matrices.

(a) Purpose - The purpose of the evaluation matrices is to provide a means by which the applicant can demonstrate, in a standardized way, the bases upon which the preferred site was chosen from among the alternative sites proposed.

(b) Methodology

1. Cost matrices

a. The cost matrices shall be assembled as follows:

FIGURE 1

CAPITAL COST MATRIX

FACTORS	SITE A	SITE B
Land Acquisition	$	$
Site Preparation		
Structures and Improvements		
LNG Processing Equipment		
LNG Transportation Facilities		
Other Equipment		
TOTAL	$	$

FIGURE 2

ANNUAL COST MATRIX

FACTORS	SITE A	SITE B
Operating Expenses	$	$
Maintenance Expenses		
TOTAL	$	$

b. Current dollar figures shall be estimated for each cost item.

c. The cost matrices must be accompanied by a narrative explaining the sources of the estimated cost figures.

2. Environmental Matrix

a. The environmental matrix should be assembled as follows:

FIGURE 3

ENVIRONMENTAL MATRIX

FACTORS	SITE A COMPARATIVE RATING	SITE B COMPARATIVE RATING
Ease of Acquisition		
Climatology		
Geology		
Hydrology		
Transportation Access		
Ecological Sensitivity		
Socioeconomics		
Special Resources		
Commitment		
Other		

- The ratings should be based upon the total number of sites proposed (number of sites = n). The most preferred site for each factor should receive a rating of n. The site preferred next should be rated n-1, and so forth.
- Reconnaissance level data may be employed in constructing the environmental matrix, including existing studies and reports completed by public or private agencies. If such sources are not available or adequate, site analyses must be conducted.
- The environmental matrix shall be accompanied by a narrative which references the sources of the data used for each factor and an explanation of how these data were used to arrive at the relative rating for each proposed site.

(c) Summary of Alternative Sites The applicant must synthesize from the matrices the comparative cost and environmental data for each alternative site, and discuss, in detail, the bases upon which the preferred site was selected over the other proposed site or sites.

10.03: Performance Standards for Determining Site Sizes

(1) Thermal Radiation Protection.

(a) The area of the property must be sufficiently large to provide a thermal protection zone.

(b) Within the protection zone, the dike constructed to impound the LNG may not be located closer to targets listed in 980 CMR 10.03(1)(d) than distance "d".

(c) The protection distance "d" is measured as shown in FIGURE 4 along the line (PT) in a vertical plane defined by the points (T) and (D), where

(T) is a point at the top of the target;

(D) is a point closest to (T) on the top inside edge of the dike;

(PD) is a line in the vertical plane which intersects (D) at an angle of 45° above horizontal;

(w) is the inside distance across the top of the impounding space measured normal to (PD); and

(P) is located where (PT) and (PD) intersect at an angle of 90° or where (PD) equals 3 (w), whichever results in the shortest length of (PD).

FIGURE 4

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(d) The length of a protection distance in feet may not be less than the distance "d" determined in accordance with the following formula for the target concerned, when "A" equals inside area in square feet measured across the top of the impounding space:

	TARGET	PROTECTION DISTANCE
1.	Any point in an area outside the property line which is not zoned for industrial use.	$d = 3.6\ (A)^{0.5}$
2.	Any point in an area outside the property line which is zoned for industrial use.	$d = 2(A)^{0.5}$

(e) For any facility which depends upon surrounding industrially zoned land for compliance as provided in 980 CMR 10.03(1)(d) the applicant must conduct a safety consultation session with the local planning board and with each owner of land in the affected portions of the surrounding industrial zone. Prior to conducting safety consultations, the applicant must confer with the Department of Public Utilities on the scope and content of the safety consultation sessions. The applicant must give notice to the Department of Public Utilities that such consultations have been completed prior to the transfer of any LNG to the site or processing of LNG at the site.

(f) The method described in 980 CMR 10.03(c) and 10.03(d) shall be the accepted method of calculation of the thermal protection distance. Any interested party may request a rulemaking procedure to qualify an additional method of calculation. No facility may be evaluated using a new method of calculation unless the method has been submitted to the Council six months prior to the filing of the forecast containing the facility proposal, and unless that method is approved and accepted by the Council prior to the filing of the forecast containing the

facility proposal.

(2) Vapor Dispersion Exclusion Zone.

(a) Zone Requirement. Each LNG facility shall be designed to prevent flammable vapor from a design spill as defined in 980 CMR 10.03(2)(b) from crossing the property line. The boundary of the vapor dispersion exclusion zone will be determined by the minimum exclusion distance computed in accordance with this section. The vapor dispersion exclusion zone will be determined by a standard at the property line of an average gas to air concentration of no more than 2.0 percent. The boundary or estimated dispersion distance (D) is measured radially from the inside edge of the impounding system along the ground contour to the vapor dispersion zone boundary.

(b) Design Accidents for the Calculation of Dispersion Distance (D) In computing dispersion distance (D) under 980 CMR 10.03(2)(d), the following applies:

1. The value of (D_1) is the lesser of the values resulting from the following vapor generation conditions:
   a. Vapor generation rate equals the maximum constant rate of discharge from failed transfer piping having the greatest overall flow capacity.
   b. Vapor generation from sudden contact of LNG with 100% of the impounding system floor area and 50% of all liquid impounding surfaces which the liquid could contact, including the walls and roof of the component served, plus flash vaporization from the maximum constant rate of discharge from failed transfer piping having the greatest overall flow capacity.
2. The value of (D_2) is based on the following applicable conditions:
   a. For all classes of impounding a sudden total spill of the maximum contents of the largest component served, with vapor generation resulting from liquid contact with surfaces of the impounding system and outer component surfaces exposed to the final static fluid configuration and flash vaporization from the contents of the component served.
3. The distance (D) equals the greater of (D_1) or (D_2).

(c) Vapor Flow Rate.

1. The maximum time (t) required for the release of liquid from a component served in a sudden total spill is determined in accordance with the following equation:

$$(t) = 9(h/G)^{0.5}$$

where (t) is the time, (h) is the difference between the maximum height in feet of the contained liquid and the equilibrium height of liquid when impounded, and (G) is the acceleration of gravity.

2. Impounding and other surfaces which may be contacted by LNG under conditions described in 980 CMR 10.03(2)(b)1. and 10.03(2)(b)2.

may be insulated. The heat transfer value and application technique of the proposed insulating material must be satisfactory to the Department of Public Utilities. The boiling rate of LNG on which (D) is based, is determined by multiplying .9 times the weighted average value of (KPC)0.5 determined from eight representative experimental tests on the contact surfaces in the impounding space, where

K = thermal conductivity in (BTU/(HR) (ft) (F°)),

P = density in (1 lb/ft^3), and

C = heat capacity in (BTU/(1b) (F°)). The test conditions should vary in terms of the spills' elevation, separate velocity, and quantity.

3. Dispersion distance (D) is determined on the basis that vapor detention space does not exceed:

a. For conditions described in 980 CMR 10.03(2)(b)1.a. of the preceding section, all space provided for liquid impoundment and vapor detention outside the component served; and

b. For conditions described in 980 CMR 10.03(2)(b)2.a. all space provided for liquid impoundment and vapor detention outside the component served less the volume of the liquid that would have entered the impounding space when generating vapor escapes the vapor detention barriers, assuming liquid to be entering the impounding space outside the component served at a constant rate over the time period prescribed by 980 CMR 10.03(2)(c)1.

(d) Calculation of Vapor Dispersion Distance. The boundary or estimated dispersion distance (D) must be calculated in accordance with the applicable parts of Appendices A, B, and C of the publication, "Evaluation of LNG Vapor Control Methods" (American Gas Association, Arlington, VA., 1974), subject to the following parameters and other requirements of 980 CMR 10.03:

1. Average gas concentration in air is 2.0% by volume.
2. Wind speed (w) is 5.0 miles per hour.
3. Source height (H) is zero.
4. Source width (L) is $A^{0.5}$, where A is the inside area measured across the top of the impounding space, as in 10.03(1)(d).
5. The Gifford-Pasquill atmospheric stability category is F (moderately stable).
6. The temperature of the impounding and storage vessel surface is 47°C.

(e) Additional Methods of Calculation. The method reference in 980 CMR 10.03(2)(d) shall be the accepted method of calculation of the vapor dispersion distance. Any interested party may request a rulemaking procedure to qualify an additional method of calculation for vapor dispersion. No facility may be evaluated using a new method of calculation unless that method has been submitted to the Council six months prior to the filing of the forecast containing