

APPENDIX J-14:
VILLAGE AT PLAYA VISTA BUILDING METHANE
MITIGATION GUIDELINES, AUGUST 12, 2003,
DRAFT METHANE MITIGATION STANDARD, LOS
ANGELES DEPARTMENT OF BUILDING AND SAFETY,
AUGUST 5, 2003, AND DRAFT BUILDING METHANE
MITIGATION REGULATIONS, DIVISION 71, JULY 24,
2003.

**Village at Playa Vista Building Methane Mitigation
Guidelines, August 12, 2003.**

VILLAGE AT PLAYA VISTA BUILDING METHANE MITIGATION GUIDELINES

I. PURPOSE.

These guidelines set forth the minimum requirements for the control of methane intrusion emanating from geologic formations. The guidelines do not regulate flammable vapor that may originate in and propagate from other sources which include, but are not limited to, ruptured hazardous material transmission lines, underground atmospheric tanks, or similar installations.

II. DEFINITIONS.

For purposes of these guidelines, certain words and phrases are defined as follows:

ALARM SYSTEM is a system consisting of components and circuits arranged to monitor and annunciate the status of gas alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals.

CABLE SEAL FITTING is an approved fitting provided in a cable system to prevent the passage of gases, vapors, or flames through electrical cable.

CONDUIT SEAL FITTING is an approved fitting provided in a conduit system to prevent the passage of gases, vapors, or flames through electrical conduit.

DESIGN METHANE CONCENTRATION is the highest concentration of methane gas found during site testing.

DESIGN METHANE PRESSURE is the highest pressure of methane gas found during site testing.

DE-WATERING SYSTEM is a permanent water removal system, consisting of perforated pipes, gravel, sump pumps and pits, designed to permanently maintain the ground water level one foot below the sub-slab vent system.

GAS DETECTION SYSTEM is one or more electrical devices that measure the methane gas concentration and communicate the information to the occupants or building management with audible or visual signals.

GRAVEL BLANKET is a layer of gravel, sand, or approved material designed to transmit gas to the vent riser without obstructing the venting system.

HISTORIC HIGH GROUND WATER TABLE ELEVATION is the highest recorded elevation of ground water table based on historic records and field investigations as determined by the engineer

for the methane mitigation system.

IMPERVIOUS MEMBRANE is a continuous gas barrier made of material approved by the department and installed beneath a building for the purpose of impeding methane migration to the interior of the building.

MECHANICAL EXTRACTION SYSTEM is a mechanical system designed for removal of methane gas from below the impervious membrane through the use of fans, blowers, or other powered devices.

MECHANICAL VENTILATION is a fan, blower or other similar mechanical system within the building which introduce and/or remove air from an enclosed space.

OIL WELL is any well drilled for the exploration of oil or gas; any well on lands producing or reasonably presumed to contain commercially viable quantities of oil or gas; any well drilled for the purpose of injecting fluids or gas for stimulating oil recovery, re-pressurizing or pressure maintenance of oil or gas, or disposing of waste fluids from an oil or gas field.

PERFORATED HORIZONTAL PIPE is a perforated pipe placed horizontally beneath the foundation of a building for the purpose of venting any accumulated methane gas and preventing the development of elevated gas pressures.

PPMV is an abbreviation for Parts per Million by Volume.

PRESSURE SENSOR is a device that measures and communicates surrounding gas pressure to an alarm or control system.

SINGLE STATION GAS DETECTOR is a device consisting of electrical components capable of measuring methane gas concentration and transmitting methane concentration data to a control panel or other components of alarm systems.

TRENCH DAM is an approved subsurface barrier installed within a trench adjacent to the foundation of a building, for the purpose of preventing the migration of methane gas beneath that foundation.

UNENCLOSED BUILDING is a building having exterior walls of the lowest level with unobstructed openings equal to at least 25 percent of the total perimeter wall area and evenly distributed and located within the upper portion of at least two opposite sides.

UNOBSTRUCTED OPENING is a permanent opening in the walls, floors or roof-ceiling assemblies without windows, doors, skylights or other solid barriers that may restrict the flow of air.

VENT RISER is a solid vertical vent piping with joints and fittings connected to Perforated Horizontal Pipes to safely convey and discharge the gas to the atmosphere.

VILLAGE AT PLAYA VISTA is the area bounded by the Playa Vista First Phase Project to the east and the west, Jefferson Boulevard to the north and the Westchester Bluffs to the south and is more particularly described in the Village at Playa Vista Environmental Impact Report.

III. GENERAL METHANE MITIGATION REQUIREMENTS

All new buildings located in the Village at Playa Vista shall comply with these guidelines and any standards or rules of general application officially adopted by the Department of Building and Safety or may as otherwise be applicable to the Village at Playa Vista.

A. Methane Mitigation Requirements. All buildings shall provide a Methane Mitigation System, as required by Table XX, except as provided below. The Methane Mitigation System requirements of Table XX are based upon the level of the Site Design Level. The Site Design Level is determined by the Design Methane Concentration and the Design Methane Pressure as determined by site testing.

The site testing shall be conducted under the supervision of a registered Civil Engineer, Soil Engineer or Geologist to locate and measure methane gas in subsurface geological formations. The registered Civil Engineer, Soil Engineer or Geologist, shall indicate in a report to the Department, the testing procedure and testing instruments used to determine the Design Methane Concentration and the Design Methane Pressure and an effective location for the deep vent wells, if required. The report shall be submitted with the plans for construction of the building and shall be signed and stamped by the responsible person.

B. Exceptions to Table XX. The provisions of this section are exceptions to the construction requirements of Table XX.

1. Narrow Buildings. When Pressure Sensors below Impervious Membrane are not required per Table XX, Pressure Sensors below Impervious Membrane may be installed in lieu of Gas Detection System and Mechanical Ventilation for Narrow Buildings. Narrow Building are buildings of width less than 50 feet, footprint of less than 50,000 square feet and having a minimum 2-foot wide landscaped area immediately adjacent to the exterior wall for at least 50 percent of the perimeter of the building.

2. Buildings with Raised Floor Construction. A building with raised floor construction shall have adequate under-floor ventilation by providing the following:

- a. An approved mechanical ventilation system; or
- b. An under-floor system with a clear height above grade of at least 12 inches to girder and 18 inches to floor joist; and
- c. Openings for under-floor area or crawl space ventilation shall be located less than 6 inches below the bottom of the floor joists. The openings shall be located to provide cross

ventilation and shall be the larger of:

1. Openings of not less than 1.5 square feet for each 25 linear feet of exterior wall; or
 2. Openings shall be 1% of under-floor area.
- d. The required area of such openings shall be approximately equally distributed along the length of at least two opposite sides of the building. They shall be covered with corrosion-resistant wire mesh with mesh openings of greater than ¼ inch and less than ½ inch in dimension.

A building with raised floor construction shall be constructed with the following mitigation components, in lieu of the requirements of Table XX:

- a. The utilities shall be installed with Trench Dams and either Conduit Seal Fittings or Cable Seals Fittings.
- b. Four inch thick gravel blanket is installed under and around the elevator pits.

3. Buildings with Natural Ventilation. Buildings with Natural Ventilation, such as, bathrooms, gazebos, barns, attendant stations, and other similar accessory buildings located in parks or buildings with lowest levels closest to grade having Group S, Division 2, 3 or 4 occupancy, or detached buildings of Group U, Division 1 occupancy, and Unenclosed Buildings shall be constructed with utilities installed with Trench Dams and either Conduit Seal Fittings or Cable Seals Fittings, in lieu of the requirements of Table XX.

Buildings with Natural Ventilation are buildings with Unobstructed Openings in exterior walls. The total area of the Unobstructed Openings in the exterior wall shall be at least 25 percent of the floor area and shall be evenly spaced to prevent the accumulation of methane gases.

4. Single Family Dwelling. Single Family Dwelling and buildings accessory to single family dwelling shall comply with all the Methane Mitigation requirements of Table XX, except the following may be substituted:

- a. Pressure Sensors below Impervious Membrane may be installed in lieu of Gas Detection System when Pressure Sensors below Impervious Membrane is not required, or
- b. Single Station Gas Detectors with battery back-up may be installed in lieu of Alarm System and Gas Detection System, or
- c. 6 mil thick Visquene may be used in lieu of Impervious Membrane, with Site Design Levels I or II, or
- d. Deep Vent Well or Mechanical Ventilation may be omitted for buildings with width less than 50 feet or footprints less than 6,000 square feet in area, or
- e. Vent Risers maybe provided in lieu of Mechanical Extraction System.

IV. EXISTING BUILDINGS.

Additions, alterations, repairs, change of use or change of occupancy to existing buildings shall comply with the methane mitigation requirements of these guidelines using the thresholds of Chapter 34 or Chapter 81 of the Building Code.

Approved gas detection and mechanical ventilation systems in existing buildings shall be tested, maintained and serviced in accordance with Section V.

V. TESTING, MAINTENANCE AND SERVICE OF GAS-DETECTION AND MECHANICAL VENTILATION SYSTEMS.

All gas detection and mechanical ventilation systems shall be maintained and serviced in proper working condition and meet all requirements of the Electrical and Mechanical Code. The testing, maintenance and service procedure for gas detection and mechanical ventilation systems shall be performed in accordance with the manufacturer's current written instructions and the following:

1. **Fire Department.** The manufacturer's instructions shall be approved and filed with the Fire Department. Testing and servicing of each system shall be performed by a person approved by the Fire Department.
2. **Notification Placard.** A permanent notification placard shall be posted and maintained at the front entrance of the building except in residential buildings. The placard shall indicate the presence of the methane Impervious Membrane barrier and ventilation system. The location of the placard, size and specification of the placard shall be approved by the Fire Department.

VI. EMERGENCY PROCEDURES.

Emergency procedures shall be established for all buildings with gas-detection systems, except buildings of Group R, Division 3 or U Occupancies. The procedures shall include the following:

1. Assignment of a responsible person to work with the Fire Department in the establishment, implementation and maintenance of an emergency plan.
2. Conspicuous posting of the Fire Department's telephone number in areas designated by the Fire Department.
3. Conspicuous posting of emergency plan procedures approved by the Fire Department.

VII. ADDITIONAL REMEDIAL MEASURES.

A. General Remedial Measures. In the event the concentration of methane gas in any building reaches or exceeds 25 percent of the minimum concentration of gas that will form an ignitable mixture with air at ambient temperature and pressure, the owner shall hire a qualified engineer to investigate, recommend and implement additional mitigating measures. Such measures shall be subject to approval by the Building and Safety Department and Fire Department.

B. Abandoned Oil Well. Any abandoned oil well encountered during construction shall be evaluated by the Fire Department and may be required to be re-abandoned in accordance with applicable rules and regulations of the Division of Oil and Gas of the State of California. Buildings shall comply with these provisions and the requirements of Section 6105 of the Building Code, whichever is more restrictive.

Table XX — MITIGATION REQUIREMENTS FOR VILLAGE AT PLAYA VISTA

Site Design Level			LEVEL I		LEVEL II		LEVEL III		LEVEL IV		LEVEL V
Design Methane Concentration (ppmv)			0-100		101-1,000		1,001-5,000		5,001-12,500		>12,500
Design Soil Gas Pressure (inches of water pressure)			≤2"	>2"	≤2"	>2"	≤2"	>2"	≤2"	>2"	All Pressures
PASSIVE SYSTEM	De-watering System ¹		X	X	X	X	X	X	X	X	X
	Sub-Slab Vent System	Perforated Horizontal Pipes	X	X	X	X	X	X	X	X	X
		Gravel Blanket Thickness Under Impervious Membrane	2"	2"	2"	3"	2"	3"	2"	4"	4"
		Gravel Thickness Surrounding Perforated Horizontal Pipes	2"	2"	2"	3"	2"	3"	2"	4"	4"
		Vent Risers	X	X	X	X	X	X	X	X	X
	Impervious Membrane		X	X	X	X	X	X	X	X	X
ACTIVE SYSTEM	Sub-Slab Vent System	Pressure Sensors Below Impervious Membrane								X	X
		Mechanical Extraction System								X	X
	Lowest Occupied Space System	Gas Detection System ²		X		X	X	X	X	X	X
		Mechanical Ventilation ^{2,3}		X		X	X	X	X	X	X
		Alarm System		X		X	X	X	X	X	X
	Control Panel			X		X	X	X	X	X	X
MISC. SYSTEM	Trench Dam		X	X	X	X	X	X	X	X	X
	Conduit or Cable Seal Fitting		X	X	X	X	X	X	X	X	X
	Deep Vent Well ⁴										X

X = Indicates a Required Mitigation Component

¹ De-watering not required when the maximum Historical High Ground Water Table Elevation, or projected post-construction ground water level, is more than 12 inches below the bottom of the Perforated Horizontal Pipes.

² See exception for Narrow Buildings.

³ Natural ventilation, may be used in lieu of mechanical ventilation.

⁴ Deep Vent Well is not required when Vent Risers are installed at twice the design Vent Riser requirements.

**Draft Methane Mitigation Standard, Los Angeles
Department of Building and Safety, August 5, 2003.**

Notwithstanding its use of the word “Draft”, the Methane Mitigation Standard contained herein is intended to be fully applicable for purposes of implementing the Village at Playa Vista Building Methane Mitigation Guidelines.

METHANE MITIGATION STANDARD

INTRODUCTION

The purpose of this Methane Mitigation Standard is to clarify the requirements for site testing, methane prevention, building ventilation, methane detection, building monitoring and occupant contingency plan as required in Chapter 71 of the Los Angeles Building Code.

The purpose of methane mitigation is to maintain public safety and welfare by impeding the seepage of methane gases from the earth into buildings using the methods prescribed in this Standard. This Standard is the result of joint efforts between City agencies (Building and Safety, Fire, and Public Works) and the construction industry experts to accomplish the following objectives:

- Standardize the methane testing procedures, and
- Standardize the methane mitigation design protocol.

- DRAFT -

REVISED: August 5, 2003

The information contained in this Standard is in the process of being reviewed and edited.

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I. DEFINITIONS

For the purposes of this Standard, certain terms, phrases, and words shall be defined as follows:

Adequate Ventilation: The ventilation of a structure corresponding to 1) mechanical systems providing a minimum of four air changes per hour upon methane gas detection; 2) mechanical systems providing a continuous air change at a rate of one air change per hour; or 3) Natural Ventilation with requirements as stated in this Standard.

Conduit or Cable Seal Fitting: An approved fitting provided in a conduit system to prevent the passage of gases, vapors, or flames through electrical conduit or cable.

Deputy Inspector: A witness, approved by LADBS, to observe and report to the City Inspector and design engineer on the accuracy of the installation, testing of the Impervious Membrane, and the operation of the methane gas mitigation system.

Design Methane Concentration: The highest methane gas concentration found during site testing program and record search, including all sampling gas measurements outlined in this Standard.

Design Methane Pressure: The highest soil gas pressure found during site testing and record search.

Detector: A device consisting of electrical components capable of measuring methane gas concentration and transmitting methane concentration data to a control panel or other components of alarm systems.

De-Watering System: A permanent water removal system, consisting of perforated pipes, gravel, sump pumps and pits, designed to permanently maintain the ground water level one foot below the Sub-Slab Vent System.

DOGGR: Division of Oil, Gas, and Geothermal Resources, Department of Conservation, State of California

DPWBOE: Department of Public Works, Bureau of Engineering

Enclosed Building: Buildings other than Unenclosed Buildings.

Gas Detection System: One or more electrical devices that measure the methane gas concentration and communicate the information to the occupants or building management with audible or visual signals.

Gas Probe Set: A set of sensors placed in the ground to measure the concentration and pressure of subsurface methane gas.

Gravel Blanket: A layer of gravel, sand, or other approved material designed to transmit gas to the Vent Riser pipes.

Historical High Ground Water Table: The highest recorded ground water table elevation based on historical records and field investigations as determined by the engineer responsible for the design of the methane mitigation system.

Impervious Membrane: A continuous gas barrier made of materials approved through the Research Unit, LADBS, installed beneath a structure for the purpose of impeding methane migration to the interior of that structure.

Landfill: Any land that has been used for disposal of refuse that may be documented by the Department of Environmental Affairs, City of Los Angeles.

LADBS: Los Angeles Department of Building and Safety.

LAFD: Los Angeles Fire Department.

LARR: Los Angeles Research Report.

Lower Explosive Limit (LEL): Minimum concentration of methane in air at which flame propagation or explosion will occur in the presence of an ignition source. For the purposes of these Standards, the LEL for methane shall be taken as 50,000 ppmv.

Mechanical Extraction System: A mechanical system designed for methane gas removal from below the impervious membrane through the use of fans, blowers, or similar mechanical systems.

Mechanical Ventilation: The introduction and/or removal of air from an enclosed space within the building by means of fans, blowers, or similar mechanical system.

Natural Ventilation: The introduction and removal of air from a building or structure by means of unobstructed openings or an opening with a wind-assisted system in compliance with these Standards.

Oil Field: The area within the Administrative or Productive Limits of any oil/gas field as defined by the Division of Oil, Gas and Geothermal Resources, Department of Conservation, State of California.

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Oil Well: Any well drilled for the exploration of oil or gas; any well on lands producing or reasonably presumed to contain oil or gas; any well drilled for the purpose of injecting fluids or gas for stimulating oil recovery, re-pressurizing or pressure maintenance of oil or gas, or disposing of waste fluids from an oil or gas field.

ppmv: Parts per million by volume.

Perforated Horizontal Piping: Piping placed beneath the foundation system of a building for the purpose of venting any accumulated methane gas and preventing the development of elevated gas pressures.

Pressure Sensor: A device that measures and communicates surrounding soil gas pressure to an alarm or control system.

Standard: This document, describing installation procedures, design parameters, and test protocols for methane gas mitigation shall be recognized as the Standard.

Sub-Slab Vent System: A system consisting of Perforated Horizontal Pipes, non-perforated Vent Risers, and Gravel Blanket for the purpose of collecting and conveying methane gas from the soil to the atmosphere.

Tar Seep: Any location, above or beneath the ground surface, where tar seepage is historically documented or where the amount of tar present within the pore space of the soil or rock exceeds 5% by weight (50,000 mg/kg) in accordance with EPA 418.1 testing procedures.

Trench Dam: An approved subsurface barrier installed within a trench adjacent to the foundation of a building, for the purpose of preventing the migration of methane gas beneath that foundation or into the building.

Underground Gas Storage Facility: An underground reservoir or other geologic feature into which natural gas or fluid was pumped or injected for storage.

Unenclosed Building: A building having exterior walls of the lowest level with unobstructed openings equal to at least 25 percent of the total perimeter wall area and located within the upper portion of at least two opposite sides.

Unobstructed Opening: Permanent openings in walls, floors or ceilings without windows, doors, or similar barriers that may restrict air flow.

Vent Riser: Solid vertical vent piping with joints and fittings connected to Perforated Horizontal Pipes to safely convey and discharge the soil gas into the atmosphere.

II. METHANE MITIGATION SITES

A. METHANE GAS SOURCES

The maps identifying the following primary gas sources are referenced from the City of Los Angeles Department of Environmental Affairs, and DOGGR:

1. Landfills,
2. Oil fields,
3. Oil wells, and
4. Underground gas storage facilities.

B. METHANE MITIGATION ZONE BOUNDARIES

Based on the information provided by DOGGR, City of Los Angeles Department of Environmental Affairs, or field testing results, two classes of Methane Mitigation Zones are identified in the City of Los Angeles: Methane Zone and Methane Buffer Zone. The boundaries of each zone can be identified in current maps produced and maintained by the City of Los Angeles, Department of Public Works, Bureau of Engineering, Mapping Division. These maps are found at www.navigatela.lacity.org/common/mapgallery/index.htm.

1. Methane Zone - Areas surrounding a methane gas source where testing and mitigation are required.
2. Methane Buffer Zone - Areas surrounding a Methane Zone where testing is required and mitigation may be required.

A building proposed on a site, partially in one zone or located within both of these Methane Zones shall be designed to the more restrictive requirements.

III. SITE INVESTIGATION

All site investigations shall be conducted with the procedures of this Standard for determining the quantity of Gas Probe Sets, locating the Gas Probe Sets, installing the Gas Probe Sets, collecting the data, and locating deep vent wells.

A. SITE GRADING

1. All site investigations shall be conducted at least 30 days following any site grading unless a shorter waiting period is approved by LADBS.
2. Requests for a reduced waiting period shall be based on site information relating to soil permeability and ground water depths.

B. QUANTITY OF GAS PROBE SETS

1. Small sites – less than or equal to 20,000 square feet in area, install a minimum of two probes per site.
2. Large sites – more than 20,000 square feet in area, install probe sets at a rate of one per 20,000 square feet or portion thereof.

Exception: Shallow gas data, collected as described below, may be used in lieu of Gas Probe Set data when ground water is found less than 5 feet below the ground surface.

C. LOCATING GAS PROBE SETS

1. The methane design engineer shall select the best locations for installation of Gas Probe Sets based on shallow soil gas samples taken:
 - a. At a rate of one sample per 10,000 square feet of site area, or portion thereof.
 - b. Not less than 4 feet below ground surface, or above the ground water level if water level is found less than 4 feet below ground surface.
2. The site observations and the results of the shallow soil gas samples shall be evaluated by the engineer responsible for the site investigation to locate the probes around suspected methane gas sources.

D. GAS PROBE SET INSTALLATION

1. Gas Probe Sets shall be installed using the appropriate configurations shown in the details of this Standard.

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2. Each Gas Probe Set shall be installed at approximate sampling depths of 5 feet, 10 feet, and 20 feet below the elevation of the lowest building slab or footing.
3. Gas Probe Sets shall be installed a minimum of 12 inches above ground water table.

E. DATA COLLECTION EQUIPMENT

1. Gas probe sets shall be capable of collecting data for both soil gas pressure and methane concentration.
2. Instruments and test procedures used to determine gas pressure and concentrations shall be in accordance with the parameters listed in Table 2 – Gas probe Monitoring Parameters.
3. Portable gas sampling instruments shall consist of methane specific infrared gas analyzer or other combustible gas analyzers. Flame Ionization Detector (FID) and Photo Ionization Detector (PID) shall not be used to measure Design Methane Concentration.

F. DATA RECORDING

1. Measurements shall be taken on at least two separate occasions, with a minimum 24-hour interval between sequential readings during periods of falling barometric pressure.
2. Site test data shall be recorded on Form 1 – Certificate of Compliance for Methane Test Data.

G. LOCATING DEEP VENT WELLS

When Deep Vent Wells are required by Table 1A – Mitigation Requirements for Methane Zone or Table 1B – Mitigation Requirements for Methane Buffer Zone, the site investigation shall utilize deep probes to identify sub-surface zones of gas accumulation that enable pressurized methane gas to collect and create a hazard to building occupants.

1. Minimum Number of Deep Probes – Place a minimum of one deep probe per 20,000 square feet of lot area or fraction thereof.
2. Deep Probe Depths – Explore subsurface depths to a minimum of 50 feet below the lowest floor or basement.

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3. Performance Evaluation - Evaluate deep probe data for flow and evidence of pressurized sub-surface zones of gas at more than 6 inches of water pressure.

H. ADDITIONAL INVESTIGATION

1. Additional investigation may be required when:
 - a. Gas Probe Test identifies gas concentration in excess of 12,500 ppmv and with a pressure in excess of 6 inches of water column, or
 - b. LADBS determines that the reports submitted do not adequately characterize the methane anomalies at the site to develop safe methane gas mitigation for the project.
2. Additional methane gas investigation may include any or all of the following conducted with protocol approved by the Grading Division of LADBS:
 - a. Methane Gas Source identification by the analysis of soil gases on all relevant nearby sites
 - b. Flux Chamber Testing
 - c. Isotopic Analysis
 - d. Carbon Dating
 - e. Additional Gas Probe Sets
 - f. Any other investigation the LADBS and LAFD determine to be necessary for the development of safe methane gas mitigation for the project
 - g. Soil Resistivity Test for electrical systems over 600 volts

I. REPORTING SITE TEST RESULTS

The methane site data shall be organized as described below:

1. Certificate of Compliance for Methane Test Data, Form 1, shall be completed, stamped and signed by a registered civil engineer, soil engineer, or geologist.
2. Site Plan showing:
 - a. Locations of Shallow Soil Gas tests and probe sets.
 - b. Locations and dimensions of the proposed and existing building footprints.
3. Affix Form 1 – Certificate of Compliance for Methane Test Data to the plans submitted as part of the building permit process.
4. When a Soil Electrical Resistivity Test is required, the Form 2 - Certificate of Compliance for Soil Electrical Resistivity Test, shall be affixed to the plans and submitted for electrical plan check.

IV. MITIGATION REQUIREMENTS

A. NEW BUILDINGS

1. Methane mitigation requirements as specified in Table 1A (for Methane Zone) and Table 1B (for Methane Buffer Zone) shall apply to the sites identified in Section II (Methane Mitigation Sites) of this Standard.
2. Other sites may be required to comply with the requirements when LADBS or LAFD determines that a subsurface methane hazard exists.

B. EXISTING BUILDINGS

Existing buildings with additions, alterations, change of use, or change of occupancy shall comply with the requirements of this Standard, only when referred by Chapter 34 or Chapter 81 of the Los Angeles Building Code.

C. MAINTENANCE OF MITIGATION SYSTEMS

Approved methane mitigation systems in existing buildings shall be maintained in accordance with Chapter 71 of the Los Angeles Building Code.

V. DESIGN CRITERIA

A. PASSIVE SYSTEM

The passive system consists of a De-Watering System (when conditions require), a Sub-Slab Vent System, and an approved Impervious Membrane.

1. De-Watering System
 - a. De-Watering System is required when the historical high ground water table is within twelve (12) inches from the lowest horizontal vent pipe inverts.
 - b. De-watering rates shall be noted on the methane mitigation plans. The engineer or geologist responsible for determining the dewatering rates shall approve the plans.
 - c. Applications for water discharge location shall be approved and permitted by the Department of Public Works:
 - i. Bureau of Sanitation, Industrial Waste, and
 - ii. Bureau of Engineering, Storm Water Management.

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- d. The de-watering pipe shall be minimum Schedule 40, slotted or perforated Polyvinyl Chloride (PVC) pipe or other materials approved under Los Angeles Plumbing Research Report for the intended use.
- e. De-watering pipes shall be installed as follows:
 - i. De-watering pipes shall be sloped at ¼ inch vertical to 12 inch horizontal (2% slope). The slope may be reduced to 1% if the pipe size is increased one full size in pipe diameter.
 - ii. Combination de-watering and Sub-Slab vent piping system may be used when installed with nominal 4 inch diameter pipes.
- f. Each sump pump pit shall contain a primary pump and a back-up pump.

2. Sub-Slab Vent System

Sub-Slab Vent System shall consist of Perforated Horizontal Pipes, Gravel Blanket Under Impervious Membrane, Gravel Around Perforated Horizontal Pipes, and Vent Risers.

- a. Perforated Horizontal Pipes:
 - i. Perforated Horizontal Pipes shall be of minimum Schedule 40, slotted or perforated PVC pipe or other materials approved under Los Angeles Plumbing Research Report for the intended use.
 - ii. Perforated Horizontal Pipe shall be installed as follows:
 - Spacing and location of Perforated Horizontal Pipes shall be per Table 3 – Spacing / Location of Horizontal Pipes and Vent Risers,
 - Vent only pipes may be installed in the horizontal position,
 - Combination vent/dewatering pipes shall be sloped at ¼ inch vertical to 12 inch horizontal (2% slope), and
 - Undulations in the Perforated Horizontal Pipes, which may impede the passage of gas, shall be avoided (e.g. Perforated Horizontal Pipes shall not be deformed to pass below interior footings).
- b. Gravel Blanket Thickness Under Impervious Membrane:
 - i. The thickness of the Gravel Blanket under Impervious Membrane shall be per Tables 1A and 1B.
 - ii. The composition of gravel shall be washed particles that have no more than one fractured face.
 - iii. The gradations of gravel shall conform to Table 4 – Specifications for Gravel.
 - iv. The gradations of sand shall conform to Table 5 – Specifications for Sand.
- c. Gravel Thickness Around Perforated Horizontal Pipes:
 - i. Gravel thickness around Perforated Horizontal Pipes shall be per Tables 1A and 1B.

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- ii. When sand is used as the Gravel Blanket a geo-fabric to prevent sand from entering the Perforated Horizontal Pipes shall be placed above the gravel around the Perforated Horizontal Pipes. Sand shall not be used around Perforated Horizontal Pipes.
 - iii. Gravel shall be composed entirely of particles that have no more than one fractured face.
- d. Vent Risers:
- i. Vent Risers shall be connected to Perforated Horizontal Pipes and constructed of cast iron.
 Exception:
 - Acrylonitrile Butadiene Styrene (ABS) pipes may be allowed for residential buildings up to two (2) stories, or
 - Any other material approved under Los Angeles Plumbing Research Report for the intended use as a methane Vent Riser.
 - ii. Vent Risers shall be spaced and located as per Table 3 – Spacing / Location of Horizontal Pipes and Vent Risers.
 - iii. Vent Riser outlets shall be located at least:
 - 10 feet above grade,
 - 10 feet away from any window, doors, roof hatch, opening or air intake into the building,
 - 3 feet above the roofline,
 - 3 feet away from any parapet,
 - 4 feet away from the property line, and
 - 5 feet away from any electrical device.
 - iv. If rain guards are provided, they shall be non-restricting.

3. Impervious Membrane

a. Impervious Membrane Installation:

- i. Installation of Impervious Membrane shall comply with the Los Angeles Research Report conditions of approval and manufacturer's specification.
- ii. Impervious Membrane shall be installed at the following locations:
 - Below the building slab surrounded by the inner face of the exterior footings
 - On the exterior surface of walls from the finished grade level to a minimum of 6 inches below the bottom of the adjoining building slab
 - Around sides of pile caps and caisson caps
 Exception:
 - Impervious Membrane shall not be installed under exterior or interior footings.

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- iii. Impervious Membranes at elevator and sump pits shall be installed as follows:
 - Two layers of Impervious Membrane below slabs and footings of all elevator pits, sump pits, and holding tanks.
 - Impervious Membrane does not need to be placed below elevator pistons.
 - Impervious Membrane shall be attached to the elevator piston cylinder casing or at the sump pit floor slab to prevent methane intrusion.
 - iv. The engineer responsible for the design of the methane mitigation system shall inspect and certify on Form 3 that the Impervious Membrane was installed per approved plans.
 - v. The completed Form 3 shall be given to the inspector prior to placement of parts or the whole concrete floor slab.
- b. Seals at Impervious Membrane Penetrations:
- i. Where footings, plumbing pipes, electrical conduits, and other materials penetrate the Impervious Membrane, the penetrations shall be sealed by using sleeves or boots composed of the same material or other approved materials and methods in accordance with manufacturer's specification.
 - ii. A gas tight seal shall be provided where the Impervious Membrane is attached to all interior footings and exterior wall footings.
 - iii. All elevator piston shaft casing shall be constructed of stainless steel and sealed at the elevator pit floor slab level in accordance with the specifications of the Impervious Membrane manufacturer.
 - iv. The bottom of the elevator piston casing shall be sealed to prevent gas migration into the building.
- c. Impervious Membrane Protection Prior to Floor Slab Placement
- i. Installation Sequence for Protection Material Below the Impervious Membrane:
 - Finish the Gravel Blanket smooth using mechanical means (eg. roller).
 - Place geotextile filter fabric over the Gravel Blanket to protect the smooth finish of the Gravel Blanket and prevent sand migration into the Gravel Blanket.
 - Prepare protective course for Impervious Membrane.
 - Option A: If Sand is used as Gravel Blanket, then the Impervious Membrane may be placed directly on the geotextile, or
 - Option B: If Gravel is used as for the Gravel Blanket, then place a minimum 1-inch thick Sand layer directly over the geotextile.
 - Option C: If Gravel is used as for the Gravel Blanket, then place a geotextile with a minimum weight of 16 ounces per square yard.

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- ii. Installation Sequence for Protection Material Above the Impervious Membrane:
 - Place 2-inch thick sand directly over the Impervious Membrane, or a minimum 1-inch thick lean concrete mix (slurry as specified in the Standard Specifications for Public Works Construction, Green Book)
 - Place geotextile fabric if sand is used in the prior step. If lean concrete mix is used, geotextile is not required.
 - Place concrete, reinforcing steel, piping and other forms so as not to be supported directly on the Impervious Membrane. Equipment shall not be driven over the Impervious Membrane or its protective covering.

B. ACTIVE SYSTEM

The Active System consists of the Sub-Slab Vent System, Lowest Occupied Space System, and Control Panel.

1. Sub-Slab System

Sub-slab System shall consist of Pressure Sensors and a Mechanical Extraction System.

a. Pressure Sensors

- i. All devices and wiring shall be listed by a recognized testing laboratory and suitable for the intended use in the classified hazardous or corrosive environments.
- ii. Pressure Sensors shall receive power, report gas pressures, and be calibrated by signals from the Gas Detection and Pressure Sensor Control Panel.
- iii. Probes for Pressure Sensors shall be installed within the Gravel Blanket a minimum of 2 inches below the Impervious Membrane.
- iv. A minimum of two Pressure Sensors shall be installed in buildings with footprint less than or equal to 20,000 square feet. For buildings with footprint more than 20,000 square feet, install Pressure Sensors at a rate of one per 20,000 square feet or portion thereof.
- v. Pressure sensor devices shall be located to accurately measure gas pressure below the Impervious Membrane relative to the ambient pressure of lowest occupied spaces.
- vi. Methane Vent Risers and Perforated Horizontal Pipes shall not be used to run wires to the pressure sensors.

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b. Mechanical Extraction System

The Mechanical Extraction System shall consist of Detectors in Vent Risers, gas detection and pressure sensor control panel, and gas extraction powered devices and shall be designed in consideration for the migration of subsurface gas from adjacent properties.

i. Detectors in Vent Risers

- Detectors and associated transmitters shall be listed by a recognized testing laboratory for the intended use.
- Detectors and associated wiring shall be immune to radio frequency and infrared remote-transmitters frequency interference.
- Detector shall be fitted within the vent pipe so that no gas may leak through the fittings.
- The associated wiring and associated raceways shall be:
 - Mounted to a secure surface independent of detectors and their associated transmitter.
 - Protected from physical damage.

ii. Gas Extraction Powered Devices

- Gas Extraction Powered Devices shall consist of fans, blowers, or other powered devices to exhaust or provide make-up air into the space below the Impervious Membrane and shall be capable of ventilating the Gravel Blanket and Perforated Horizontal Pipes spaces at a rate of 4 air changes per hour.
- The volume of air used to size the Gas Extraction Powered Devices shall include the volume of the Gravel Blanket and Perforated Horizontal Vent Pipes beneath the Impervious Membrane.

2. Lowest Occupied Space System

The Lowest Occupied Space System shall consist of Gas Detection System, Mechanical Ventilation System, and Alarm System.

a. Gas Detection System

- i. The specifications for Detectors shall be the same as specified for Detectors in Vent Risers except as modified in Table 6 -- Sequence of Operation.**
- ii. Detectors in lowest occupied spaces shall be installed in accordance with manufacturers' requirements and listing agency approvals.**
 - Detectors shall be located with respect to airflow in rooms, location of probable gas leaks, and the recommendations of the manufacturer.
 - Number of required Detectors shall be based on Table 7 -- Detector Spacing.

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b. Mechanical Ventilation System

i. Mechanical Ventilation System shall consist of blowers, fans or other powered devices for exhaust or make-up air as approved by Mechanical Plan Check Section.

ii. The make-up air shall be 100% outside air.

iii. Mechanical Ventilation System shall be provided using one of the following options for garages, lowest occupied, and unoccupied spaces:

Option #1: Activated Mechanical Ventilation - Mechanical Ventilation System shall be capable of removing methane gas at a rate of 4 air changes per hour when activated by the Gas Detection and Control Panel, at 10% LEL (5,000 ppmv). Back-up power is not needed for mechanical ventilation in this option. Parts of fans in this Option shall be of nonferrous or non-sparking materials or their casing shall be lined or constructed of such material.

Option #2: Continuous Ventilation - Mechanical Ventilation System sized to ventilate the building spaces at a rate of one (1) air change per hour on a continuous basis. Mechanical ventilation in this option shall be provided with 24 hours of back-up power when Detectors and pressure sensors are not provided. Explosion proof or approved type (spark proof) for the intended uses.

Option #3: Scheduled Start-up Ventilation - Mechanical Ventilation System shall start-up at least once every (6) six hours to provide a minimum of 24 air changes per day. Mechanical ventilation in this option shall be provided with 24 hours of back-up power when Detectors and pressure sensors are not provided.

Option #4: Alternate Natural Ventilation - Alternate method of ventilation may be utilized in lieu of mechanical ventilation in Options #1, #2, and #3 when designed in accordance with the Natural Ventilation requirements of this Standard.

c. Alarm Systems

i. Alarm Systems shall consist of audible and visual signals to notify occupants of significant levels of methane intrusion in to the building and shall be designed with the Sequence of Operation shown in Table 6 of these Standards.

ii. Audible alarms shall be at least 15dB above ambient noise level in all areas subject to methane gas intrusion.

iii. Visual alarms shall be a minimum of 15 candela output and be located at each audible device.

iv. The audible signal warning building occupants of hazardous levels of methane gas shall be distinctively different from the fire alarm system.

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- v. Signs shall be posted adjacent to each alarm signaling device indicating, "Methane Alarm – Evacuate Building."

3. Control Panel

a. General Installation

- i. Control Panel shall be listed by a recognized testing laboratory.
- ii. Control Panel shall have the following characteristics:
 - Devices that receive signals from the Detectors and pressure sensors and send signals to the Alarm System, and
 - Designed not to override the building fire alarm, smoke control, and ventilation systems.
- iii. A manual shall be provided with the Control Panel describing the installation, wiring, operation, maintenance, and testing.

b. Power Source

- i. Primary Power Source
 - Control Panel shall be hard wired to the building normal power.
 - The circuits supplying power to the Control Panel shall be lockable in the closed position.
- ii. Back-Up Power Supply
 - A Control Panel shall monitor the power to Detectors and Pressure Sensors, annunciator, and associated components.
 - Back-Up battery or emergency power shall be rated for a minimum of 24 hours for standby mode plus 5 minutes of alarm under full load condition.
 - This Back-Up power shall be available within 30 seconds of primary power loss.

c. Panel Operation

- i. Device Activation
 - Control Panel shall recognize alarm conditions, then activate required audible devices, visual devices, and Gas Extraction Powered Devices.
 - Components of the Active System shall be activated as shown in the Table 6 - Sequence of Operation.
- ii. Trouble Annunciation
 - Control Panel or annunciator shall indicate each trouble or alarm condition by a visual alarm.

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- Control Panel shall supervise and identify fault and trouble conditions with the following:
 - Main supply circuits,
 - Rechargeable battery circuits,
 - Initiating device circuits,
 - Alarm device circuits,
 - Supplementary or auxiliary signaling circuits, and,
 - Signaling line circuits.

C. NATURAL VENTILATION

Natural Ventilation may be allowed as equivalents for the Active System when allowed by Tables 1A – Mitigation Requirements for Methane Zone and 1B – Mitigation Requirements for Methane Buffer Zone.

1. Vent Openings

Vent Openings for Natural Ventilation shall be constructed as follows:

- a. Vent Openings shall be permanently affixed in the open position.
- b. Vent Openings shall be free of obstructions, except for screens made with at least 1/4" mesh, or wind driven turbines.
- b. Aggregate size of Vent Openings providing Natural Ventilation for an enclosed space shall be the larger of:
 - i. 5% of total floor area of the room or the area of the enclosed space, or
 - ii. 25% of the area of all walls on the perimeter of the building or enclosed space.

2. Location

- a. Vent Openings shall be in walls or roofs to facilitate natural venting of methane gas to the atmosphere.
- b. Locate uniformly distributed Vent Openings on two or more exterior sides to provide cross ventilation as close to corners as practical.
- c. Vent Openings shall comply with the provisions of the Building Code including location on property, openings adjacent to stairways and courts
- d. Vent Openings in walls shall be located:
 - i. a maximum of 6 inches below roof joists or ceiling joists in the space to be ventilated,
 - ii. no more than 50 feet from any point within the building, and
 - iii. to provide cross ventilation utilizing either of the following:
 - two opposite sides of the building or space to provide cross ventilation.

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- two adjacent sides where at least 50% of the required area of vents are centered a distance of one half the diagonal of the space being ventilated.
- e. Ducts or pipes shall be located:
 - i. to remove gases from the highest point in the room or enclosed space,
 - ii. at a minimum of two positions a maximum of 50 feet on center, and
 - iii. evenly distributed throughout the enclosed space.

D. MISCELLANEOUS SYSTEMS

1. Trench Dam

Trench dams are intended to prevent travel of underground gas into buildings or structures along the trench backfill.

- a. A gas mitigation barrier shall be installed in all electrical, plumbing, gas, or other trenches that extend beneath the building foundation.
- b. If piping and conduits are placed before precise grading of the building pad, then trench dams will not be required.
- c. Trench dams shall be installed in the trench immediately adjacent to the exterior perimeter of the building foundation.
- d. A trench dam shall have a minimum length of twice the width of the trench or a minimum of 36 inches in length
- e. Trench dams may be of the following:
 - i. Lean concrete mixture with 10% by volume of bentonite clay powder added. Lean concrete shall be 300 to 500 psi (28 days), or
 - ii. Soil compacted to a minimum 90 percent of the maximum dry density of the fill material.
- f. Pipes and conduits shall be covered by trench dam material at least 6 inches thick below, to the sides and above.

2. Hazardous Area Classification

For the purpose of determining the appropriate electrical wiring method and equipment, boundaries of the hazardous area classification are specified in Tables 8, 9, and 10.

3. Wiring

The wiring system shall be in accordance with the code, and as required herein.

a. Depressurization Enclosure

- i. A depressurization enclosure is a ventilated wiring pull box installed at buildings with Design Methane Pressure greater than 6 inches of water.
- ii. Wiring system between a classified area and a non-classified area shall be supplemented by a depressurization enclosure.
- iii. The wiring system supplied from the depressurization enclosure shall be kept above ground. The pull box shall be suitable for the location and shall contain only wiring and approved splices. The depressurizing enclosure shall be located outdoors and shall comply with one of the following options:
 - A standard pull box fitted with a breather suitable for Class I, Group D locations where:
 - The breather shall be located on the side of the enclosure within 2 inches from the top of the pull box.
 - The breather shall have minimum dimensions of 1.5 inches long and 15/16 inch diameter, or
 - A standard pull box fitted with louvered ventilation where:
 - The louvered openings shall be within 2 inches from the top of the box.
 - The minimum total enclosure ventilation opening shall be 1.41 square inches. A louvered pull box shall be installed in a non-classified area.

b. Conduit Seal Fittings and Cable Seal Fittings

Conduit Seal Fittings and Cable Seal Fittings are designed to prevent the passage of gases, vapors, or flames inside the electrical conduits.

- i. Conduit Seal Fittings are required where conduits pass through a classified hazardous area per the Los Angeles Electrical Code and clarified herein.
- ii. Any conduit that penetrates the Impervious Membrane shall be provided with a conduit seal.
- iii. Conduit or Cable Seal Fittings are not required when the incoming underground wiring system.
- iv. Conduit Seal Fittings shall be installed in the vertical portion of conduit where the PVC conduit emerges from a classified location. Rigid material shall be it material shall be rigid metal that has the same trade size as conduit runs.
- v. Vertical conduit risers shall not be less than 24 inches long.

c. Polyvinyl Chloride (PVC) Conduit in Outdoor Class I Division 2 Locations

PVC Conduits may be installed outdoors in Class I Division 2 locations provided:

- i. Trenches containing PVC Conduit shall be at least 6 inches wider than the

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- conduit outside diameter.
- ii. PVC Conduit shall be schedule 80, or schedule 40 with a red warning (barrier) tape located 12 inches above the conduit for the entire length of the conduit.
 - iii. Trench Dams, conforming to this Standard, shall be placed in all trenches containing PVC Conduit.
- d. Vertical Conduit Risers
- i. To install a conduit seal fitting on a vertical conduit riser transition from the underground horizontal PVC conduit, the vertical conduit material shall be changed to a rigid metal conduit that has the same trade size as the PVC conduit.
 - ii. Vertical conduit risers emerging from a classified location to a non-classified location shall consist of a rigid galvanized conduit of the same trade size as the main horizontal conduit runs. This conduit riser shall not be less than 24 inches long.
- e. Grounding Electrical Systems
- Electrical systems required by the code to be grounded shall be connected to the earth using the Prescriptive Method or Soil Resistance Method.
- i. Prescriptive Method

When a Ground Ring is not used as part of the Grounding Electrical Systems required by the Electrical Code, 250-81, at least one of the following supplemental grounding electrodes shall be used:

 - Rod and Pipe Electrodes 250-83 (c)
 - Plate Electrodes 250-83 (d)
 - ii. Soil Resistance Method

Grounding systems other than specified in item a, above, shall be based on soil electrical resistivity site investigation as follows:

 - Soil Electrical Resistance - The soil resistivity shall be measured by the four-point method as described in IEEE Standard 81, latest editions. This measurement shall take into account the geological features of the soil as determined by the engineer. Whenever driven ground rods are to be used, the measurement shall correlate with the installed effective depth of the ground electrodes. The measurement shall take into account the expected soil temperature, moisture and gas or soluble chemical contents.
 - Measurement - The average of all readings on the site shall establish the Design Soil Electrical Resistance for the site. Measurements shall be made at the center and corners of 50 feet by 50 feet square grids, or partial thereof.

4. Vaults

Underground concrete vaults not larger than 5,000 cubic feet in volume shall be installed as specified in the Details of this Standard. Concrete vaults more than 5,000 cubic feet in volume require additional review during the plan check process. Design approvals of vaults larger than 5,000 cubic feet in volume shall address the following issues:

a. Vent System

- i. The Vent System for the vault shall provide sufficient Natural Ventilation to prevent the build-up of methane.
- ii. Mechanical ventilation may be substituted for Natural Ventilation when back-up power sufficient to run the system for 24 hours is provided.

b. Vault Exterior

- i. Approved seals shall be used to prevent the water from entering from the sides and top of the vault.
- ii. All vault covers shall be provided with a restraint system to prevent unauthorized entry.
- iii. Soil gases under the vault shall be vented in a similar manner to those in the Standard Details.

c. Vault Interior

- i. Conduits entering or leaving the vault shall be sealed.
- ii. All wiring terminations, equipment and insulating materials used inside the vault shall be suitable for wet location.

5. Deep Vent Wells

a. General

Deep vent wells may provide a preferential pathway for subsurface soil gases to vent to the atmosphere before entering the building mitigation systems in sites designed to meet the requirements of Site Design Level III.

b. Deep Vent Well System Design

i. General

The Deep Vent Well System shall consist of a well shaft, gas release control, and filter screen to relieve subsurface gas pressure and reduce the amount of subsurface gas reaching the building mitigation systems.

ii. Well Shaft

- The well shaft shall be a steel tube at least 16" diameter.
- The annular space between the shaft and the surrounding soil shall be sealed with a bentonite slurry mix to prevent gases from traveling along the outside of the well shaft.

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iii. Gas Release Control

- Gases collected in the Deep Vent Well shall be conveyed to the outside of the building. See Section VI.A.d. of this Standard for Vent Riser design requirements.
- Water drainages from the wells shall comply with all applicable regulations of the City of Los Angeles, Department of Public Works and the Regional Water Quality Control Board, State of California.

iv. Filter Screen

- Filters that will prevent soil from blocking the Deep Vent Well shall be provided.
- When tar or oil is encountered on the site, the Deep Vent Well shall be maintained clear of oil or tar to allow venting of subsurface gases.

VI. ALTERNATE DESIGN CRITERIA

Alternate design methods shall be submitted for approval by the respective LAFD and plan check sections shown in Table 11 – Plan Check Procedures. Each proposal shall demonstrate that deviations are slight, provide a level of safety equivalent to the code, applicable test results, and analyses based on established engineering practices. Such equivalents shall be approved by the respective engineering disciplines of LADBS.

VII. SYSTEMS MAINTENANCE

A. PROCEDURES

The calibration, testing, and service procedure for gas-detection and Mechanical Ventilation Systems shall be performed in accordance with the manufacturer's current written instructions. These instructions shall be approved and filed with the Fire Department. Testing and servicing shall be performed by a person approved by the Environmental Unit, LAFD.

B. SCHEDULE

Notwithstanding the recommendations by the manufacturer, calibration, testing and service of each system shall be performed at least once annually.

C. REPAIRS

All components required to mitigate methane hazards shall be repaired or replaced to the manufacturer's original specification.

D. OCCUPANT NOTIFICATION

A permanent notification shall be provided at each building indicating the presence of the methane Impervious Membrane. This notification shall be at the front entrance, be visible, and be legible as approved by the Engineer and LADBS. See Detail 14 – Gas Membrane Identification in Section IX of this Standard.

VIII. CONTINGENCY PLANNING

A contingency plan outlining emergency procedures shall be established for all buildings with a gas-detection system, with the exception of buildings with R3 or U Occupancies. The procedures shall include, but need not be limited to, the identification of the responsible person assigned to manage the contingency plan, posting of the contingency plan, and the approval process of the contingency plan.

A. RESPONSIBLE PERSON

The assigned responsible person shall work with the Fire Department in the establishment, implementation and maintenance of an emergency plan.

B. POSTING

A sign shall be posted in a conspicuous location designated by the Fire Department with the Fire Department's telephone number.

C. APPROVAL

All contingency plans for emergency procedures shall be approved by the Fire Department.

IX. FORMS AND TABLES

LIST OF FORMS AND TABLES

- Form 1 – Certificate of Compliance for Methane Test Data
- Form 2 – Certificate of Compliance for Soil Electrical Resistivity Test
- Form 3 – Impervious Membrane Installation Certificate
- Table 1A – Mitigation Requirements for Methane Zone
- Table 1B – Mitigation Requirements for Methane Buffer Zone
- Table 2 – Gas Probe Monitoring Parameters
- Table 3 – Spacing / Location of Perforated Horizontal Pipes and Vent Risers
- Table 4 – Specifications for Gravel
- Table 5 – Specifications for Sand
- Table 6 – Sequence of Operation
- Table 7 – Detector Spacing
- Table 8 – Outdoor Hazardous Area Classification
- Table 9 – Vent Riser Hazardous Area Classification
- Table 10 – Building Hazardous Area Classification
- Table 11 – Summary of Plan Check Requirements

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FORM 1 - CERTIFICATE OF COMPLIANCE FOR METHANE TEST DATA

Part 1: Certification Sheet

Site Address: _____

Legal Description: Tract: _____ Lot: _____ Block: _____

Building Use: _____

Registered Civil Engineer, Soil Engineer, or
Geologist Stamp:

Name of Engineer or Geologist: _____

Mailing Address: _____

Telephone: _____

Name of Testing Laboratory: _____

Telephone: _____

Architect's Stamp not required.

I hereby certify that I have tested the above site for the purpose of methane mitigation, and that all procedures were conducted in conformity with the requirements of the LADBS Methane Mitigation Standard. Where the inspection and testing of all or part of the work above is delegated, full responsibility shall be assumed by the licensed engineer or geologist whose signature is affixed thereon.

Signed: _____ date _____

Required Data:

- Depth of ground water: _____ feet below the Impervious Membrane.
- Design Methane Concentration: _____ parts per million in volume (ppmv)
- Design Methane Pressure: _____ inches of water column.

De-watering:

- De-watering (is) (is not) required.
- Pump discharge rate _____ cubic feet per minute.
- Reference geology or soil report: _____ dated _____

Additional Investigation:

- Additional investigation (was) (was not) conducted.

Latest Grading on Site:

- Date of last grading on site was _____
- See Attached explanation of the effect on soil gas survey results by grading operations:

Description of Gas Analysis Instrument(s):
Instrument Name and Model:

As a covered entity under Title II of the Americans with Disabilities Act, the City of Los Angeles does not discriminate on the basis of disability and, upon request, will provide reasonable accommodation to ensure equal access to its programs, services and activities. For efficient handling of information internally and in the Internet, conversion to this new format of code related and administrative information bulletins including MGD and RGA that were previously issued will also allow flexibility and timely distribution of information to the public.

FORM 2 – CERTIFICATE OF COMPLIANCE FOR SOIL ELECTRICAL RESISTIVITY TEST

Part 1: Certification Sheet

Site Address: _____

Legal Description: Tract: _____ Lot: _____ Block: _____

Building Use: _____

Registered Civil Engineer, Electrical Engineer,
Soil Engineer, or Geologist Stamp:

Name of Engineer: _____

Mailing Address: _____

Telephone: _____

Name of Testing Laboratory: _____

Telephone: _____

Architect's Stamp not required.

I hereby certify that I have tested the above site for the purpose of methane mitigation, and that all procedures were conducted in conformity with the requirements of the LADBS Methane Mitigation Standard. Where the inspection and testing of all or part of the work above is delegated, full responsibility shall be assumed by the licensed engineer whose signature is affixed thereon.

Signed: _____ date _____

Summary of Findings:

- Measured Soil Electrical Resistivity:
Highest: _____ Ohms; Lowest: _____ Ohms; Average: _____ Ohms
- Measured temperature: _____; Humidity: _____
- Last rainfall was _____ days ago.

FORM 2 (CONTINUED) – CERTIFICATE OF COMPLIANCE FOR SOIL ELECTRICAL RESISTIVITY TEST

Part 2: Test Data

[illegible]

Sketch locations of the electrical probes:

A full-page view of a blank sheet of graph paper. The grid consists of small squares formed by thin black lines. There are approximately 20 columns and 20 rows of squares. The paper has a slightly off-white or light gray tint.

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FORM 3 - IMPERVIOUS MEMBRANE INSTALLATION CERTIFICATE

Site Information:

Address: _____

Legal Description: Tract: _____ Lot: _____ Block: _____

Building Use: _____

Registered Civil Engineer, Soil Engineer, or
 Geologist Stamp:

Name of Engineer: _____

Mailing Address: _____

Telephone: _____

I hereby certify that I have inspected the installation and reviewed the test results of the Impervious Membrane system at the above-described property. On the basis of these inspections and tests it is my conclusion that the Impervious Membrane system was installed in conformity with the recommendations of the manufacturer and the requirements of the LADBS Methane Mitigation Standard. Where the inspection and testing of all or part of the work above is delegated, full responsibility shall be assumed by the licensed engineer whose signature is affixed thereon.

Signed: _____ date _____

TABLE 1A - MITIGATION REQUIREMENTS FOR METHANE ZONE

		Site Design Level		LEVEL I		LEVEL II A		LEVEL II B		LEVEL II C		LEVEL III
		Design Methane Concentration (ppmv)		0 – 100		101 – 1,000		1,001 – 5,000		5,001 – 12,500		> 12,500
		Design Methane Pressure (Inches of water column)		≤ 2"	> 2"	≤ 2"	> 2"	≤ 2"	> 2"	≤ 2"	> 2"	All Pressures
PASSIVE SYSTEM	De-watering System (See note 1)		X	X	X	X	X	X	X	X	X	X
	Sub-Slab Vent System	Perforated Horizontal Pipes	X	X	X	X	X	X	X	X	X	X
		Gravel Blanket Thickness Under Impervious Membrane	2"	2"	2"	3"	2"	3"	2"	4"	4"	4"
		Gravel Thickness Surrounding Perforated Horizontal Pipes	2"	2"	2"	3"	2"	3"	2"	4"	4"	4"
		Vent Risers	X	X	X	X	X	X	X	X	X	X
	Impervious Membrane (See note 2)		X	X	X	X	X	X	X	X	X	X
ACTIVE SYSTEM (See note 3)	Sub-Slab Vent System	Pressure Sensors Below Impervious Membrane									X	X
		Mechanical Extraction System									X	X
	Lowest Occupied Space System (See note 6)	Gas Detection System (See notes 4 & 5)		X		X	X	X	X	X	X	X
		Mechanical Ventilation		X		X	X	X	X	X	X	X
		Alarm System		X		X	X	X	X	X	X	X
Control Panel (See notes 4 & 5)			X		X	X	X	X	X	X	X	
MISC. SYSTEM (see note 10)	Trench Dam (See note 7)		X	X	X	X	X	X	X	X	X	X
	Conduit or Cable Seal Fitting (See note 8)		X	X	X	X	X	X	X	X	X	X
	Deep Vent Well (See note 9)											X

X = Required Mitigation Components

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TABLE 1B – MITIGATION REQUIREMENTS FOR METHANE BUFFER ZONE

Site Design Level		LEVEL I		LEVEL II A		LEVEL II B		LEVEL II C		LEVEL III
Design Methane Concentration (ppmv)		0 – 100		101 – 1,000		1,001 – 5,000		5,001 – 12,500		> 12,500
Design Methane Pressure (inches of water column)		≤ 2"	> 2"	≤ 2"	> 2"	≤ 2"	> 2"	≤ 2"	> 2"	All Pressures
PASSIVE SYSTEM	De-watering System (See note 1)		X		X		X	X	X	X
	Sub-Slab Vent System	Perforated Horizontal Pipes		X	X		X	X	X	X
		Gravel Blanket Thickness Under Impervious Membrane		2"	3"		3"	2"	4"	4"
		Gravel Thickness Surrounding Perforated Horizontal Pipes		2"	3"		3"	2"	4"	4"
		Vent Risers		X	X		X	X	X	X
	Impervious Membrane (See note 2)		X		X		X	X	X	X
ACTIVE SYSTEM (See note 3)	Sub-Slab Vent System	Pressure Sensors Below Impervious Membrane							X	X
		Mechanical Extraction System							X	X
	Lowest Occupied Space System (See note 6)	Gas Detection System (See notes 4 & 5)		X	X		X	X	X	X
		Mechanical Ventilation		X	X		X	X	X	X
		Alarm System		X	X		X	X	X	X
	Control Panel (See notes 4 & 5)		X		X		X	X	X	X
MISC. SYSTEM (see note 10)	Trench Dam (See note 7)		X		X	X	X	X	X	X
	Conduit or Cable Seal Fitting (See note 8)		X		X	X	X	X	X	X
	Deep Vent Well (See note 9)									X

X = Required Mitigation Components

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NOTES FOR TABLES 1A AND 1B:

1. **DEWATERING:** De-watering will be required if the maximum Historical High Ground Water Table elevation, or projected post-construction ground water level, is within 12 inches below the bottom of the installed Perforated Horizontal Pipes.
2. **SINGLE FAMILY DWELLINGS AND ACCESSORY BUILDINGS TO SINGLE FAMILY DWELLINGS**
 - a. The Impervious Membrane may be 6 mil thick visquene in lieu of the approved 60 mil thick Impervious Membrane in buildings located in the Methane Buffer Zone with Site Design Levels A and Level B with less than 2" Design Methane Pressure.
 - b. Pressure Sensors Below the Impervious Membrane and its Control Panel which signal a Warning Annunciator at 3 inches water pressure may be used in lieu of the Gas Detection System, Mechanical Ventilation System, and the Mechanical Extraction System for buildings located in all Site Design Levels except for Site Design Level D with Design Methane Pressure greater than 2" and Site Design Level E.
 - c. Gas Detection System that triggers an alarm at gas concentration of 12,500 ppmv may be used in lieu of the Mechanical Ventilation System when the following are provided:
 - i. Detectors are placed in each room, hallways, closets, and enclosed spaces.
Exception: Kitchens and bathrooms do not need to be equipped with detectors.
 - ii. All Detectors including single station types shall be hardwired to the building power source and be provided with back-up power for 24 hours of standby and 5 minutes in the alarm mode.
 - d. Single-station Detectors with built-in backup battery may be used in lieu of a complete alarm system.
 - e. Detectors in dwelling units may be wired as individual units or in tandem. The primary power to each Detector shall be from a dwelling unit branch circuit ahead of any disconnecting device.
 - f. Deep Vent Wells are not required for all each detached buildings with footprint less than 6,000 square feet in area.
3. **EXCEPTIONS BASED ON BUILDING SIZE:** Pressure Sensors Below the Impervious Membrane and its Control Panel which signal a Warning Annunciator at 3 inches water pressure may be used in lieu of the Gas Detection System, Mechanical Ventilation System, and the Mechanical Extraction System for buildings with Site Design Levels A, B, and C with all of the following physical features:
 - a. width less than 50 feet, and
 - b. footprint less than 50,000 square feet of lot area, and
 - c. landscaping at least 2 feet wide located immediately adjacent to the exterior walls covering more than 50% of the exterior walls of the building.
4. **WIRING:**
 - a. Detectors in dwelling units may be wired as individual units or in tandem.
 - b. The primary power to each Detector shall be from a dwelling unit branch circuit ahead of any disconnecting device.

- c. In lieu of a complete alarm system, single-station Detectors with built-in backup battery may be used within dwelling units in of residential buildings.
- d. Trench dams shall be installed for all underground electrical conduit or cable systems entering or leaving a building or structure. Trench dams shall also be installed for any utility mechanical piping system.
- e. Conduit or Cable Seal Fitting shall also be installed for any installation as required by the electrical code and for any outdoor equipment installation protected by an Impervious Membrane.
5. **MECHANICAL VENTILATION:** The requirements for Mechanical Ventilation in the Lowest Occupied Space System may be fulfilled using one of the following options:
 - Option 1 – Triggered Mechanical Ventilation
 - Gas Detection System shall be provided with 24-hour back-up power.
 - Alarms shall be provided with 5 minutes of back-up power.
 - Option 2 – Continuous Mechanical Ventilation
 - Gas Detection System and alarms are not required.
 - Back-up power to continuously operate the Mechanical Ventilation System for a minimum of 24 hours shall be provided.
 - Option 3 – Scheduled Start-Up Ventilation
 - Gas Detection System and Alarm System are not required.
 - Back-up power to operate the Mechanical Ventilation System throughout a 24-hour start-up schedule shall be provided.
 - Option 4 – Natural Ventilation
 - Gas Detector System and Alarm System are not required.
 - The entire building or portions of buildings may be provided with Natural Ventilation in accordance with standards established by the Superintendent of Building.
6. **DEEP VENT WELLS:** Vent Risers installed at a rate greater than twice the standard rate established by the Superintendent of Building may be used in lieu of Deep Vent Wells.
7. **TAR COLLECTION SUMPS:** Tar collection sumps shall be installed in all buildings within 50 feet of a tar seep boundary to prevent tar from blocking Perforated Horizontal Pipes and De-Watering Systems.

TABLE 1C - SEQUENCE OF OPERATION

		System Component Triggered by Pressure Sensors, Detectors and Gas Sensors			
		Pressure Sensor Below Impervious Membrane	Detector in the Lowest Occupied Space		Gas Sensor in Vent Risers
System Name	System Component	More Than 3" Water Pressure	More Than 10%LEL	More Than 25%LEL	More Than 75%LEL
Below Impervious Membrane System	Warning Annunciator	X			
	Mechanical Extraction Fan				X
Lowest Occupied Space System	Mechanical Ventilation		X	X	
	Alarm (audible and visible)			X	
	Warning Annunciator	X	X	X	X

NOTE FOR TABLE 6:

1. Gas Detection Control Panels as part of the Lowest Occupied Space Systems and Below Impervious Membrane Systems, shall determine the gas concentration using a time weighted average of 10 minutes.

TABLE 2 – GAS PROBE MONITORING PARAMETERS

Parameter	¹Equipment or Procedure	²Detection Limit
Barometric Pressure	Barometer or GA-90	0.1" of Hg
Gas Probe Pressure	Pressure Gauge	0.1" of H ₂ O
Methane Concentration	Landtec GA-90 (Field) or EPA 8015 (Lab)	0.1% or 1,000 ppm
Combustible Gas Concentration	LTX-310 (Field) or EPA 8015 (Lab)	0.1% or 1,000 ppm

NOTES FOR TABLE 2:

1. The field equipment listed in this table is presented as an example of suitable devices. This list is not intended to be complete or comprehensive. Other equipment may be utilized if the manufacturer and the Methane engineer can establish acceptable performance.
2. These represent minimum standards with respect to detection limits. Lower detection limits are desirable and should be sought wherever practical.

TABLE 3 - SPACING/LOCATION OF HORIZONTAL PIPES AND VENT RISERS:

Vent Riser Pipe Diameter (inches)	Max. Sub-Slab Vent Horizontal Pipe Spacing (feet)	Max. Sub-Slab Combination Horizontal Pipe for Dewatering and Vent Spacing (feet)	Number of Vent Riser Per Building Footprint Area (square feet)
1 ½	12.5	Not Allowed	1/1,250 (min of 2 risers)
2	25	Not Allowed	1/2,500 (min of 2 risers)
2 ½	50	Not Allowed	1/5,000 (min of 3 risers)
3	75	Not Allowed	1/7,500 (min of 4 risers)
4	100	50	1/10,000 (min of 4 risers)

NOTES FOR TABLE 3:

1. Riser length shall be a maximum of 100' measured along pipe (including bends).
2. Vent Risers max spacing between each riser 100' measured along horizontal pipes.
3. When the application of the spacing and location requirement of this table results in the requirement of a fractional number of Vent Risers, any fraction shall be construed as one Vent Riser.
4. Horizontal pipes shall always be equal or larger in diameter than the vertical risers.
5. Building Footprint shall be defined as the area in square feet contained within the exterior walls at or below the grade level.
6. Vent Risers shall be located as per the above table for buildings with footprint areas covering up to 100,000 square feet.
7. Vent Risers in buildings with footprint area covering over 100,000 square feet may use the minimum standards in the above table or an alternate method justified by engineering calculations approved by the Department of Building and Safety, Building and Mechanical Plan Check Sections.

TABLE 4 - SPECIFICATIONS FOR GRAVEL

SIEVE SIZE	PERCENTAGE PASSING SIEVE	
	3/4" Gravel	3/8" Gravel
1-1/2" (37.5 mm)	100	-
1" (25.0 mm)	90-100	-
3/4" (19.0 mm)	55-85	100
3/8" (9.5mm)	8-20	85-100
No. 4 (4.75mm)	0-5	0-30
No. 8 (2.36mm)	0-5	0-10
No. 200 (75µm)	0-2	0-2
ASTM C 131 TEST GRADING	B	C

TABLE 5 - SPECIFICATIONS FOR SAND

SIEVE SIZE	PERCENTAGE PASSING SIEVE
3/8" (9.5mm)	100
No. 4 (4.75mm)	90-100
No. 8 (2.36mm)	75-90
No. 16 (1.18mm)	55-75
No. 30 (600µm)	30-50
No. 50 (300µm)	10-25
No. 100 (150µm)	2-10
No. 200 (75µm)	0-5

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TABLE 7 – DETECTOR SPACING

Room Floor Area or Concealed Space Area (square feet)	Number of Detectors*	
	With Heating, Ventilation, and Air Conditioning	Without Heating, Ventilation, and Air Conditioning
10,000 and More	Minimum 3 Detectors plus one for every 20,000 and fraction thereof in excess of 10,000	Minimum of 6 Detectors plus one for every 2,500 and fraction thereof
More Than 5,000 and Less Than 10,000	3 Detectors	Minimum of 2 Detectors plus one for every 2,500 and fraction thereof
More Than 1,000 and up to 5,000	2 Detectors	Minimum of 1 Detector plus one for every 2,500 and fraction thereof
0 and Up to 1,000	1 Detector	1 Detector

NOTE FOR TABLE 7:

- * In addition to the required number of Detectors in this table, there shall be at least one Detector in each elevator shaft and enclosed stairway.

Table 8 - OUTDOOR HAZARDOUS AREA CLASSIFICATION*

LOCATION	PAVEMENT SIZE	METHANE DESIGN LEVEL	MEASURED SOIL GAS CONCENTRATION (ppmv)	MEASURED SOIL GAS PRESSURE (inches of water)	HAZARDOUS AREA CLASSIFICATION
Below finished grade	N/A	I, II A, B or C	Less than 12,500	Less than 2	Unclassified
		III	Greater than 12,500	N/A	5' or less depth; Unclassified
		I, II A, B or C	Less than 12,500	Greater than 2	Between 5' to 10' depth; Class I, Division 2 Over 10' depth; Class I, Division 1
Below finished grade with pavement greater than 15' from the outside wall of a building or structure	? Less than 5000 Sq. Ft. or ? Greater than 5000 Sq. Ft. & Less than 25' Width	I, II A, B or C	Less than 12,500	Less than 2	Unclassified
		III	Greater than 12,500	N/A	5' or less depth; Unclassified
		I, II A, B or C	Less than 12,500	Greater than 2	Between 5' to 10' depth; Class I, Division 2 Over 10' depth; Class I, Division 1
Below finished grade with pavement greater than 15' from the outside wall of a building or structure ¹	Greater than 5000 Sq. Ft. & 25' Width	I, II A, B or C	Less than 12,500	Less than 2	2.5' or less depth; Unclassified
		III	Greater than 12,500	N/A	Between 2.5' to 10' depth; Class I, Division 2
		I, II A, B or C	Less than 12,500	Greater than 2	Over 10' depth; Class I, Division 1
Below finished grade with pavement less than or equal to 15' from the outside wall of a building or structure	Greater than 5000 Sq. Ft.	I, II A, B or C	Less than 12,500	Less than 2	10' or less depth; Class I, Division 2
		III	Greater than 12,500	N/A	Over 10' depth; Class I, Division 1
		I, II A, B or C	Less than 12,500	Greater than 2	Class I, Division 1
Above grade	Regardless	N/A	N/A	N/A	Unclassified

NOTE FOR TABLE 8:

- * Unpaved open areas, such as planters or landscaped areas with space not less than 3'x3' in area spaced at less than or equal to 50' from each others edge, and the area in between them shall be treated as an area that is less than 5000 Sq. ft. If the space in between them exceeds 50', that area can be construed as less than 5000 Sq. Ft. provided that the conduit or cable is installed in a trench and back filled with 3/4-inch aggregate or gravel to the grade.

Table 9 - VENT RISER HAZARDOUS AREA CLASSIFICATION

LOCATION	POWER VENTILATED	HEMISPHERICAL DISTANCE FROM THE RIM OF THE VENT, A JOINT OR A FITTING	HAZARDOUS AREA CLASSIFICATION
Outlet	No	Within 0 to 3 feet	Class I, Division 1
		Within 3 to 5 feet	Class I, Division 2
		Over 5 feet	Unclassified
Joints and fittings not enclosed within wall spaces ¹	Yes	Within 0 to 5 feet	Class I, Division 1
		Within 5 to 10 feet	Class I, Division 2
		Over 10 feet	Unclassified
Joints and fittings within framed walls spaces ¹	N/A	Within 0 to 3 feet	Class I, Division 2
		Over 3 feet	Unclassified
		Any distance within the frame stud bay	Class I, Division 1

NOTE FOR TABLE 9:

The hazardous area designation for these areas is considered as unclassified under any one of the following conditions:

- All joints and fittings are welded in approved manner.
- Approved double walled Vent Risers.
- Approved four inches or smaller threaded steel pipe venting system or equivalent approved piping system.

Table 10 - BUILDING HAZARDOUS AREA CLASSIFICATION

LOCATION	METHANE DESIGN LEVEL	MEASURED SOIL GAS CONCENTRATION (ppmv)	MEASURED SOIL GAS PRESSURE (Inches of Water)	HAZARDOUS AREA CLASSIFICATION
Below Impervious Membrane	I, II A, B or C	Less than 12,500	Less than 2"	10' or less depth; Class I, Division 2 Over 10' depth; Class I, Division 1
Below grade within the raised floor foundation or lowest building slab without an Impervious Membrane	III	Greater than 12,500	N/A	Class I, Division 1
	I, II A, B or C	Less than 12,500	Greater than 2"	
	I, II A, B or C	Less than 12,500	Less than 2"	10' or less depth; Class I, Division 2 Over 10' depth; Class I, Division 1
	III	Greater than 12,500	N/A	Class I, Division 1
Above grade within the raised floor foundation footing without an Impervious Membrane but with adequate ventilation	I, II A, B or C	Less than 12,500	Greater than 2"	
	I, II A, B or C	Less than 12,500	Less than 2"	Unclassified
	III	Greater than 12,500	N/A	Class I, Division 2
	I, II A, B or C	Less than 12,500	Greater than 2"	
Above Impervious Membrane, but below the lowest building slab or raised floor foundation	III	Below Impervious Membrane Greater than 12,500	N/A	Class I, Division 2
	I, II A, B or C	Below Impervious Membrane Less than 12,500	Below Impervious Membrane Greater than 2"	
	I, II A, B or C	Below Impervious Membrane Less than 12,500	Below Impervious Membrane Less than 2"	Unclassified
	N/A	N/A	N/A	Unclassified
Above Impervious Membrane, through the lowest building slab	N/A	N/A	N/A	Unclassified
Above slab				

TABLE 11 – PLAN CHECK PROCEDURES

		GRADING		BUILDING		ELECT.		HVAC		PLBG.		FIRE	
		REPORT REVIEW		PLAN CHECK	NO PLAN CHECK	PLAN CHECK	NO PLAN CHECK	PLAN CHECK	NO PLAN CHECK	PLAN CHECK	NO PLAN CHECK	PLAN CHECK	NO PLAN CHECK
TEST REPORTS	Shallow Gas Survey			X									
	Gas Probe			X									
	Ground Resistance					X							
	Dewatering Flow Rate	X											
PASSIVE SYSTEM	De-Watering System – Piping			X						X			
	De-Watering System –Sump Pump, and Termination					X				X			
	Tar Collection System – process and open flow drainage			X									
	Tar Collection Pumps and Heaters					X	X			X			
	Sub-Slab Vent System			X							X		
				X									
				X									
				X							X		
	Impervious Membrane			X									
ALARM SYSTEM	Pressure Sensors Below Impervious Membrane					X							
	Gas-Detection System in Lowest Occupied Enclosed Space					X						X	
	Alarm System					X						X	
ACTIVE SYSTEM	Active Methane Extraction System					X		X					
	Mechanical Ventilation in the Lowest Occupied Space					X		X					
	Control Panel					X							
MISC. SYSTEM	Deep Wells			X			X						
	Trench Dams					X							
	Conduit Seals					X							

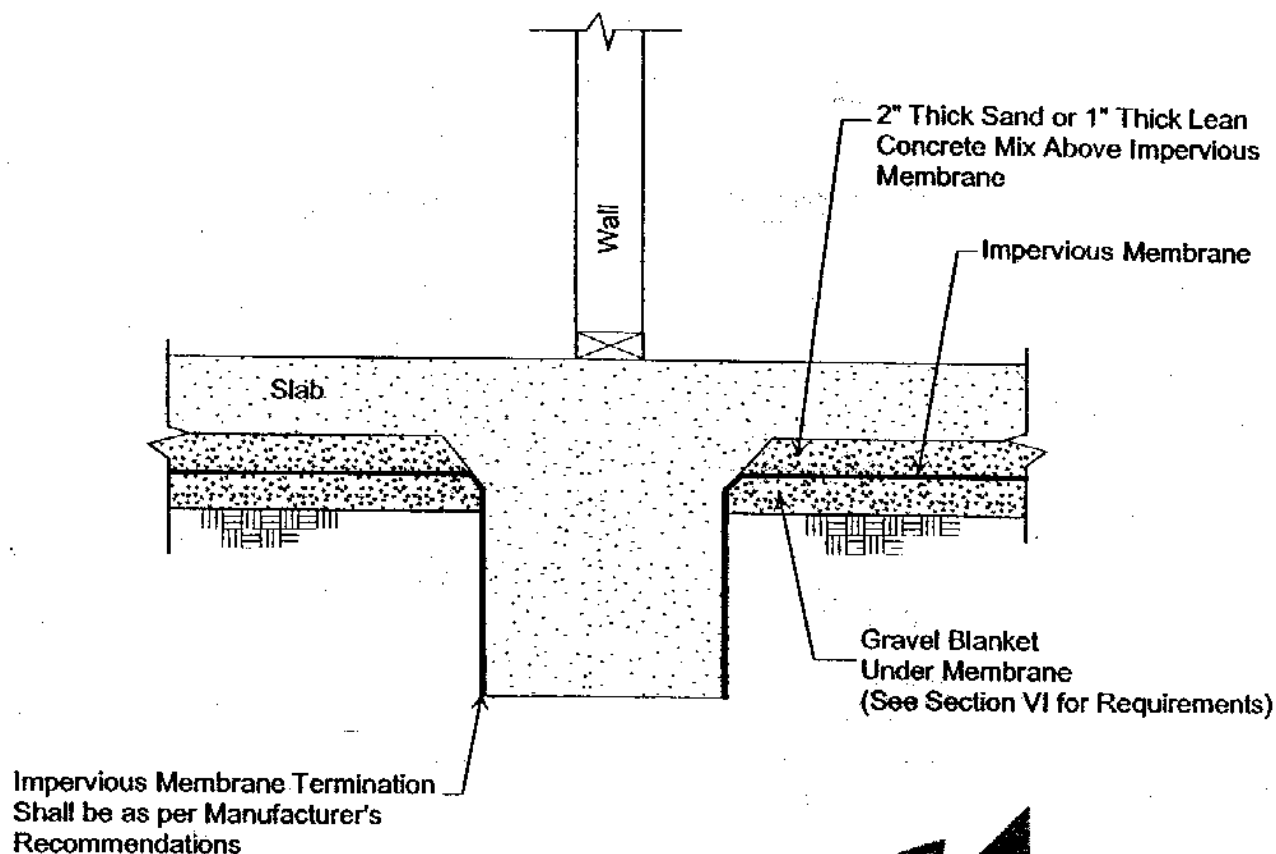
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XI. DETAILS

INDEX FOR DETAILS

Detail #	Description
1.	Membrane Termination at Interior Footing – Single Pour
2.	Sub-slab vent system
3.	Membrane Termination at Garage / Dwelling Floor Transition – Two Pour
4.	Membrane Termination at Garage Grade Beam – Two Pour
5.	Membrane Termination at Exterior Footing – Single Pour
6.	Membrane Termination at Exterior Footing – Two Pour
7.	Membrane Boot
8.	Conduit Seals
9.	Gas Sensor Control Panel Diaphragm
10.	Methane Alarm Device – Horn and Strobe Combination
11.	Methane Alarm Mount
12.	Vent Pipe at Interior Footing
13.	Combination De-watering and Vent Pipe
14.	Gas Membrane Identification
15.	Deep Single Stage Gas Probe Configuration
16.	Shallow Single Stage Gas Probe
17.	Shallow Multi Stage Gas Probe
18.	Utility Trench Dam
19.	Utility Vault
20.	Deep Vent Wells

DETAIL 1 MEMBRANE TERMINATION AT INTERIOR FOOTING-SINGLE POUR

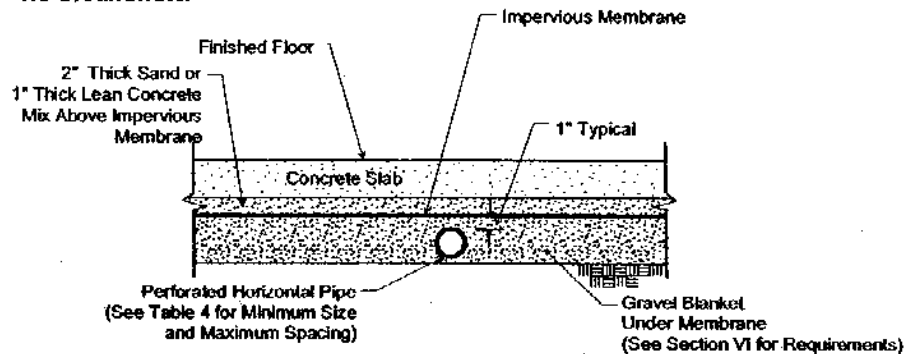


- Note: 1. See Section I for Definitions and Section VI for Design Criteria.
2. Membrane is Not to be Placed Under the Building Footings.

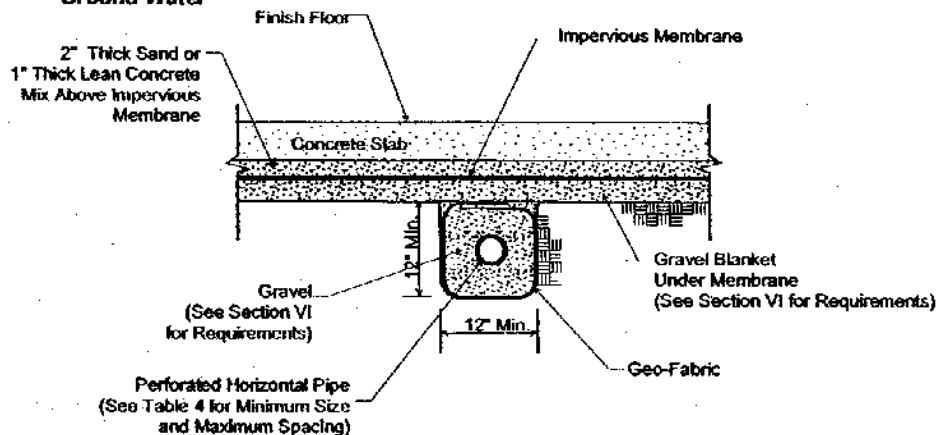
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DETAIL 2 SUB-SLAB VENT SYSTEM

Alternative A:
No Groundwater

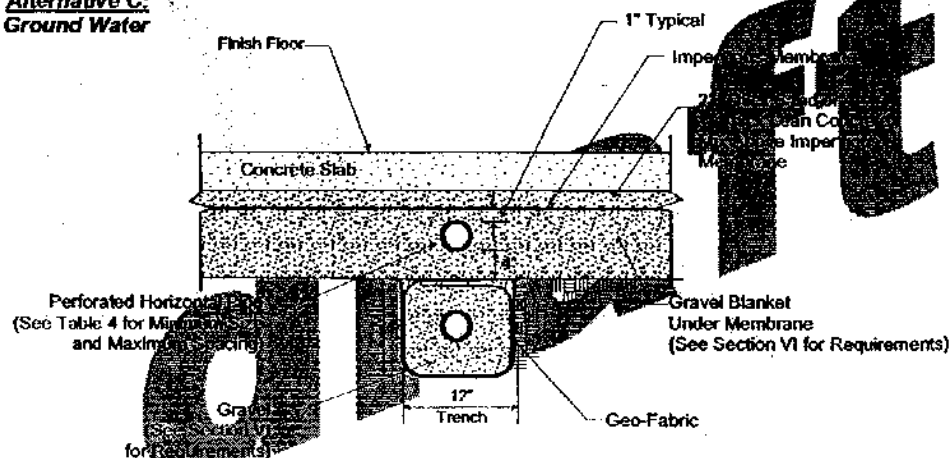


Alternative B:
Ground Water

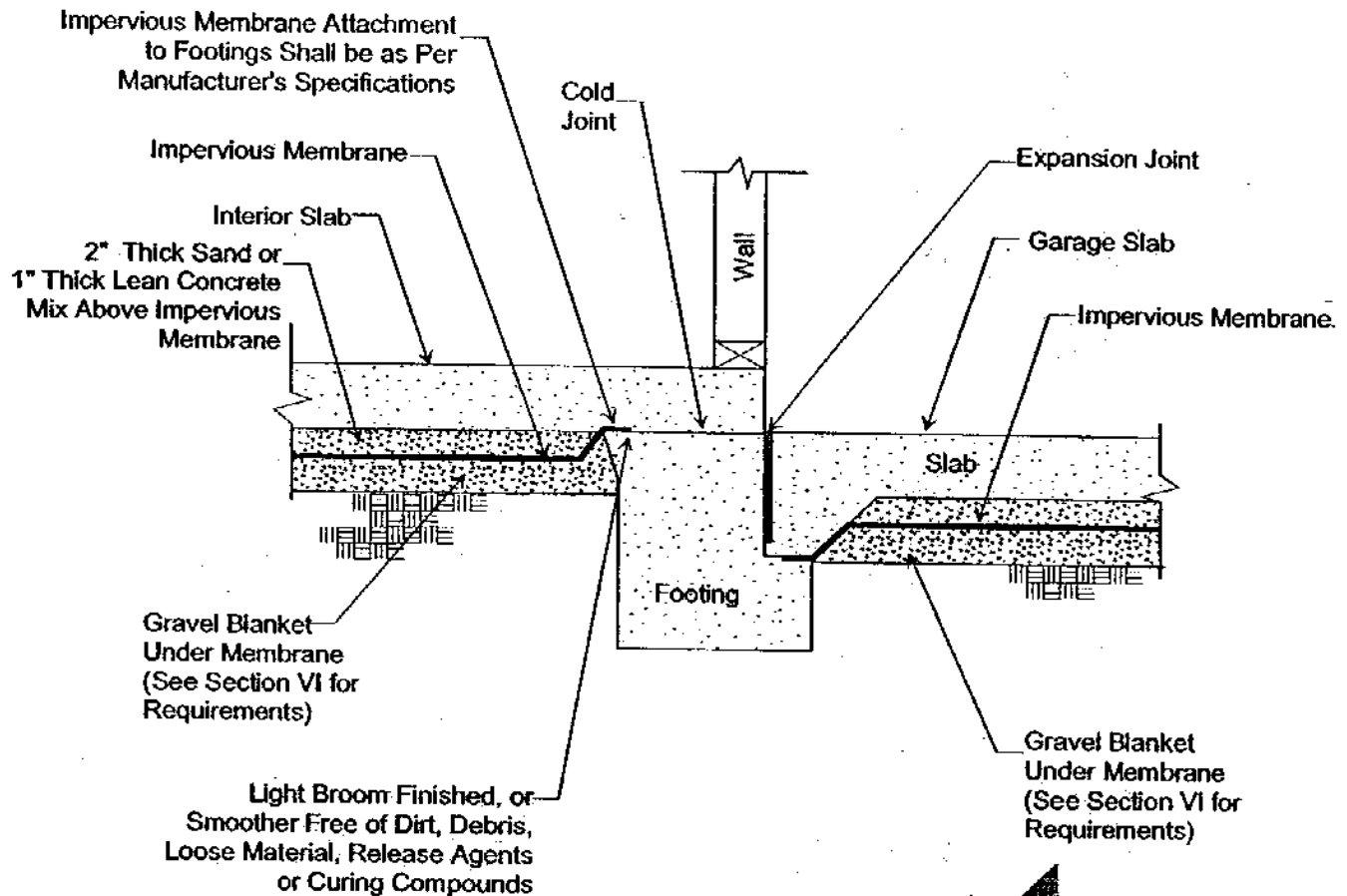


Note: See Section I for Definitions and Section VI for Design Criteria

Alternative C:
Ground Water



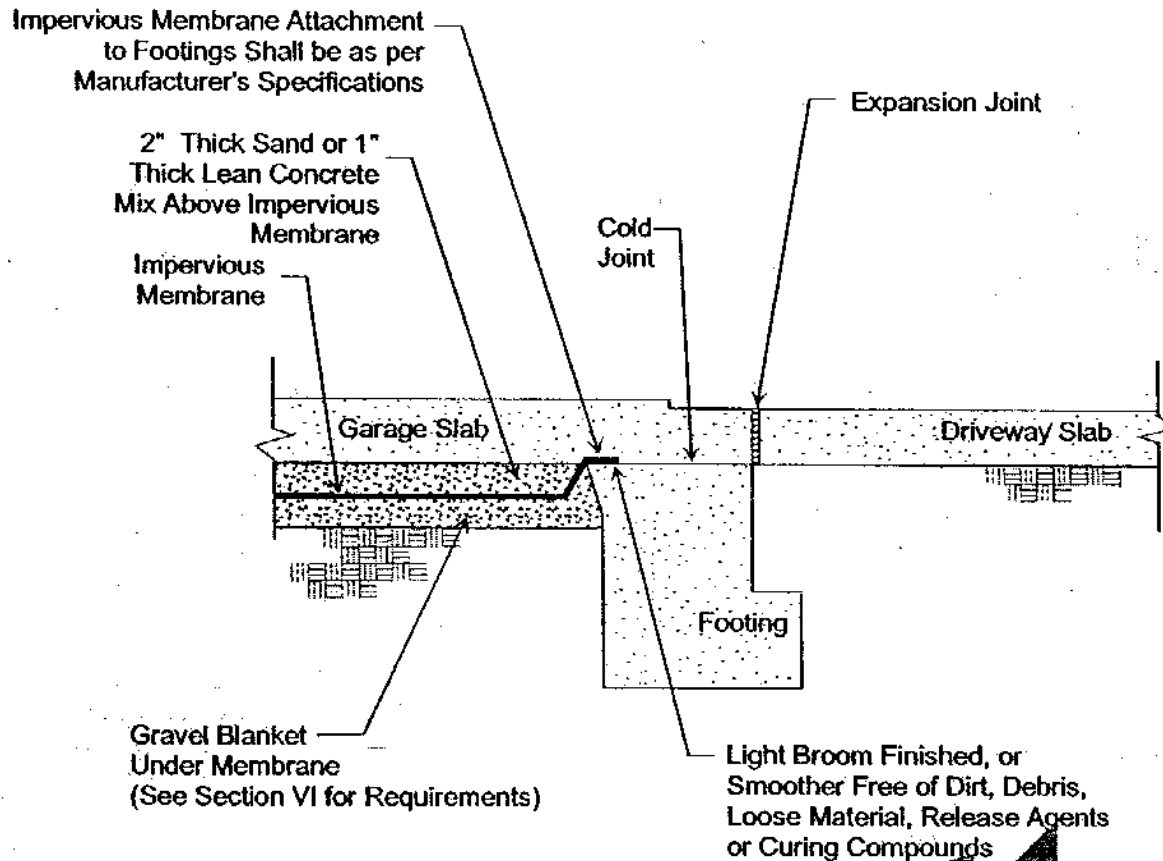
DETAIL 3 MEMBRANE TERMINATION AT GARAGE / DWELLING FLOOR TRANSITION (TWO POUR)



- Note: 1. See Section I for Definitions and Section VI for Design Criteria
2. Membrane is Not to be Placed Under the Building Footings

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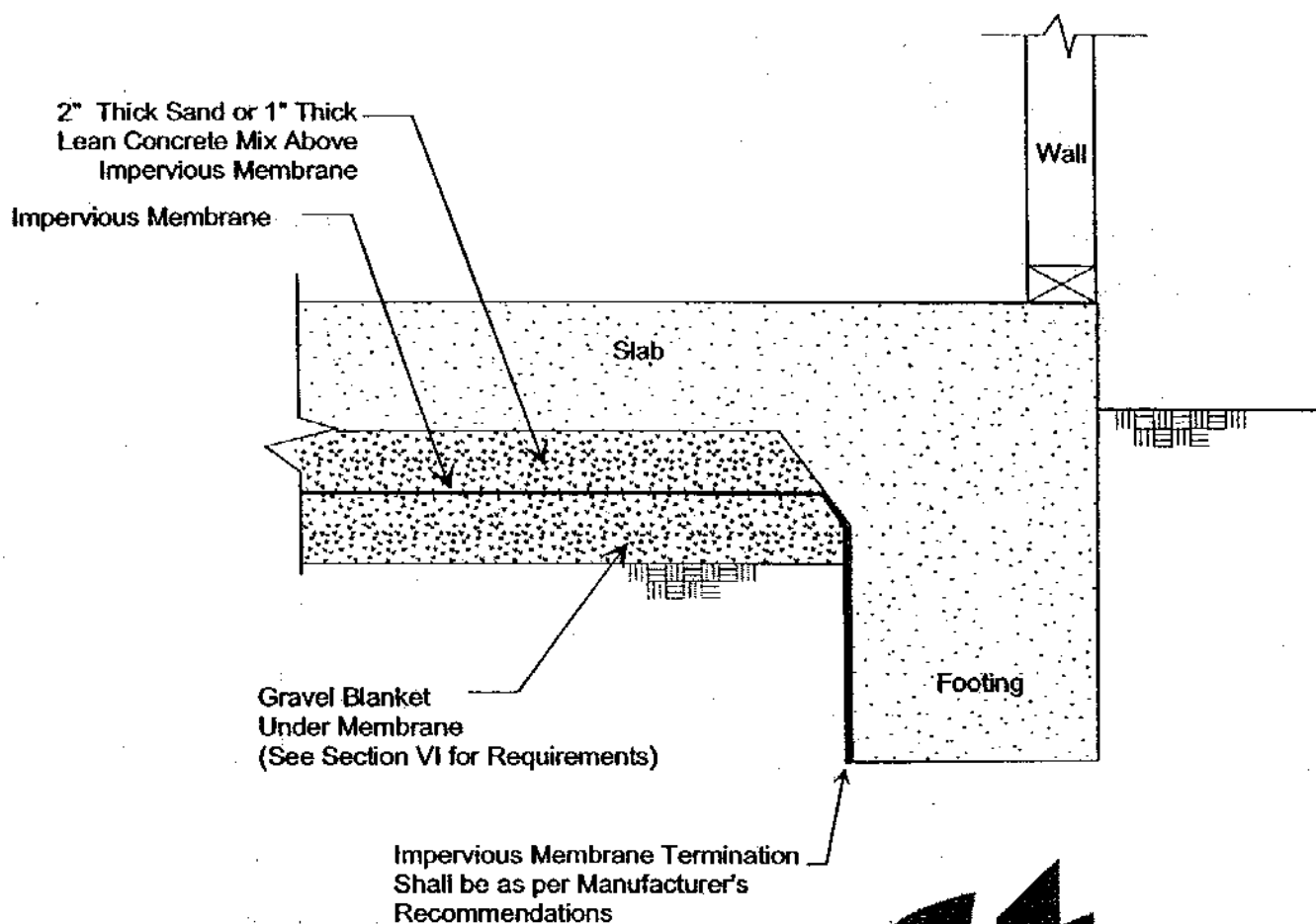
**DETAIL 4 MEMBRANE TERMINATION AT GARAGE GRADE
 BEAM - TWO POUR**



- Note:** 1. See Section VI for Definitions and Section VI 4 for Design Criteria.
 2. Membrane is to be placed Under the Building Footings.

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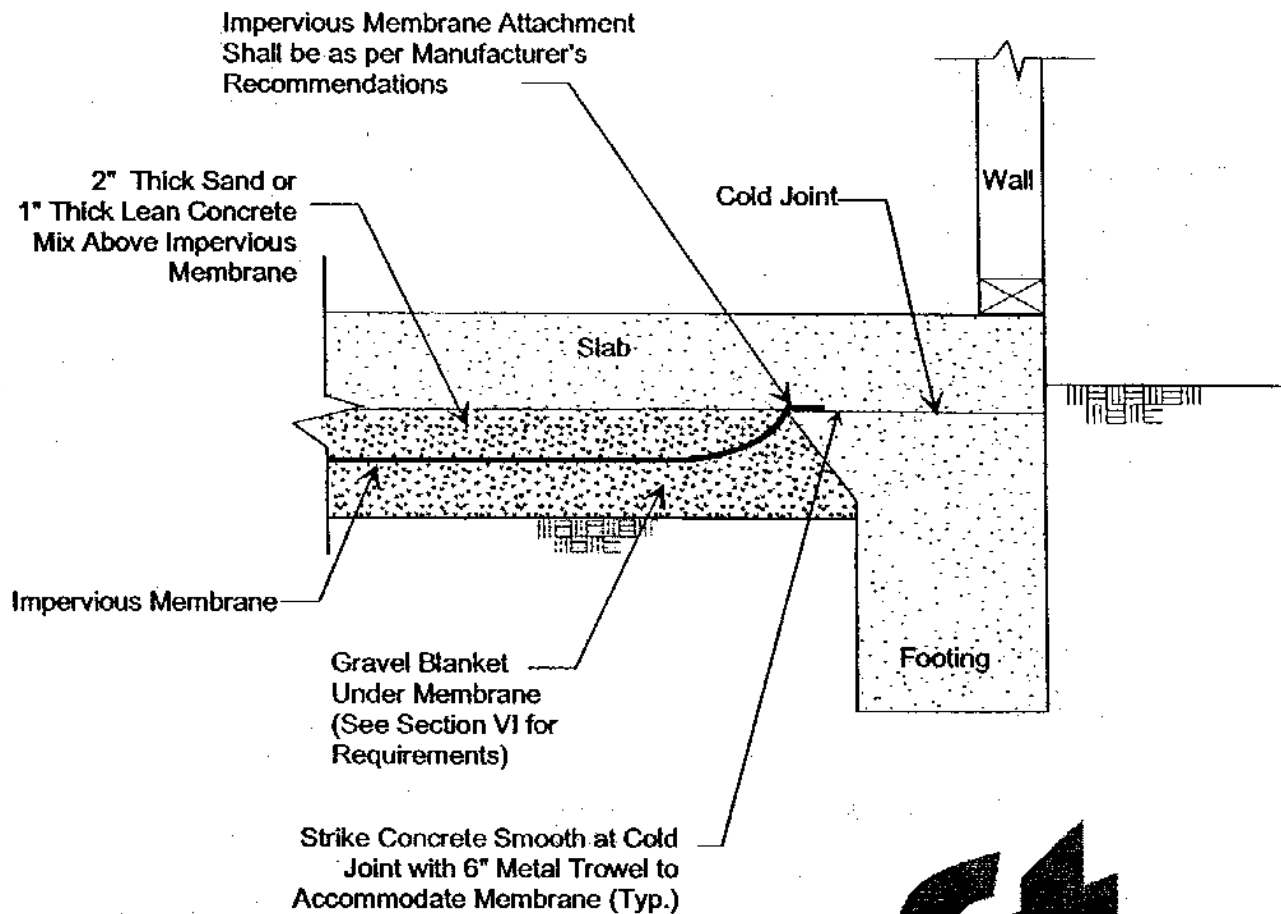
DETAIL 5 MEMBRANE TERMINATION AT EXTERIOR FOOTING - SINGLE POUR



- Note:** 1. See Section I for Definitions and Section VI for Design Criteria.
 2. Membranes Not to Be Placed Under the Building Footings.

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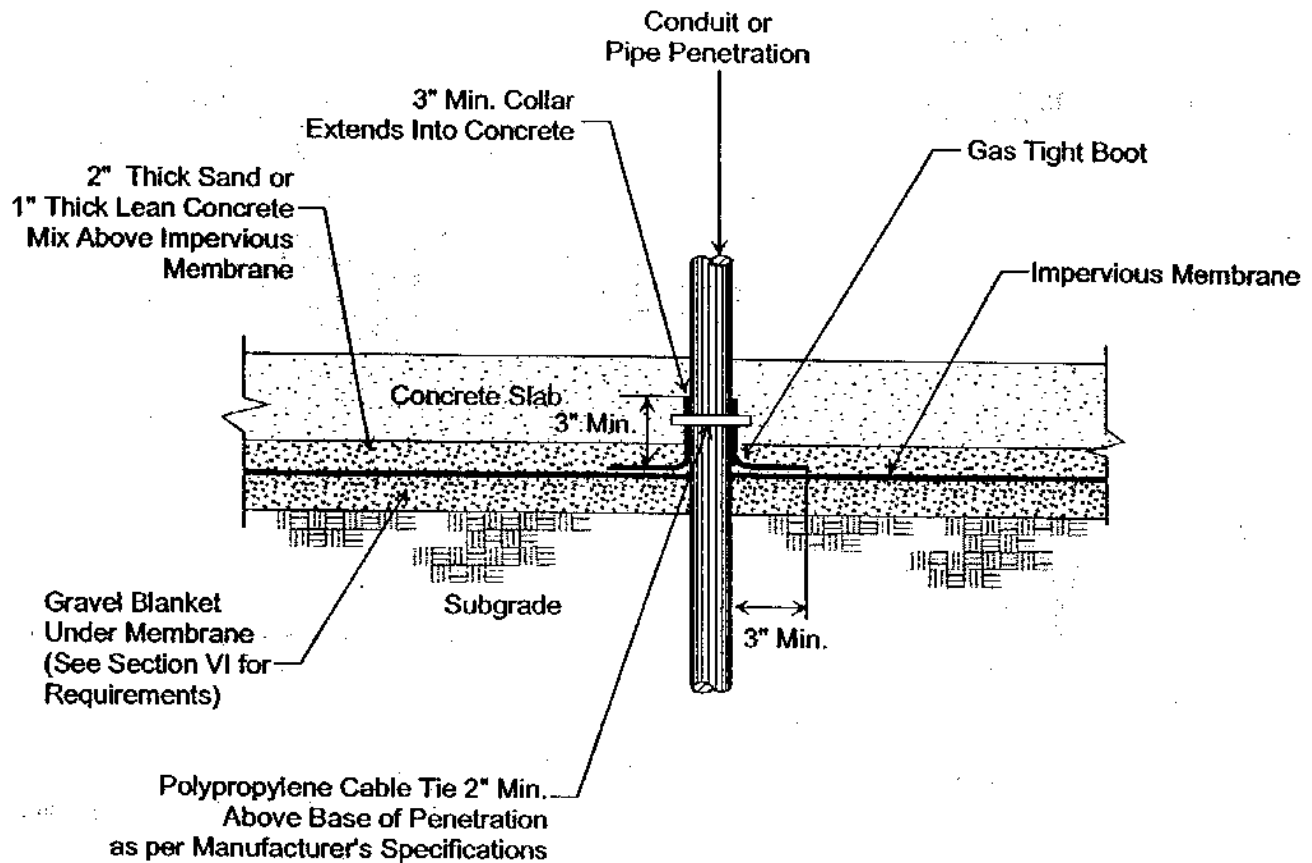
DETAIL 6 MEMBRANE TERMINATION AT EXTERIOR FOOTING - TWO POUR



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Note: See Section I for Definitions and Section VI for Design Criteria

DETAIL 7 MEMBRANE BOOT

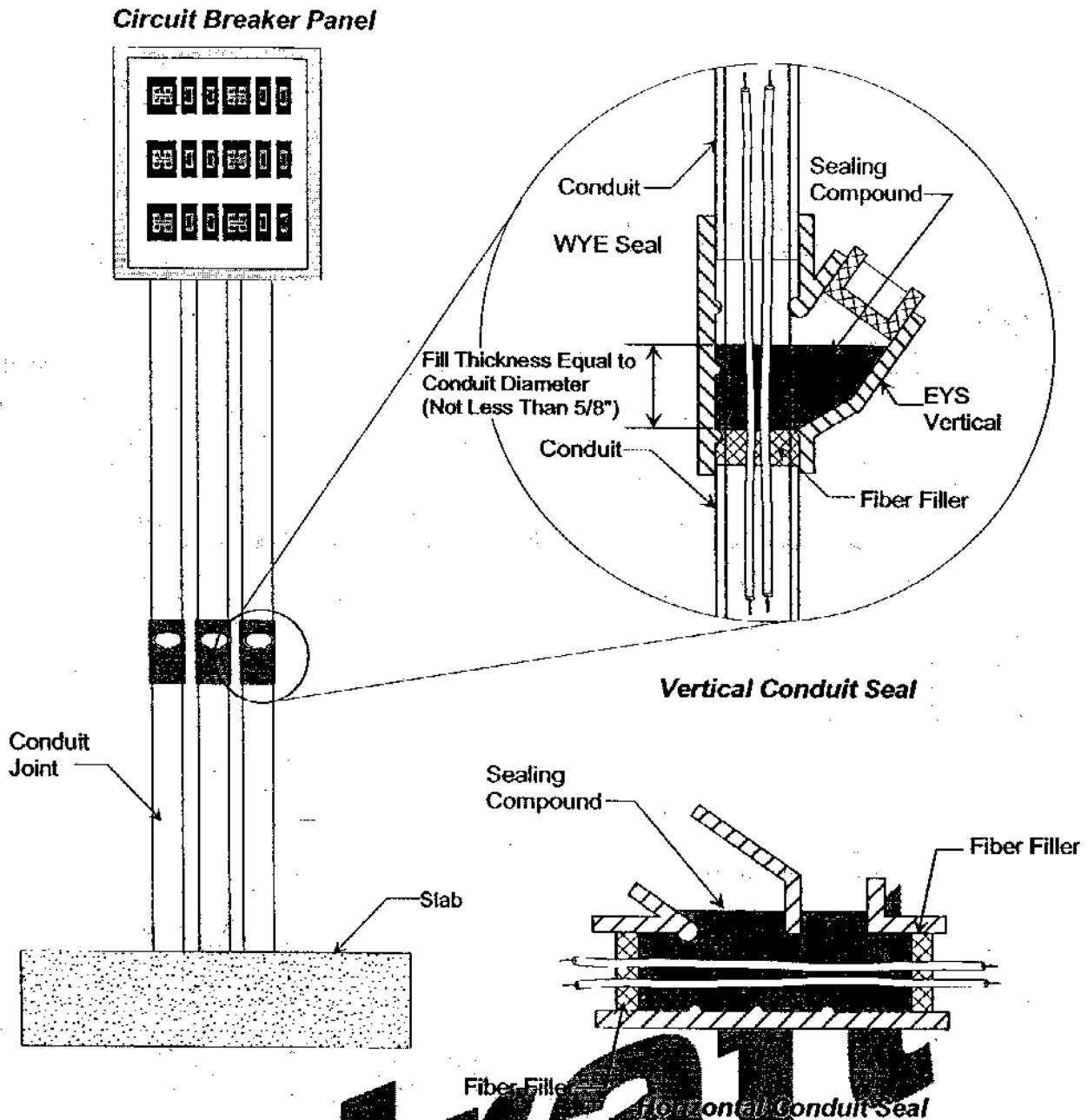


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Note: See Section I for Definitions and Section VI for Design Criteria

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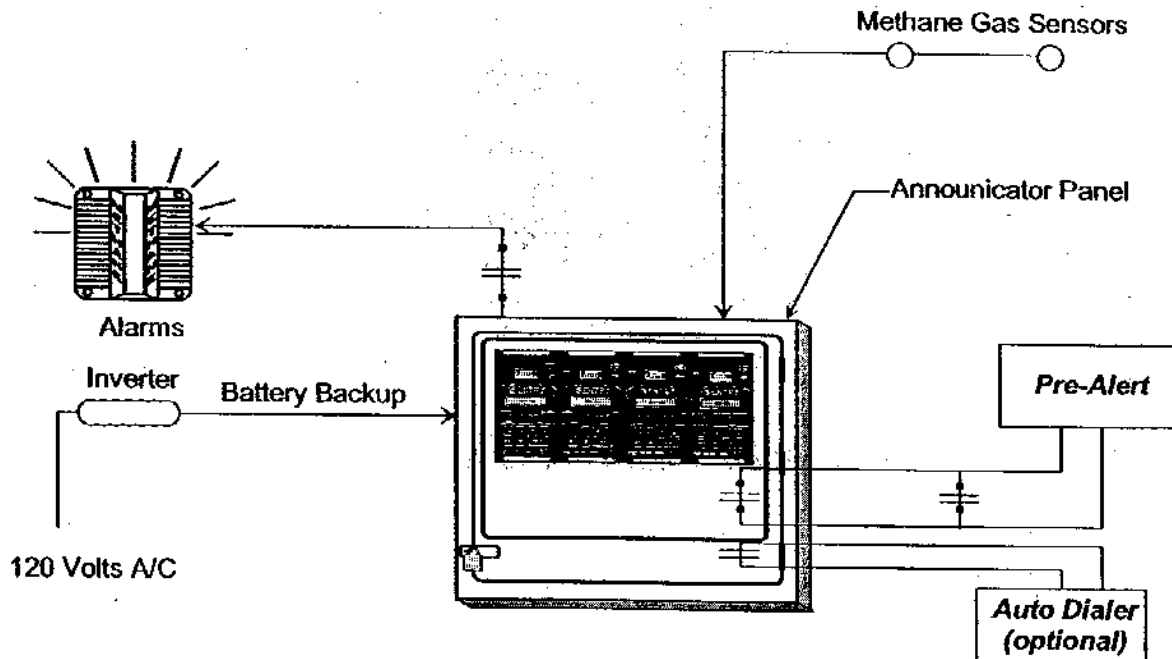
DETAIL 8 CONDUIT SEAL



Note:

1. Other Configurations That Produce a Gas Tight Seal May Be Approved by LADBS

DETAIL 9 GAS SENSOR CONTROL PANEL DIAGRAM



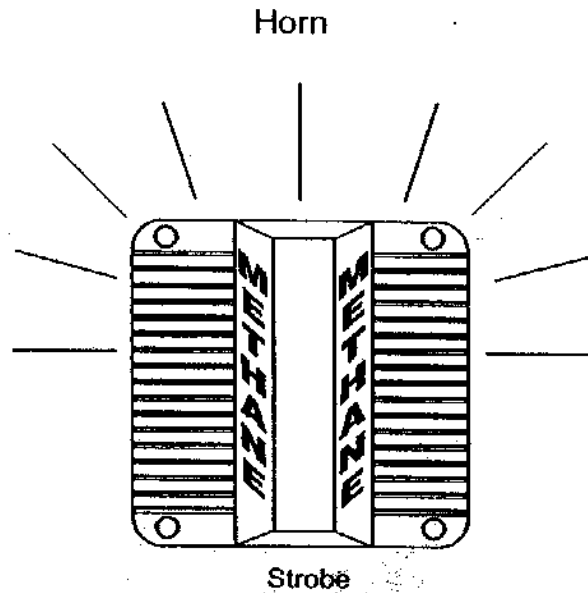
Notes:

1. The methane gas detection system shall operate 24hr./day continuously.
2. All building strobes/alarms to sound simultaneously upon any high gas detection in building.

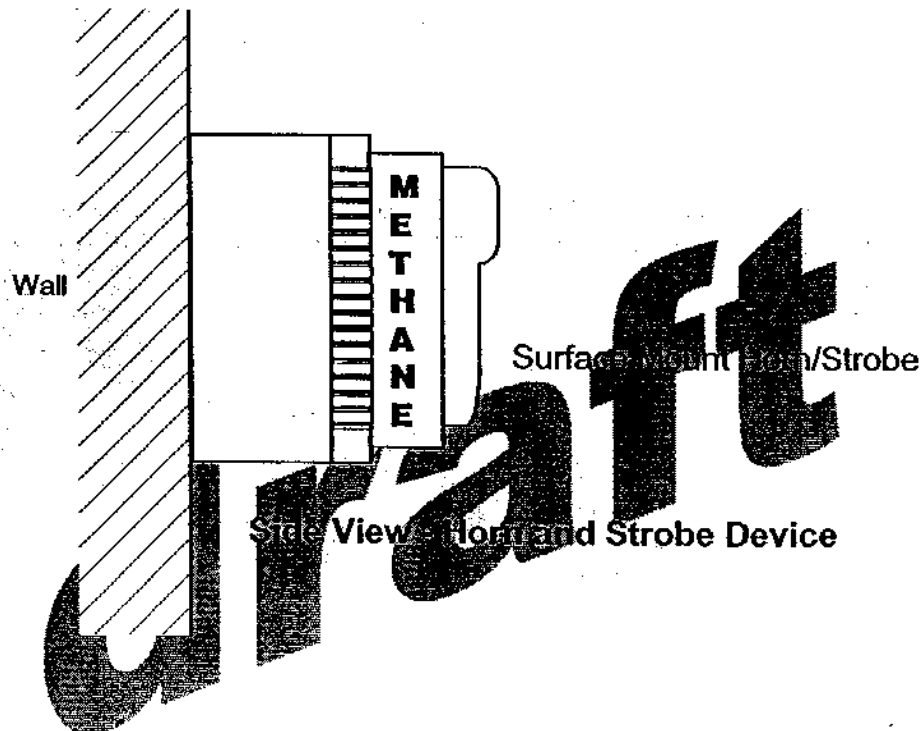
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DETAIL 10 METHANE ALARM DEVICE - HORN AND STROBE COMBINATION

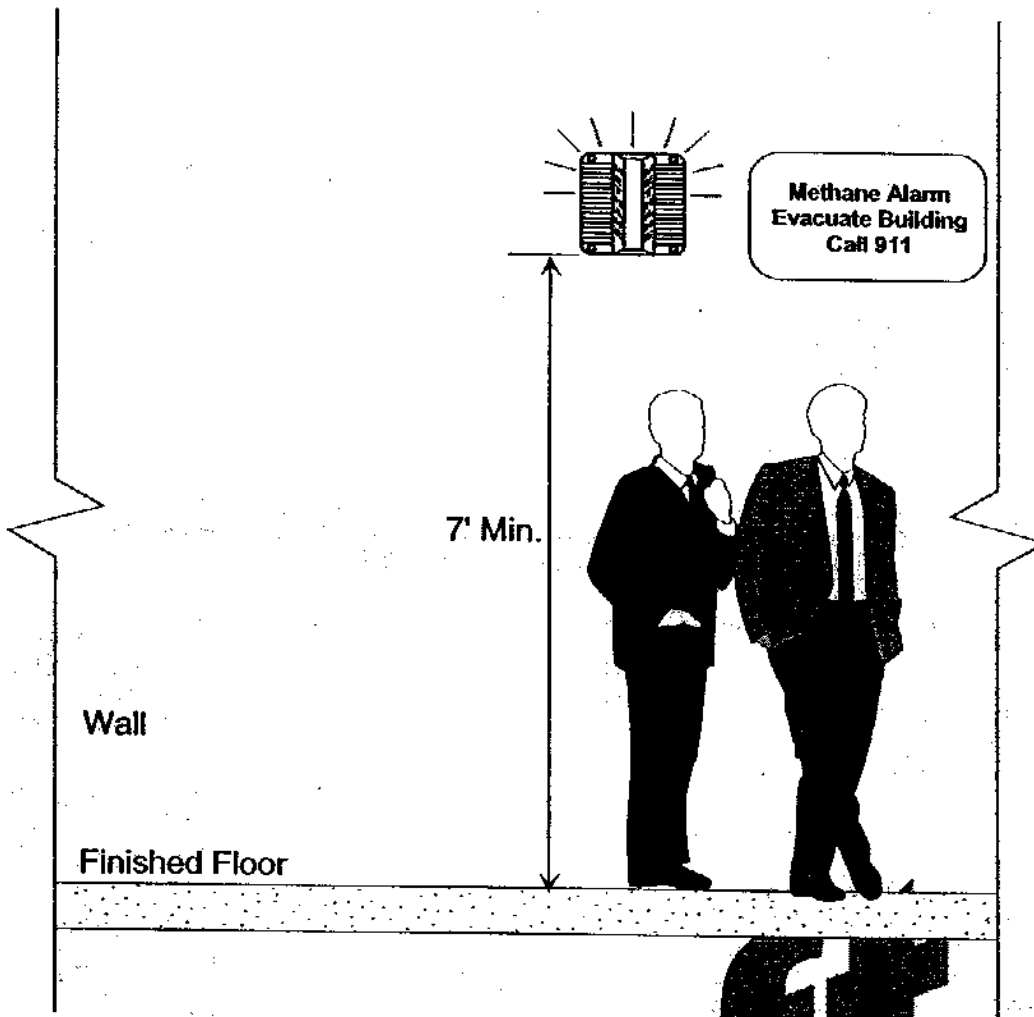


Front View - Horn and Strobe Device



Side View - Horn and Strobe Device

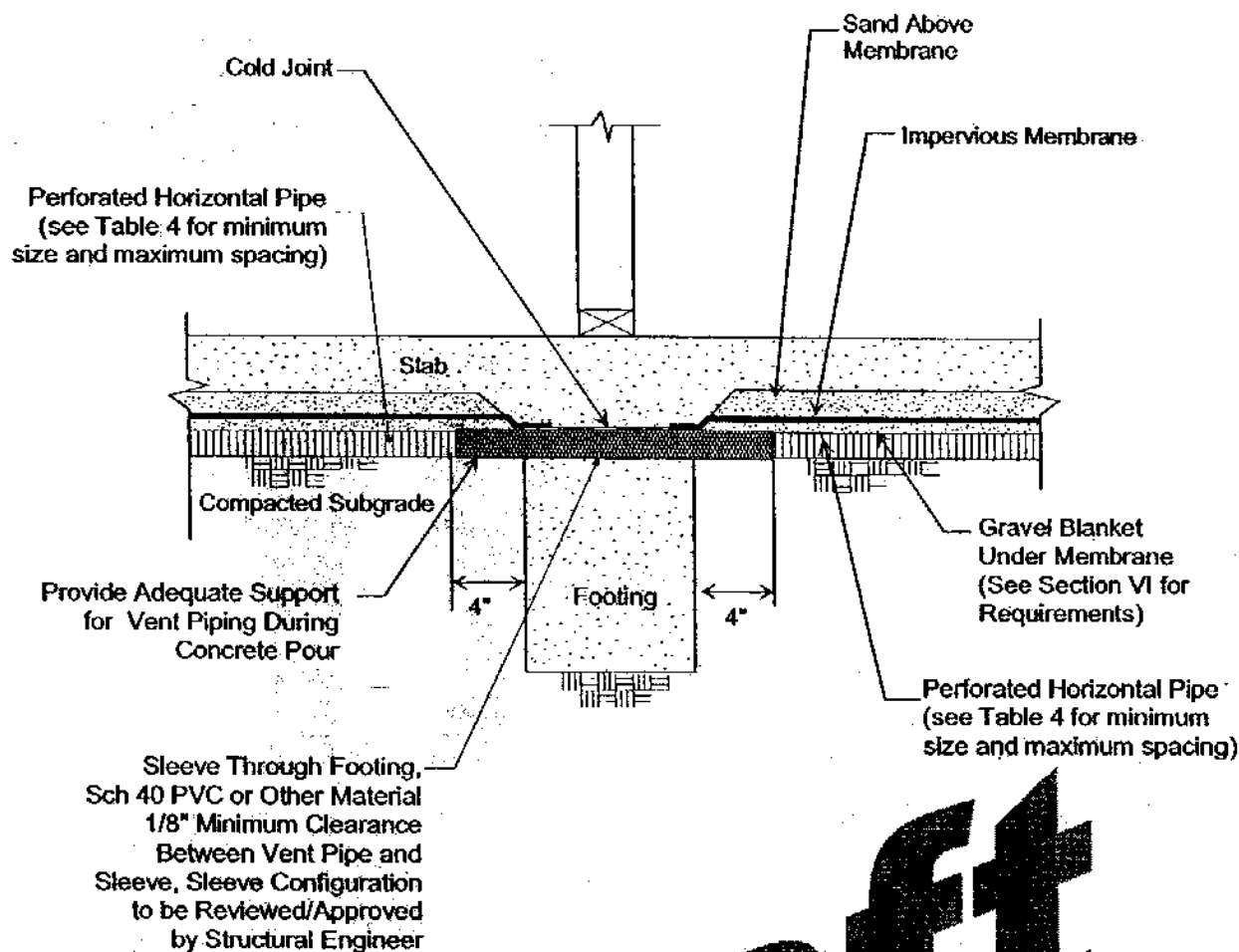
DETAIL 11 METHANE ALARM MOUNT



All Methane audio/visual alarms shall be installed above the floor at a standard height of 7 feet with adjacent signage (as shown) unless otherwise noted.

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DETAIL 12 VENT PIPE AT INTERIOR FOOTING

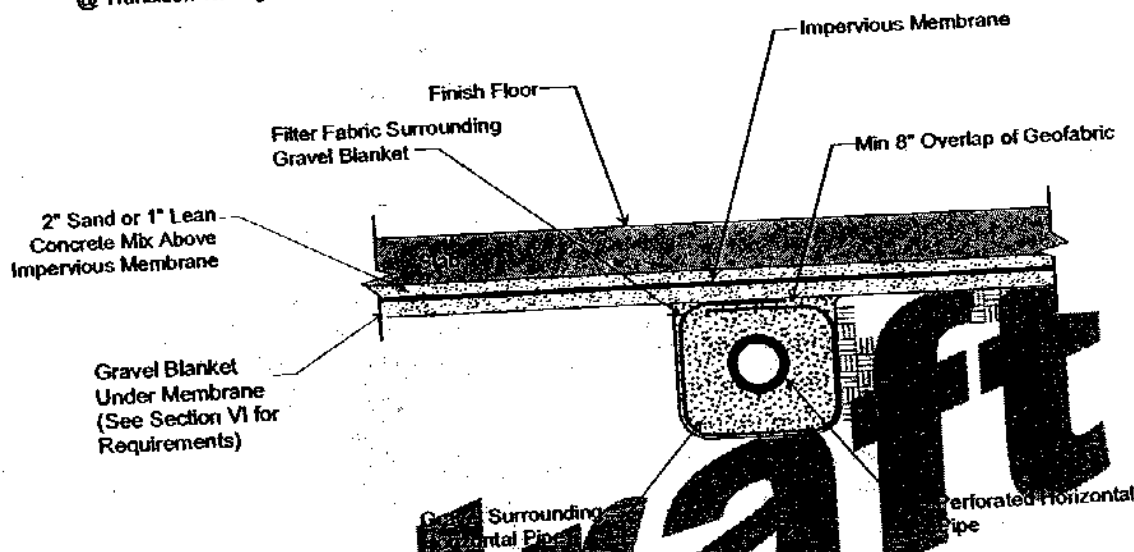
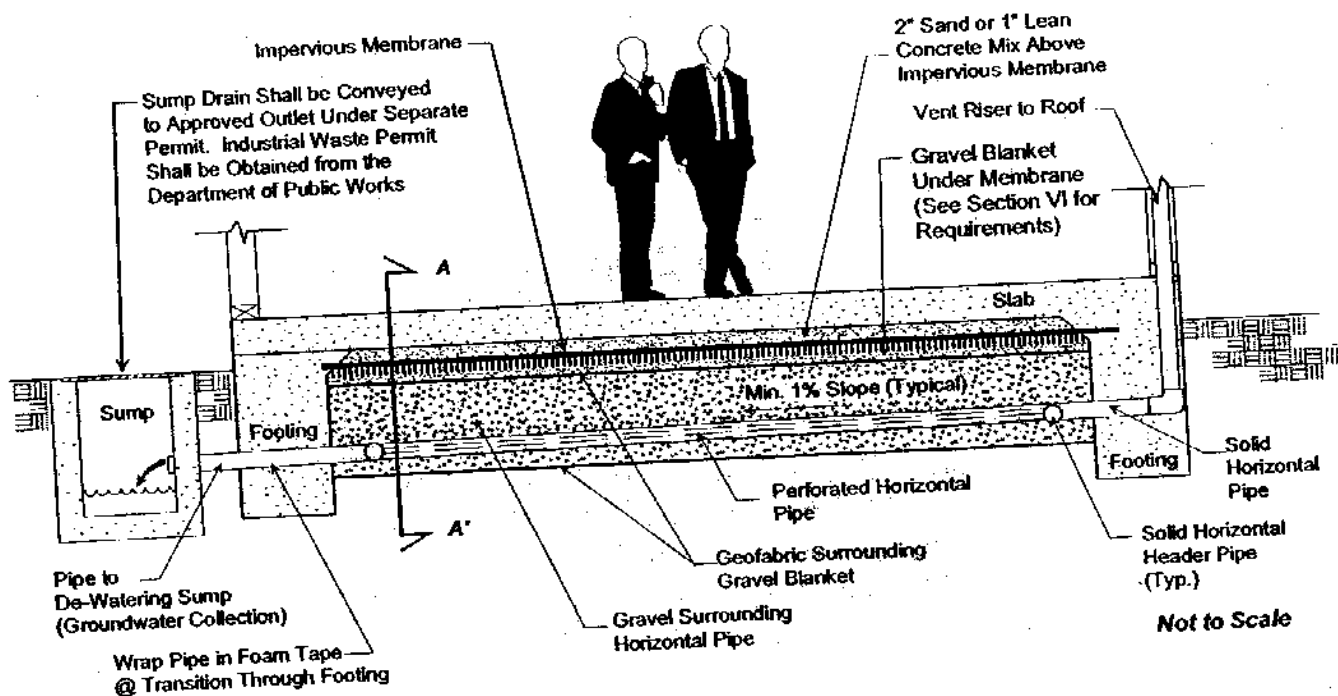


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Note: See Section I for Definitions and Section VI for Design Criteria

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DETAIL 13 COMBINATION DE-WATERING AND VENT PIPE



Section A-A'

Note: See Section VI for Definitions and Section VI for Design Criteria

DETAIL 14 GAS MEMBRANE IDENTIFICATION

WARNING

**THIS BUILDING IS PROTECTED WITH
A METHANE GAS CONTROL BARRIER.
ANY PROPOSED PENETRATION OR
ALTERATION OF FLOOR SLAB
REQUIRES NOTIFICATION OF THE
BUILDING OFFICIAL AND INSPECTION
BY ENGINEER**

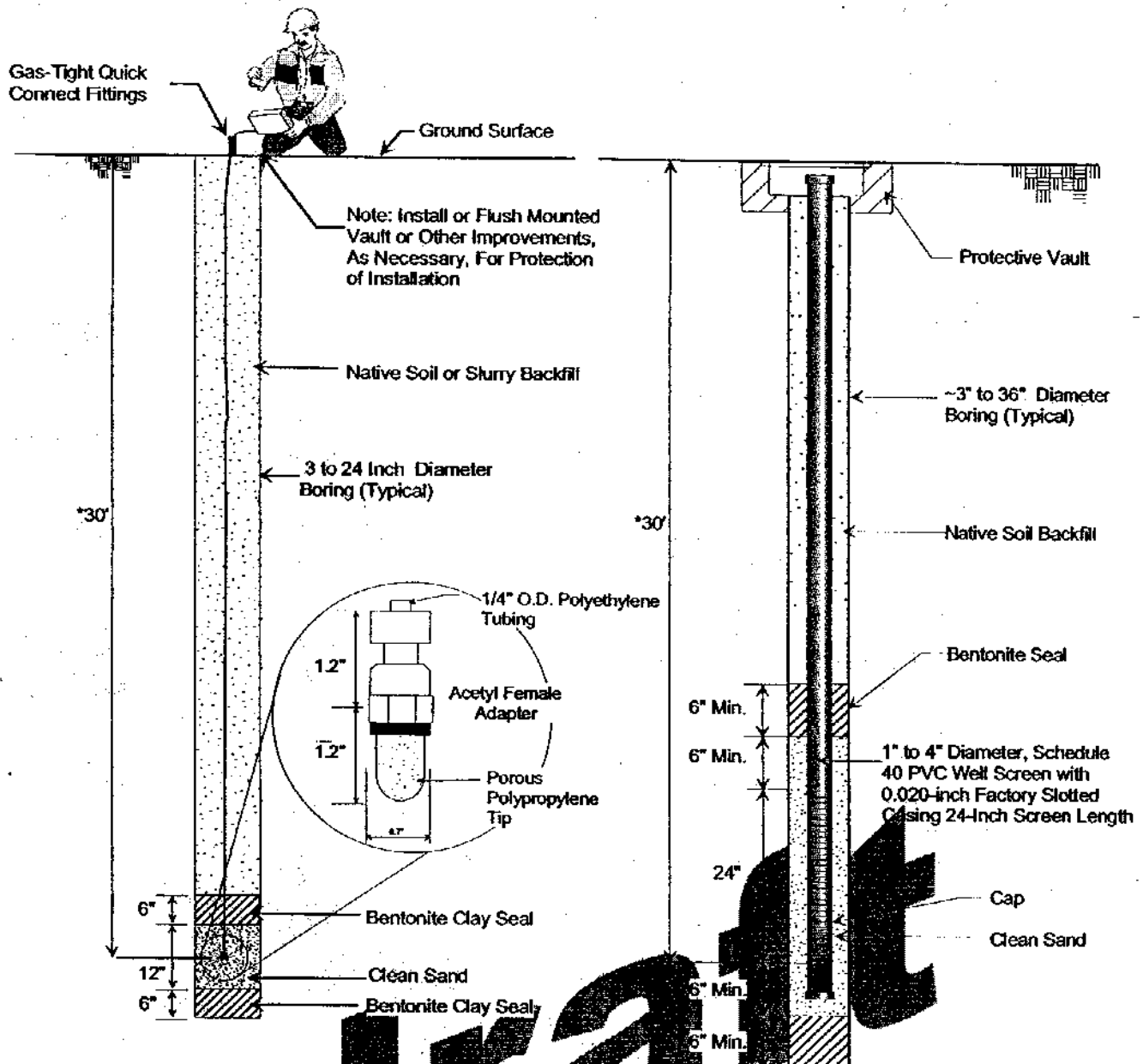
Notes:

1. This Notification is to be Permanently Stamped or Etched in the Surface of the Garage Slab or Other Location Approved by the City of Los Angeles, Department of Building and Safety at the Time of Construction.
2. Location of Notification to be determined by Building Inspector
3. All Letters 1/2" (Min.) in Height
4. One Required per Dwelling

DETAIL 15 DEEP SINGLE STAGE GAS PROBE CONFIGURATION

Option A - Polypropylene Tip

Option B - Slotted PVC Casing

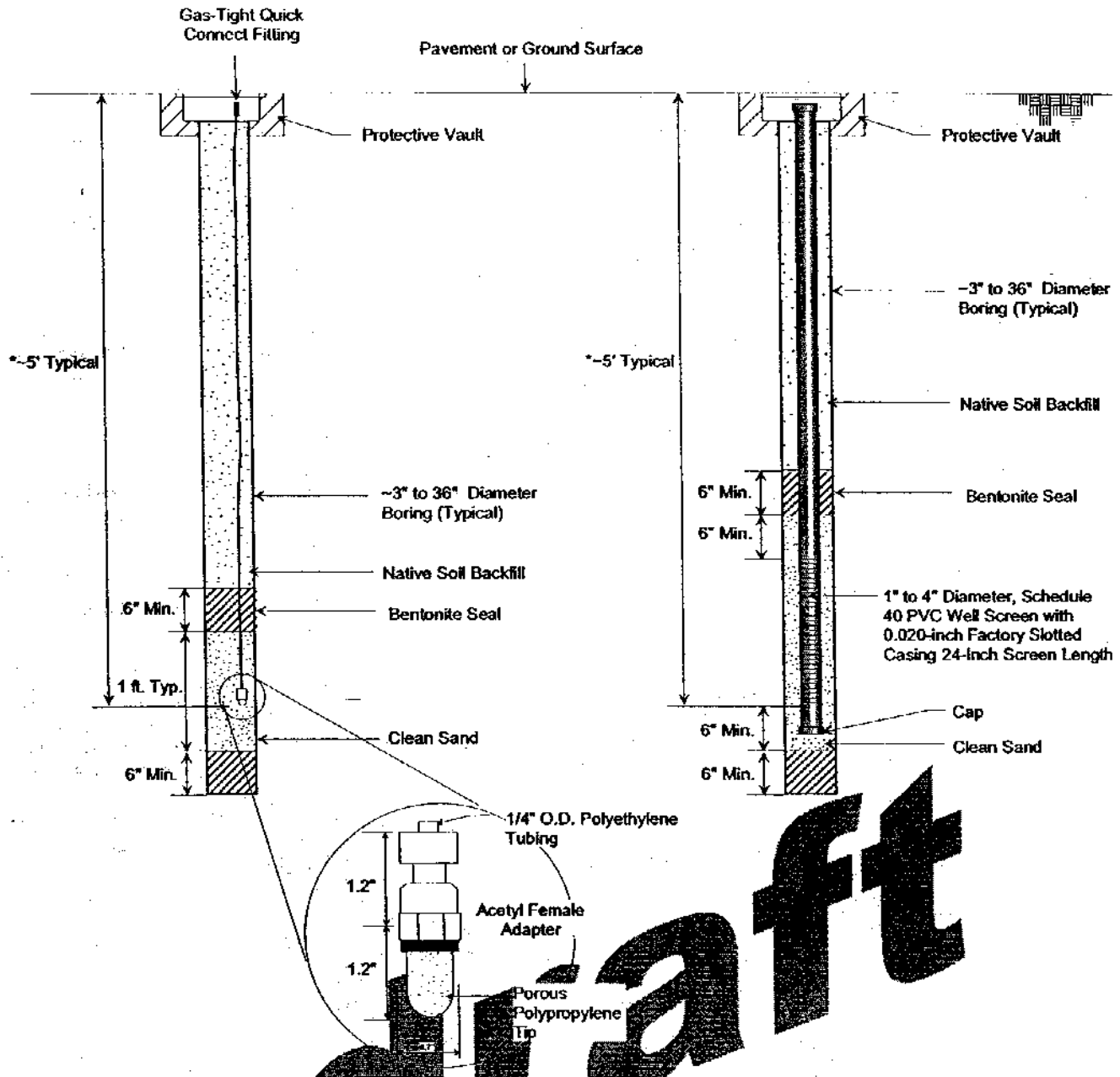


*Note: Gas probe depths may vary depending upon Site Conditions

DETAIL 16 SHALLOW SINGLE STAGE GAS PROBE

Option A - Polypropylene Tip

Option B - Slotted PVC Casing



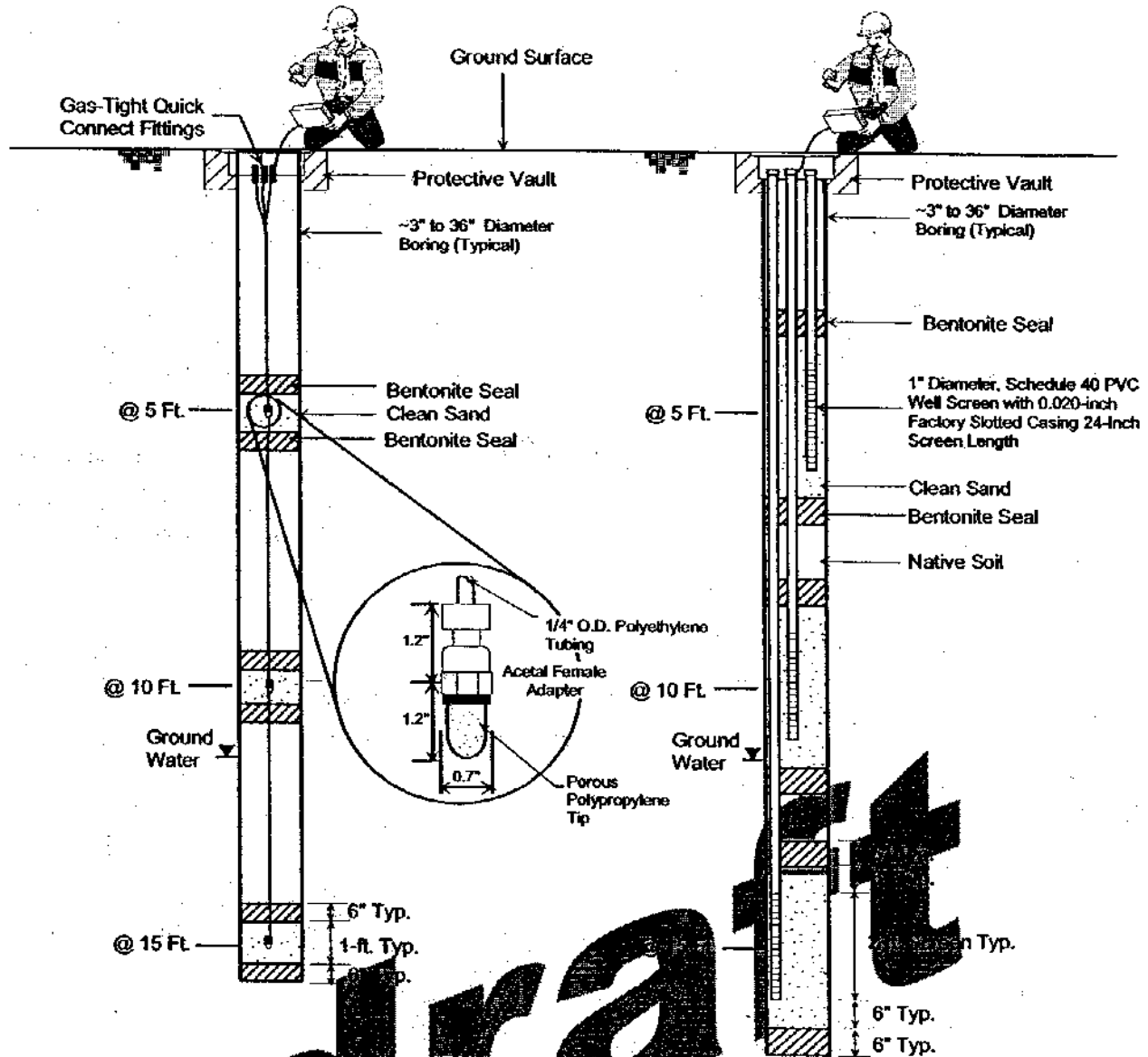
*Note: Gas probe depths may vary depending upon Site Conditions

NOT TO SCALE

DETAIL 17 SHALLOW MULTI STAGE GAS PROBE

Option A - Polypropylene Tip

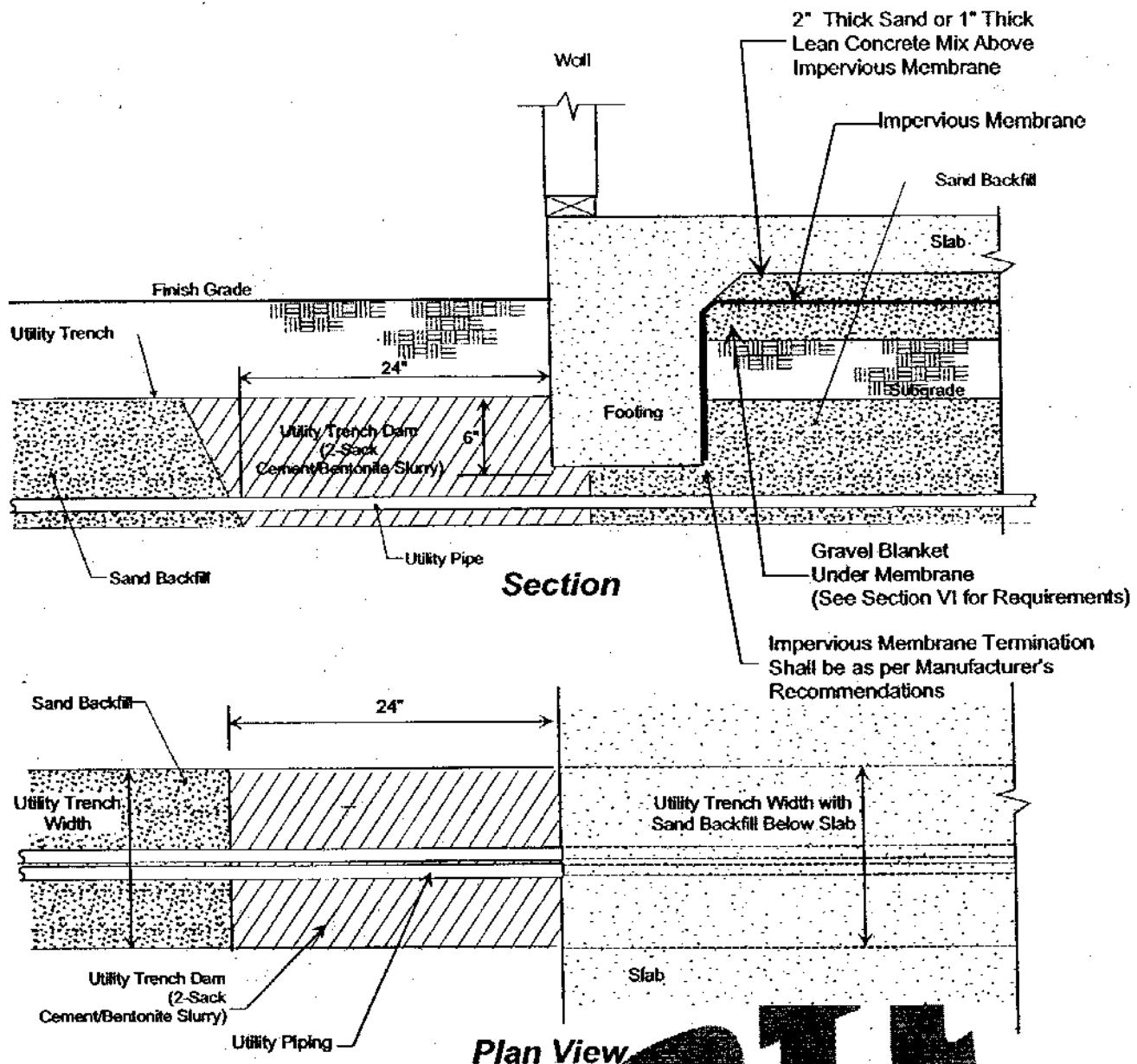
Option B - Slotted PVC Casing



Note: Gas probe depths may vary depending upon Site Conditions

NOT TO SCALE

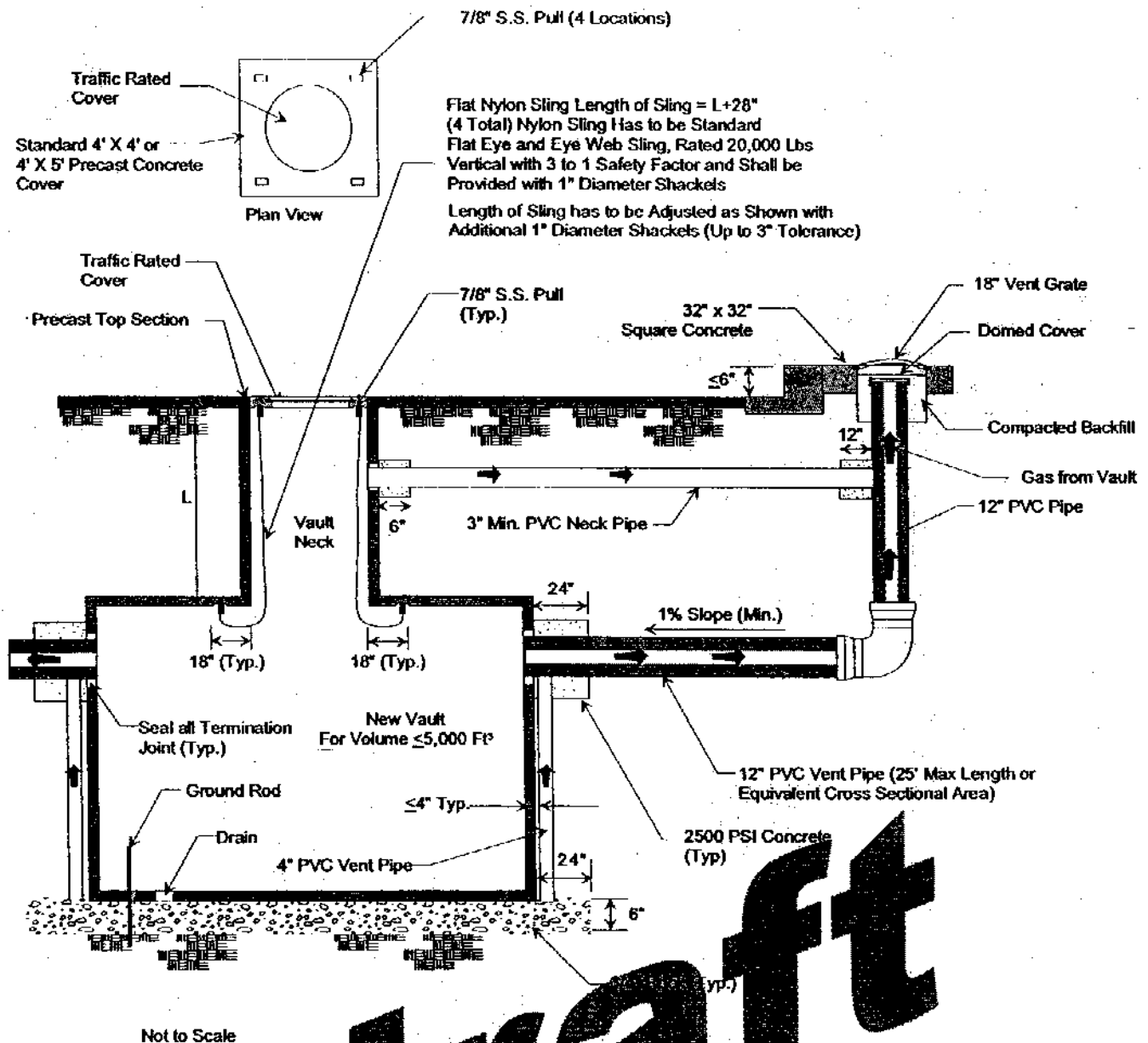
DETAIL 18 UTILITY TRENCH DAM



Utility Trench Dams

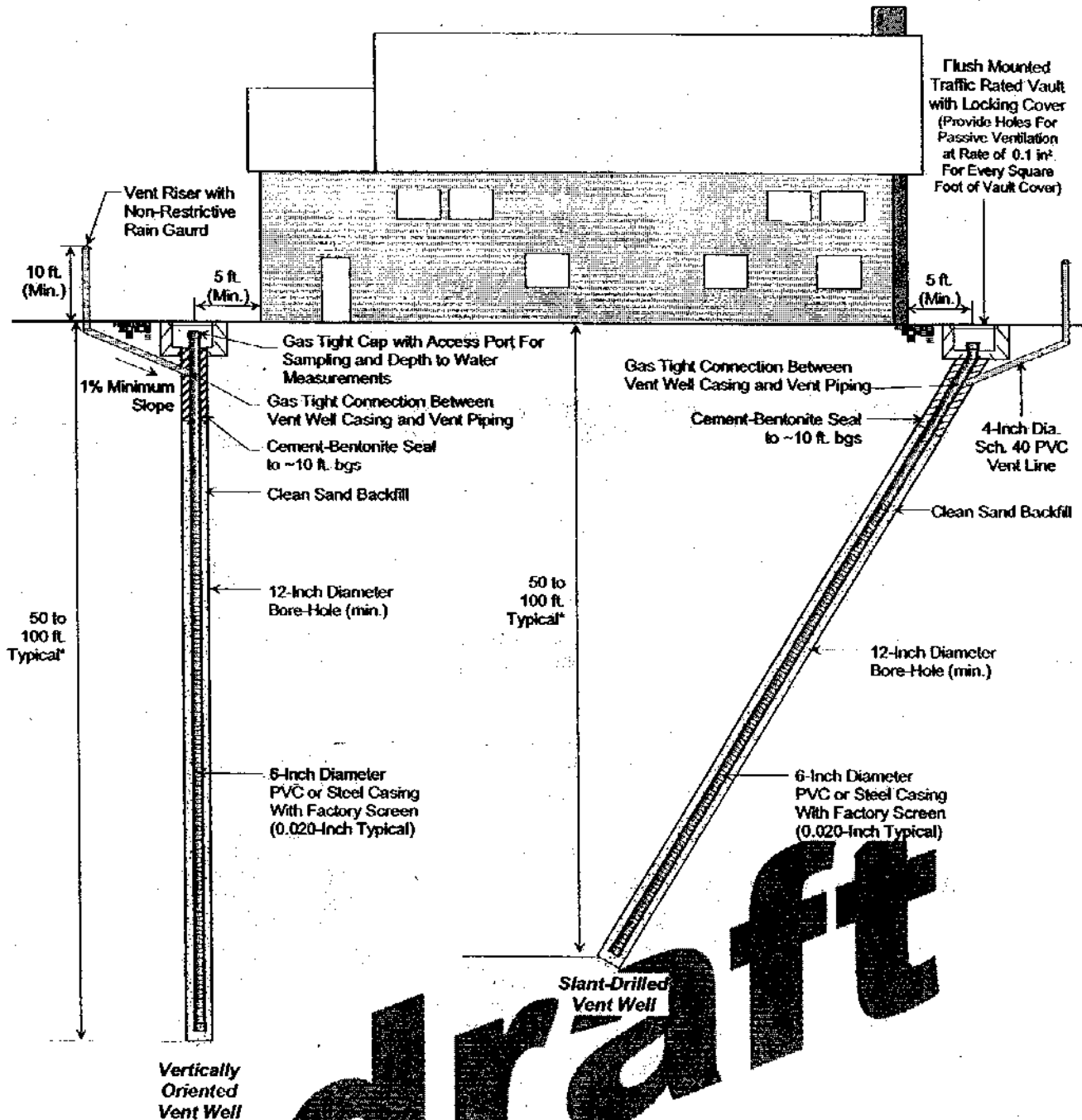
- A. A gas migration barrier shall be installed in all utility trenches that extend below the house foundation from areas outside the perimeter of the house.
- B. The gas migration barrier shall be installed from the utility trench immediately adjacent to the exterior perimeter of the house foundation.
- C. The gas migration barrier shall consist of one of the following:
 1. A minimum 2-foot continuous length of Sand Slurry consisting of a mixture of 4% Type II Cement, and 2% powdered bentonite by weight. The slurry shall extend from the bottom of the trench to a level of 6-inches above the base of the adjacent footing.
 2. A minimum 5-foot continuous length of native soil backfill compacted to at least 90% Relative Compaction in accordance with ASTM D-1557 testing procedures. The compacted soil backfill shall extend from the bottom of the trench to a level at least 6" above the base of the adjacent footing.

DETAIL 19 UTILITY VAULT



draft

DETAIL 20 DEEP VENT WELL



*Note: Depth of well should be based upon site specific subsurface conditions

**Draft Building Methane Mitigation Regulations,
Division 71, July 24, 2003.**

DIVISION 71

BUILDING METHANE MITIGATION REGULATIONS

SEC. 91.7101. PURPOSE.

This division sets forth the minimum requirements of the City of Los Angeles for control of methane intrusion emanating from geologic formations. The requirements do not regulate flammable vapor that may originate in and propagate from other sources which include, but are not limited to, ruptured hazardous material transmission lines, underground atmospheric tanks, or similar installations.

SEC. 91.7102. DEFINITIONS.

For purposes of this division, certain words and phrases are defined as follows:

ALARM SYSTEM is a system consisting of components and circuits arranged to monitor and annunciate the status of gas alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals.

CABLE SEAL FITTING is an approved fitting provided in a cable system to prevent the passage of gases, vapors, or flames through electrical cable.

CONDUIT SEAL FITTING is an approved fitting provided in a conduit system to prevent the passage of gases, vapors, or flames through electrical conduit.

DESIGN METHANE CONCENTRATION is the highest concentration of methane gas found during site testing.

DESIGN METHANE PRESSURE is the highest pressure of methane gas found during site testing.

DE-WATERING SYSTEM is a permanent water removal system, consisting of perforated pipes, gravel, sump pumps and pits, designed to permanently maintain the ground water level one foot below the sub-slab vent system.

GAS DETECTION SYSTEM is one or more electrical devices that measure the methane gas concentration and communicate the information to the occupants or building management with audible or visual signals.

GRAVEL BLANKET is a layer of gravel, sand, or approved material designed to transmit gas to the vent riser without obstructing the venting system.

HISTORIC HIGH GROUND WATER TABLE ELEVATION is the highest recorded elevation of ground water table based on historic records and field investigations as determined by the engineer

for the methane mitigation system.

IMPERVIOUS MEMBRANE is a continuous gas barrier made of material approved by the department and installed beneath a building for the purpose of impeding methane migration to the interior of the building.

LOWER EXPLOSIVE LIMIT (LEL) is the minimum concentration of methane in air at which flame propagation or explosion will occur in the presence of an ignition source.

MECHANICAL EXTRACTION SYSTEM is a mechanical system designed for removal of methane gas from below the impervious membrane through the use of fans, blowers, or other powered devices.

MECHANICAL VENTILATION is a fan, blower or other similar mechanical system within the building which introduce and/or remove air from an enclosed space.

METHANE ZONE are all property designated within the boundaries of the Methane Zone as shown on the Methane Map.

METHANE BUFFER ZONE are all property designated within the boundaries of the Methane Buffer Zone as shown on the Methane Map.

OIL WELL is any well drilled for the exploration of oil or gas; any well on lands producing or reasonably presumed to contain oil or gas; any well drilled for the purpose of injecting fluids or gas for stimulating oil recovery, re-pressurizing or pressure maintenance of oil or gas, or disposing of waste fluids from an oil or gas field.

PERFORATED HORIZONTAL PIPE is a perforated pipe placed horizontally beneath the foundation of a building for the purpose of venting any accumulated methane gas and preventing the development of elevated gas pressures.

PPMV is an abbreviation for Parts per Million by Volume.

PRESSURE SENSOR is a device that measures and communicates surrounding gas pressure to an alarm or control system.

SINGLE STATION GAS DETECTOR is a device consisting of electrical components capable of measuring methane gas concentration and transmitting methane concentration data to a control panel or other components of alarm systems.

TRENCH DAM is an approved subsurface barrier installed within a trench adjacent to the foundation of a building, for the purpose of preventing the migration of methane gas beneath that foundation.

UNENCLOSED BUILDING is a building having exterior walls of the lowest level with

unobstructed openings equal to at least 25 percent of the total perimeter wall area and evenly distributed and located within the upper portion of at least two opposite sides.

UNOBSTRUCTED OPENING is a permanent opening in the walls, floors or roof-ceiling assemblies without windows, doors, skylights or other solid barriers that may restrict the flow of air.

VENT RISER is a solid vertical vent piping with joints and fittings connected to Perforated Horizontal Pipes to safely convey and discharge the gas to the atmosphere.

SEC. 91.7103. METHANE ZONE AND METHANE BUFFER ZONE BOUNDARIES.

Boundaries of the Methane Zone and Methane Buffer Zone set forth herein are specifically designated graphically by the Methane Map designated Plate # _____ attached to Council File No. _____.

SEC. 91.7104. GENERAL METHANE MITIGATION REQUIREMENTS

All new buildings located in the Methane Zone or Methane Buffer Zone shall comply with these regulations and standards established by the Superintendent of Building.

91.7104.1. Methane Mitigation Requirements. All buildings within the scope of this Division shall provide a Methane Mitigation System, as required by Table 71-A for buildings located in the Methane Zone and Table 71-B for buildings located in the Methane Buffer Zone. The Methane Mitigation System requirements of Tables 71-A and 71-B are based upon the level of the Site Design Level. The Site Design Level is determined by the Design Methane Concentration and the Design Methane Pressure as determined by site testing.

The site testing shall be conducted under the supervision of a registered Civil Engineer, Soil Engineer or Geologist to locate and measure methane gas in subsurface geological formations. The registered Civil Engineer, Soil Engineer or Geologist, shall indicate in a report to the Department, the testing procedure and testing instruments used to determine the Design Methane Concentration and the Design Methane Pressure and an effective location for the deep vent wells, if required, and that the testing procedure conforms to the prescribed standards established by the Superintendent of Building. The report shall be submitted with the plans for construction of the building and shall be signed and stamped by the responsible person.

91.7104.2. Exceptions to Tables 71-A and 71-B. The provisions of this section are exceptions to the construction requirements of Tables 71-A and 71-B.

91.7104.2.1. Narrow Buildings. When Pressure Sensors below Impervious Membrane are not required per Table 71-A or 71-B, Pressure Sensors below Impervious Membrane may be installed in lieu of Gas Detection System and Mechanical Ventilation for Narrow Buildings. Narrow Building are buildings of width less than 50 feet, footprint of less than 50,000 square feet and having a

minimum 2-foot wide landscaped area immediately adjacent to the exterior wall for at least 50 percent of the perimeter of the building.

91.7104.2.2. Buildings with Raised Floor Construction. A building with raised floor construction shall have adequate under-floor ventilation by providing the following:

- a. An approved mechanical ventilation system; or
- b. An under-floor system with a clear height above grade of at least 12 inches to girder and 18 inches to floor joist; and
- c. Openings for under-floor area or crawl space ventilation shall be located less than 6 inches below the bottom of the floor joists. The openings shall be located to provide cross ventilation and shall be the larger of:
 1. Openings of not less than 1.5 square feet for each 25 linear feet of exterior wall; or
 2. Openings shall be 1% of under-floor area.
- d. The required area of such openings shall be approximately equally distributed along the length of at least two opposite sides of the building. They shall be covered with corrosion-resistant wire mesh with mesh openings of greater than $\frac{1}{4}$ inch and less than $\frac{1}{2}$ inch in dimension.

A building with raised floor construction shall be constructed with the following mitigation components, in lieu of the requirements of Tables 71-A and 71-B:

- a. The utilities shall be installed with Trench Dams and either Conduit Seal Fittings or Cable Seals Fittings.
- b. Four inch thick gravel blanket is installed under and around the elevator pits.

91.7104.2.3. Buildings with Natural Ventilation. Buildings with Natural Ventilation, such as, bathrooms, gazebos, barns, attendant stations, and other similar accessory buildings located in parks or buildings with lowest levels closest to grade having Group S, Division 2, 3 or 4 occupancy, or detached buildings of Group U, Division 1 occupancy, and Unenclosed Buildings shall be constructed with utilities installed with Trench Dams and either Conduit Seal Fittings or Cable Seals Fittings, in lieu of the requirements of Tables 71-A and 71-B.

Buildings with Natural Ventilation are buildings with Unobstructed Openings in exterior walls. The size and location of the Unobstructed Openings shall comply with the standards established by the Superintendent of Building. The total area of the Unobstructed Openings in the exterior wall shall be at least 25 percent of the floor area and shall be evenly spaced to prevent the accumulation of methane gases.

91.7104.2.4. Single Family Dwelling. Single Family Dwelling and buildings accessory to single family dwelling shall comply with all the Methane Mitigation requirements of Table 71-A or 71-B

except the following may be substituted:

- a. Pressure Sensors below Impervious Membrane may be installed in lieu of Gas Detection System when Pressure Sensors below Impervious Membrane is not required, or
- b. Single Station Gas Detectors with battery back-up may be installed in lieu of Alarm System and Gas Detection System, or.
- c. 6 mil thick Visquene may be used in lieu of Impervious Membrane, when the site is located in the Methane Zone with Site Design Levels I or II, or
- d. Deep Vent Well or Mechanical Ventilation may be omitted for buildings with width less than 50 feet or footprints less than 6,000 square feet in area, or
- e. Vent Risers provided at a rate twice that established by the Superintendent of Building maybe provided in lieu of Mechanical Extraction System.

SEC. 91.7105. EXISTING BUILDINGS.

Additions, alterations, repairs, change of use or change of occupancy to existing buildings shall comply with the methane mitigation requirements of Section 91.7104.1, as required by Division 34 or Division 81 of this Code.

Approved methane mitigation systems in existing buildings shall be maintained in accordance with Section 91.7106.

SEC. 91.7106. TESTING, MAINTENANCE AND SERVICE OF GAS-DETECTION AND MECHANICAL VENTILATION SYSTEMS.

All gas detection and mechanical ventilation systems shall be maintained and serviced in proper working condition and meet all requirements of the Electrical and Mechanical Code. The testing, maintenance and service procedure for gas detection and mechanical ventilation systems shall be performed in accordance with the manufacturer's current written instructions and the following:

1. **Fire Department.** The manufacturer's instructions shall be approved and filed with the Fire Department. Testing and servicing of each system shall be performed by a person approved by the Fire Department.
2. **Notification Placard.** A permanent notification placard shall be posted and maintained at the front entrance of the building except in residential buildings. The placard shall indicate the presence of the methane Impervious Membrane barrier and ventilation system. The location of the placard, size and specification of the placard shall be approved by the Fire Department.

SEC. 91.7107. EMERGENCY PROCEDURES.

Emergency procedures shall be established for all buildings with gas-detection systems, except buildings of Group R, Division 3 or U Occupancies. The procedures shall include the following:

1. Assignment of a responsible person to work with the Fire Department in the establishment, implementation and maintenance of an emergency plan.
2. Conspicuous posting of the Fire Department's telephone number in areas designated by the Fire Department.
3. Conspicuous posting of emergency plan procedures approved by the Fire Department.

SEC. 91.7108. APPLICATION OF METHANE SEEPAGE DISTRICT REGULATIONS TO LOCATIONS OR AREAS OUTSIDE THE SECTION 91.7103 BOUNDARIES.

Upon a determination by the Department of Building and Safety that a hazard may exist from methane intrusion at a geographical location or in an area outside the boundaries established in Section 91.7103 of this code, the Department of Building and Safety and the Fire Department may enforce any or all of the requirements of Division 71 of this code as required to reduce the potential of fire or explosion from methane concentration.

SEC. 91.7109. ADDITIONAL REMEDIAL MEASURES.

91.7109.1. General Remedial Measures. In the event the concentration of methane gas in any building located in the Methane Zone or in the Methane Buffer Zone reaches or exceeds 25 percent of the minimum concentration of gas that will form an ignitable mixture with air at ambient temperature and pressure, the owner shall hire a qualified engineer to investigate, recommend and implement mitigating measures. Such measures shall be subject to approval by the Building and Safety Department and Fire Department.

91.7109.2. Abandoned Oil Well. Any abandoned oil well encountered during construction shall be evaluated by the Fire Department and may be required to be re-abandoned in accordance with applicable rules and regulations of the Division of Oil and Gas of the State of California. Buildings shall comply with these provisions and the requirements of Section 91.6105 of this code, whichever is more restrictive.

TABLE 71-A MITIGATION REQUIREMENTS FOR METHANE ZONE

Site Design Level			LEVEL I		LEVEL II		LEVEL III		LEVEL IV		LEVEL V
Design Methane Concentration (ppmv)			0-100		101-1,000		1,001-5,000		5,001-12,500		>12,500
Design Soil Gas Pressure (inches of water pressure)			≤2"	>2"	≤2"	>2"	≤2"	>2"	≤2"	>2"	All Pressures
PASSIVE SYSTEM	De-watering System ¹		X	X	X	X	X	X	X	X	X
	Sub-Slab Vent System	Performed Horizontal Piles	X	X	X	X	X	X	X	X	X
		Gravel Blanket Thickness Under Impervious Membrane	2"	2"	2"	3"	2"	3"	2"	4"	4"
		Gravel Thickness Surrounding Perforated Horizontal Pipes	2"	2"	2"	3"	2"	3"	2"	4"	4"
		Vent Risers	X	X	X	X	X	X	X	X	X
	Impervious Membrane		X	X	X	X	X	X	X	X	X
ACTIVE SYSTEM	Sub-Slab Vent System	Pressure Sensors Below Impervious Membrane								X	X
		Mechanical Extraction System								X	X
	Lowest Occupied Space System	Gas Detection System ²		X		X	X	X	X	X	X
		Mechanical Ventilation ^{2, 3}		X		X	X	X	X	X	X
		Alarm System		X		X	X	X	X	X	X
	Control Panel			X		X	X	X	X	X	X
MISC. SYSTEM	Trench Dam		X	X	X	X	X	X	X	X	X
	Conduit or Cable Seal Fitting		X	X	X	X	X	X	X	X	X
	Deep Vent Well ⁴										X

X = Indicates a Required Mitigation Component

- ¹ De-watering not required when the maximum Historical High Ground Water Table Elevation, or projected post-construction ground water level, is more than 12 inches below the bottom of the Perforated Horizontal Pipes.
- ² See Section 91.7104.2.1 for exception for Narrow Buildings.
- ³ Natural ventilation complying with the standard established by the Superintendent, may be used in lieu of mechanical ventilation.
- ⁴ Deep Vent Well is not required when Vent Risers are installed at least twice the rate established by the Department of Building and Safety.

TABLE 71-B MITIGATION REQUIREMENTS FOR METHANE BUFFER ZONE

Site Design Level			LEVEL I		LEVEL II		LEVEL III		LEVEL IV		LEVEL V
Design Methane Concentration (ppmv)			0-100		101-1,000		1,001-5,000		5,001-12,500		>12,500
Design Soil Gas Pressure (inches of water pressure)			<2"	>2"	<2"	>2"	≤2"	>2"	≤2"	>2"	All Pressures
PASSIVE SYSTEM	De-watering System ¹			X		X		X	X	X	X
	Sub-Slab Vent System	Performed Horizontal Piles		X		X		X	X	X	X
		Gravel Blanket Thickness Under Impervious Membrane		2"		3"		3"	2"	4"	4"
		Gravel Thickness Surrounding Perforated Horizontal Pipes		2"		3"		3"	2"	4"	4"
		Vent Risers		X		X		X	X	X	X
	Impervious Membrane			X		X		X	X	X	X
ACTIVE SYSTEM	Sub-Slab Vent System	Pressure Sensors Below Impervious Membrane								X	X
		Mechanical Extraction System								X	X
	Lowest Occupied Space System	Gas Detection System ²		X		X		X	X	X	X
		Mechanical Ventilation ^{2,3}		X		X		X	X	X	X
		Alarm System		X		X		X	X	X	X
	Control Panel			X		X		X	X	X	X
MISC. SYSTEM	Trench Dam			X		X	X	X	X	X	X
	Conduit or Cable Seal Fitting			X		X	X	X	X	X	X
	Deep Vent Well ⁴										X

X = Indicates a Required Mitigation Component

- ¹ De-watering not required when the maximum Historical High Ground Water Table Elevation, or projected post-construction ground water level, is more than 12 inches below the bottom of the Perforated Horizontal Pipes.
- ² See Section 91.7104.2.1 for exception for Narrow Buildings.
- ³ Natural ventilation complying with the standard established by the Superintendent, may be used in lieu of mechanical ventilation.
- ⁴ Deep Vent Well is not required when Vent Risers are installed at least twice the rate established by the Department of Building and Safety.